FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007030	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0M01
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	7.12	**TER**	14.14
Environmental	94 A	**% DER<TER**	49.63		
CO_2 Emissions (t/year)	0.47	**DFEE**	30.62	**TFEE**	32.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.06		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South West
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               14.3, 79.1, 2.7
Living Area:                   30 m2, fraction: 37.9%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                10.91, 38.61, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South West, , None, 0, , 0, 0, 0, 12.70,
     Under Balcony             Window, External Wall 1, South West, , Light-coloured curtain or roller blind, 1, True, 0, 0, 0, 12.00, 20
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.242
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.12 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)32.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing South West:		24.70 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.7000	1.1450	31.7176			(27)
External Wall 1	38.6100	27.7000	10.9100	0.1500	1.6365			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3541			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	42.7141	(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	19.1392	18.9146	18.6899	17.5667	17.3420	16.2188	16.2188	15.9941	16.6681	17.3420	17.7913	18.2406	(38)
Heat transfer coeff	61.8533	61.6286	61.4040	60.2807	60.0561	58.9328	58.9328	58.7082	59.3821	60.0561	60.5054	60.9547	(39)
Average = Sum(39)m / 12 =												60.2246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7820	0.7791	0.7763	0.7621	0.7592	0.7450	0.7450	0.7422	0.7507	0.7592	0.7649	0.7706	(40)
HLP (average)												0.7614	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (64)
Total per year (kWh/year) = Sum(64)m = 2102.7967 (64)
Heat gains from water heating, kWh/month
94.2750 83.7191 89.3955 82.1788 82.0112 75.4046 74.4391 78.8966 77.8843 85.1147 87.4331 92.6956 (65)

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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.3947 17.2262 14.0093 10.6059 7.9280 6.6932 7.2322 9.4007 12.6176 16.0210 18.6989 19.9337 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
217.5493 219.8067 214.1180 202.0072 186.7196 172.3514 162.7525 160.4951 166.1838 178.2946 193.5822 207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 35.2278 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 (71)
Water heating gains (Table 5)
126.7136 124.5819 120.1553 114.1372 110.2301 104.7286 100.0525 106.0439 108.1726 114.4014 121.4349 124.5909 (72)
Total internal gains
423.3410 421.2983 407.9659 386.4338 364.5612 343.4567 329.7208 335.6231 346.6575 368.4004 393.3994 412.1584 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	24.7000	36.7938	0.6800	0.8000	0.7700	342.6132	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains 355.3740 609.5719 845.3014 1066.2403 1211.5025 1210.3181 1163.7228 1054.1924 921.6344 676.7424 426.4280 303.6266 (83)
Total gains 778.7150 1030.8702 1253.2673 1452.6741 1576.0637 1553.7747 1493.4435 1389.8154 1268.2919 1045.1428 819.8273 715.7850 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.5231	35.6526	35.7831	36.4498	36.5862	37.2835	37.2835	37.4262	37.0014	36.5862	36.3145	36.0468	
alpha	3.3682	3.3768	3.3855	3.4300	3.4391	3.4856	3.4856	3.4951	3.4668	3.4391	3.4210	3.4031	
util living area	0.8659	0.7566	0.6272	0.4774	0.3479	0.2414	0.1733	0.1938	0.3187	0.5520	0.7836	0.8878	(86)
MIT	20.0716	20.4498	20.7293	20.9064	20.9731	20.9946	20.9987	20.9981	20.9854	20.8756	20.4823	19.9896	(87)
Th 2	20.2690	20.2715	20.2739	20.2863	20.2888	20.3012	20.3012	20.3037	20.2962	20.2888	20.2838	20.2789	(88)
util rest of house	0.8529	0.7379	0.6043	0.4527	0.3225	0.2154	0.1459	0.1646	0.2873	0.5212	0.7631	0.8765	(89)
MIT 2	19.0423	19.5630	19.9381	20.1766	20.2601	20.2963	20.3003	20.3023	20.2824	20.1465	19.6269	18.9355	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	19.4327	19.8993	20.2382	20.4534	20.5305	20.5612	20.5652	20.5662	20.5491	20.4230	19.9513	19.3353	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4327	19.8993	20.2382	20.4534	20.5305	20.5612	20.5652	20.5662	20.5491	20.4230	19.9513	19.3353	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8363	0.7278	0.6032	0.4586	0.3312	0.2251	0.1563	0.1757	0.2986	0.5271	0.7529	0.8596	(94)
Useful gains	651.2172	750.2674	755.9411	666.1566	521.9504	349.7796	233.3747	244.1271	378.7311	550.9040	617.2584	615.2579	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	936.0059	924.3873	843.5778	696.4467	530.3270	351.3082	233.6815	244.5922	382.9594	589.9332	777.5753	922.5680	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	211.8828	117.0086	65.2017	21.8088	6.2322	0.0000	0.0000	0.0000	0.0000	29.0378	115.4282	228.6388	(98)
Space heating												795.2389	(98)
Space heating per m2											(98) / (4) =	10.0536	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	553.9686	436.1029	446.1822	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9902	0.9948	0.9931	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	548.5515	433.8285	443.1195	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1894.3902	1822.2730	1702.2936	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	969.0039	1033.0027	936.8255	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2938.8321	(104)
Cooled fraction										fC = cooled area / (4) =		0.7585	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	183.7555	195.8918	177.6534	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												557.3007	(107)
Space cooling per m2												7.0455	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	795.2389	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	292.2503	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	542.7505	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2102.7967	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	772.7778	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.1588	(310b)
Electricity used for heat distribution	30.4294	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	129.0048	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.1318	(330a)
Total electricity for the above, kWh/year	179.1318	(331)
Electricity for lighting (calculated in Appendix L)	342.5160	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3693.5900	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1121.0822	0.2160	242.1538	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	986.8191	0.2160	213.1529	(363)
less credit emissions for electricity	-345.3867	0.5190	-179.2557	(364)
Water heating from Combined Heat and Power	2609.3796	0.2160	563.6260	(365)
less credit emissions for electricity	-913.2828	0.5190	-473.9938	(366)
Electrical energy for heat distribution	30.4294	0.5190	15.7928	(372)
Total CO2 associated with community systems			381.4760	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			381.4760	(376)
Space cooling	129.0048	0.5190	66.9535	(377)
Pumps and fans	179.1318	0.5190	92.9694	(378)
Energy for lighting	342.5160	0.5190	177.7658	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			563.4647	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1200	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1200	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		25.6642	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.6642	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3319	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4232	0.4149	0.4066	0.3651	0.3568	0.3153	0.3153	0.3070	0.3319	0.3568	0.3734	0.3900	(22b)
Effective ac	0.5895	0.5861	0.5827	0.5666	0.5636	0.5497	0.5497	0.5471	0.5551	0.5636	0.5697	0.5760	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.7800	1.3258	26.2235			(27)
External Wall 1	38.6100	19.7800	18.8300	0.1800	3.3894			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6129			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		35.0129	(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	41.5494	41.3044	41.0642	39.9361	39.7250	38.7424	38.7424	38.5604	39.1209	39.7250	40.1520	40.5984	(38)
Heat transfer coeff	76.5623	76.3173	76.0771	74.9489	74.7379	73.7553	73.7553	73.5733	74.1338	74.7379	75.1649	75.6113	(39)
Average = Sum(39)m / 12 =												74.9479	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9679	0.9648	0.9618	0.9475	0.9449	0.9324	0.9324	0.9301	0.9372	0.9449	0.9503	0.9559	(40)
HLP (average)												0.9475	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	197.1318	173.7462	182.4568	163.5395	160.2483	143.1660	137.4751	150.8812	150.6237	169.5821	179.3419	192.3818	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	197.1318	173.7462	182.4568	163.5395	160.2483	143.1660	137.4751	150.8812	150.6237	169.5821	179.3419	192.3818	(64)
								Total per year (kWh/year) = Sum(64)m =				2000.5743	(64)
Heat gains from water heating, kWh/month													
	87.3294	77.4457	82.4500	75.4573	75.0657	68.6831	67.4936	71.9511	71.1628	78.1692	80.7116	85.7501	(65)

---

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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3947	17.2262	14.0093	10.6059	7.9280	6.6932	7.2322	9.4007	12.6176	16.0210	18.6989	19.9337	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	117.3783	115.2466	110.8199	104.8018	100.8947	95.3933	90.7172	96.7085	98.8372	105.0661	112.0995	115.2555	(72)
Total internal gains													
	417.0056	414.9629	401.6306	380.0984	358.2258	337.1213	323.3854	329.2877	340.3221	362.0651	387.0640	405.8230	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	17.6400	36.7938	0.6300	0.7000	0.7700	198.3560	(79)
Northwest	2.1400	11.2829	0.6300	0.7000	0.7700	7.3792	(81)

Solar gains	205.7352	352.8943	489.3558	617.2481	701.3297	700.6394	673.6678	610.2693	533.5419	391.7787	246.8697	175.7776	(83)
Total gains	622.7409	767.8572	890.9863	997.3465	1059.5555	1037.7606	997.0532	939.5570	873.8640	753.8438	633.9337	581.6007	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7462	71.9766	72.2038	73.2906	73.4976	74.4768	74.4768	74.6610	74.0965	73.4976	73.0801	72.6486	
alpha	5.7831	5.7984	5.8136	5.8860	5.8998	5.9651	5.9651	5.9774	5.9398	5.8998	5.8720	5.8432	
util living area													
	0.9919	0.9744	0.9275	0.8112	0.6362	0.4526	0.3252	0.3597	0.5750	0.8678	0.9784	0.9943	(86)
MIT	20.1884	20.4096	20.6598	20.8794	20.9741	20.9971	20.9997	20.9994	20.9888	20.8482	20.4769	20.1483	(87)
Th 2	20.1102	20.1128	20.1153	20.1273	20.1295	20.1400	20.1400	20.1420	20.1360	20.1295	20.1250	20.1202	(88)
util rest of house													
	0.9895	0.9672	0.9092	0.7734	0.5831	0.3928	0.2618	0.2929	0.5073	0.8297	0.9711	0.9926	(89)
MIT 2	19.0413	19.3599	19.7089	20.0007	20.1075	20.1383	20.1399	20.1417	20.1285	19.9728	19.4691	18.9909	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	19.4764	19.7580	20.0695	20.3339	20.4361	20.4640	20.4660	20.4670	20.4548	20.3048	19.8513	19.4299	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4764	19.7580	20.0695	20.3339	20.4361	20.4640	20.4660	20.4670	20.4548	20.3048	19.8513	19.4299	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9872	0.9638	0.9082	0.7828	0.6021	0.4154	0.2859	0.3182	0.5327	0.8381	0.9683	0.9908	(94)
Useful gains	614.7840	740.0361	809.1507	780.7651	637.9892	431.1356	285.0203	299.0057	465.4955	631.7741	613.8124	576.2328	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1161.9369	1133.9240	1032.3296	856.9621	652.9199	432.5014	285.1366	299.2241	471.1050	725.3180	958.4532	1151.5501	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	407.0818	264.6926	166.0451	54.8619	11.1084	0.0000	0.0000	0.0000	0.0000	69.5967	248.1413	428.0361	(98)
Space heating												1649.5638	(98)
Space heating per m2											(98) / (4) =	20.8542	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1764.2394	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	407.0818	264.6926	166.0451	54.8619	11.1084	0.0000	0.0000	0.0000	0.0000	69.5967	248.1413	428.0361	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	435.3816	283.0937	177.5883	58.6758	11.8806	0.0000	0.0000	0.0000	0.0000	74.4349	265.3918	457.7926	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	197.1318	173.7462	182.4568	163.5395	160.2483	143.1660	137.4751	150.8812	150.6237	169.5821	179.3419	192.3818	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7068	85.9338	84.5636	82.2426	80.4164	79.8000	79.8000	79.8000	79.8000	82.6432	85.6803	86.8874	(217)
Fuel for water heating, kWh/month													
	227.3543	202.1860	215.7626	198.8502	199.2732	179.4061	172.2745	189.0742	188.7515	205.1978	209.3154	221.4151	(219)
Water heating fuel used												2408.8609	(219)
Annual totals kWh/year													
Space heating fuel - main system												1764.2394	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.5160	(232)
Total delivered energy for all uses												4590.6163	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1764.2394	0.2160	381.0757	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2408.8609	0.2160	520.3140	(264)
Space and water heating			901.3897	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.5160	0.5190	177.7658	(268)
Total CO2, kg/m2/year			1118.0805	(272)
Emissions per m2 for space and water heating			11.3956	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2474	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.3956 * 1.00) + 2.2474 + 0.4921, rounded to 2 d.p.			14.1400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2469	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3148	0.3086	0.3025	0.2716	0.2654	0.2346	0.2346	0.2284	0.2469	0.2654	0.2778	0.2901	(22b)
Effective ac	0.5495	0.5476	0.5457	0.5369	0.5352	0.5275	0.5275	0.5261	0.5305	0.5352	0.5386	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.7000	1.1450	31.7176			(27)
External Wall 1	38.6100	27.7000	10.9100	0.1500	1.6365			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3541			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	42.7141	(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	38.7311	38.5955	38.4626	37.8383	37.7215	37.1777	37.1777	37.0771	37.3872	37.7215	37.9578	38.2048	(38)
Heat transfer coeff	81.4452	81.3096	81.1767	80.5524	80.4355	79.8918	79.8918	79.7911	80.1012	80.4355	80.6718	80.9189	(39)
Average = Sum(39)m / 12 =												80.5518	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0296	1.0279	1.0263	1.0184	1.0169	1.0100	1.0100	1.0087	1.0127	1.0169	1.0199	1.0230	(40)
HLP (average)												1.0184	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797 (65)

---

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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3947	17.2262	14.0093	10.6059	7.9280	6.6932	7.2322	9.4007	12.6176	16.0210	18.6989	19.9337	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	339.6235	338.3501	326.6153	307.2551	286.7926	267.6735	255.6252	259.3653	269.6315	289.1264	311.5869	329.2070	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	24.7000	36.7938	0.6800	0.8000	0.7700	342.6132	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	355.3740	609.5719	845.3014	1066.2403	1211.5025	1210.3181	1163.7228	1054.1924	921.6344	676.7424	426.4280	303.6266	(83)
Total gains	694.9974	947.9220	1171.9167	1373.4954	1498.2951	1477.9916	1419.3480	1313.5577	1191.2659	965.8688	738.0149	632.8336	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.9779	27.0229	27.0672	27.2769	27.3166	27.5025	27.5025	27.5372	27.4306	27.3166	27.2365	27.1534	
alpha	2.7985	2.8015	2.8045	2.8185	2.8211	2.8335	2.8335	2.8358	2.8287	2.8211	2.8158	2.8102	
util living area	0.9190	0.8420	0.7388	0.6023	0.4614	0.3346	0.2441	0.2740	0.4340	0.6832	0.8680	0.9341	(86)
MIT	19.2996	19.7951	20.2654	20.6511	20.8656	20.9601	20.9879	20.9830	20.9155	20.5817	19.8629	19.1848	(87)
Th 2	20.0587	20.0601	20.0615	20.0681	20.0693	20.0750	20.0750	20.0761	20.0728	20.0693	20.0668	20.0642	(88)
util rest of house	0.9087	0.8248	0.7137	0.5694	0.4221	0.2893	0.1941	0.2208	0.3828	0.6456	0.8501	0.9255	(89)
MIT 2	18.5222	18.9969	19.4374	19.7899	19.9729	20.0516	20.0698	20.0683	20.0198	19.7422	19.0766	18.4151	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	18.8171	19.2996	19.7514	20.1165	20.3114	20.3961	20.4180	20.4152	20.3595	20.0606	19.3748	18.7070	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8171	19.2996	19.7514	20.1165	20.3114	20.3961	20.4180	20.4152	20.3595	20.0606	19.3748	18.7070	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8925	0.8091	0.7048	0.5712	0.4325	0.3052	0.2127	0.2405	0.3990	0.6452	0.8349	0.9103	(94)
Useful gains	620.3173	766.9787	825.9916	784.5146	648.0824	451.0601	301.9480	315.9284	475.3358	623.1768	616.1821	576.0594	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1182.3459	1170.8243	1075.7057	903.5180	692.6662	463.0645	305.0268	320.3792	501.3929	760.9685	990.2303	1173.8892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	418.1492	271.3842	185.7873	85.6824	33.1704	0.0000	0.0000	0.0000	0.0000	102.5170	269.3147	444.7854	(98)
Space heating												1810.7906	(98)
Space heating per m2											(98) / (4) =	22.8924	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	750.9829	591.1993	606.4124	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9504	0.9689	0.9609	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	713.7590	572.7842	582.6814	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1818.6070	1748.1775	1626.0358	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	795.4906	874.4926	776.2557	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2446.2388	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   198.8726   218.6232   194.0639     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          611.5597 (107)
Space cooling per m2                                                                                                                     7.7315 (108)
Energy for space heating                                                                                                                22.8924 (99)
Energy for space cooling                                                                                                                 7.7315 (108)
Total                                                                                                                                   30.6239 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   30.6 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3319	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4232	0.4149	0.4066	0.3651	0.3568	0.3153	0.3153	0.3070	0.3319	0.3568	0.3734	0.3900	(22b)
Effective ac	0.5895	0.5861	0.5827	0.5666	0.5636	0.5497	0.5497	0.5471	0.5551	0.5636	0.5697	0.5760	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.7800	1.3258	26.2235			(27)
External Wall 1	38.6100	19.7800	18.8300	0.1800	3.3894			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.6129			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		35.0129	(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	41.5494	41.3044	41.0642	39.9361	39.7250	38.7424	38.7424	38.5604	39.1209	39.7250	40.1520	40.5984	(38)
Heat transfer coeff	76.5623	76.3173	76.0771	74.9489	74.7379	73.7553	73.7553	73.5733	74.1338	74.7379	75.1649	75.6113	(39)
Average = Sum(39)m / 12 =												74.9479	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9679	0.9648	0.9618	0.9475	0.9449	0.9324	0.9324	0.9301	0.9372	0.9449	0.9503	0.9559	(40)
HLP (average)												0.9475	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

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

	19.3947	17.2262	14.0093	10.6059	7.9280	6.6932	7.2322	9.4007	12.6176	16.0210	18.6989	19.9337	(67)

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

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

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

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)

Total internal gains

	339.6235	338.3501	326.6153	307.2551	286.7926	267.6735	255.6252	259.3653	269.6315	289.1264	311.5869	329.2070	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	17.6400	36.7938	0.6300	0.7000	0.7700	198.3560	(79)
Northwest	2.1400	11.2829	0.6300	0.7000	0.7700	7.3792	(81)

Solar gains	205.7352	352.8943	489.3558	617.2481	701.3297	700.6394	673.6678	610.2693	533.5419	391.7787	246.8697	175.7776	(83)
Total gains	545.3587	691.2443	815.9711	924.5032	988.1223	968.3129	929.2931	869.6346	803.1733	680.9051	558.4567	504.9846	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7462	71.9766	72.2038	73.2906	73.4976	74.4768	74.4768	74.6610	74.0965	73.4976	73.0801	72.6486	
alpha	5.7831	5.7984	5.8136	5.8860	5.8998	5.9651	5.9651	5.9774	5.9398	5.8998	5.8720	5.8432	
util living area	0.9958	0.9841	0.9483	0.8464	0.6747	0.4840	0.3488	0.3883	0.6203	0.9052	0.9881	0.9972	(86)
MIT	20.0968	20.3261	20.5951	20.8467	20.9650	20.9959	20.9995	20.9991	20.9835	20.8015	20.3926	20.0564	(87)
Th 2	20.1102	20.1128	20.1153	20.1273	20.1295	20.1400	20.1400	20.1420	20.1360	20.1295	20.1250	20.1202	(88)
util rest of house	0.9945	0.9794	0.9340	0.8117	0.6206	0.4206	0.2809	0.3164	0.5494	0.8736	0.9838	0.9964	(89)
MIT 2	19.2897	19.5180	19.7788	20.0150	20.1088	20.1383	20.1399	20.1417	20.1283	19.9847	19.5956	19.2579	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	19.5958	19.8245	20.0884	20.3304	20.4335	20.4636	20.4659	20.4669	20.4526	20.2945	19.8979	19.5608	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5958	19.8245	20.0884	20.3304	20.4335	20.4636	20.4659	20.4669	20.4526	20.2945	19.8979	19.5608	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9775	0.9335	0.8203	0.6400	0.4446	0.3066	0.3437	0.5759	0.8802	0.9824	0.9956	(94)
Useful gains	541.8310	675.7086	761.6954	758.3797	632.3738	430.5074	284.9603	298.8812	462.5635	599.3580	548.6076	502.7801	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1171.0821	1138.9976	1033.7639	856.7000	652.7266	432.4681	285.1322	299.2150	470.9456	724.5472	961.9508	1161.4459	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	468.1628	311.3302	202.4189	70.7906	15.1425	0.0000	0.0000	0.0000	0.0000	93.1408	297.6071	490.0474	(98)
Space heating												1948.6403	(98)
Space heating per m2											(98) / (4) =	24.6351	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	693.2996	545.7891	559.1572	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9850	0.9945	0.9916	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.9312	542.7644	554.4533	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1222.8787	1175.3860	1107.1647	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	388.7622	470.6705	411.2173	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1270.6499	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.1905	117.6676	102.8043	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	317.6625 (107)
Space cooling per m2	4.0160 (108)
Energy for space heating	24.6351 (99)
Energy for space cooling	4.0160 (108)
Total	28.6511 (109)
Target Fabric Energy Efficiency (TFEE)	32.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.7000	1.1450	31.7176			(27)
External Wall 1	38.6100	27.7000	10.9100	0.1500	1.6365			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3541			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	42.7141	(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	16.4434	16.2188	15.9941	15.5448	15.5448	14.6462	15.0955	14.6462	14.4216	14.8709	14.8709	15.7695	(38)
Heat transfer coeff	59.1575	58.9328	58.7082	58.2589	58.2589	57.3603	57.8096	57.3603	57.1356	57.5849	57.5849	58.4835	(39)
Average = Sum(39)m / 12 =												58.0530	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7479	0.7450	0.7422	0.7365	0.7365	0.7252	0.7308	0.7252	0.7223	0.7280	0.7280	0.7394	(40)
HLP (average)												0.7339	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (64)
Total per year (kWh/year) = Sum(64)m = 2102.7967 (64)
RHI water heating demand 2103 (64)
Heat gains from water heating, kWh/month
94.2750 83.7191 89.3955 82.1788 82.0112 75.4046 74.4391 78.8966 77.8843 85.1147 87.4331 92.6956 (65)

---

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	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.4867 43.0654 35.0232 26.5148 19.8201 16.7330 18.0806 23.5018 31.5441 40.0525 46.7471 49.8343 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
324.7004 328.0698 319.5791 301.5033 278.6860 257.2409 242.9142 239.5449 248.0356 266.1113 288.9287 310.3738 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 52.1189 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 -97.8225 (71)
Water heating gains (Table 5)
126.7136 124.5819 120.1553 114.1372 110.2301 104.7286 100.0525 106.0439 108.1726 114.4014 121.4349 124.5909 (72)
Total internal gains
600.9309 596.7474 575.7877 543.1855 509.7664 479.7327 462.0776 470.1207 488.7825 521.5954 558.1409 585.8291 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	24.7000	39.0225	0.6800	0.8000	0.7700	363.3656	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	377.4898	570.6457	811.2198	1062.0724	1180.6038	1262.1642	1209.2755	1125.2218	972.9602	705.3783	467.7396	330.4512	(83)
Total gains	978.4208	1167.3931	1387.0075	1605.2579	1690.3702	1741.8969	1671.3531	1595.3426	1461.7426	1226.9737	1025.8805	916.2803	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.1419	37.2835	37.4262	37.7148	37.7148	38.3056	38.0079	38.3056	38.4562	38.1562	38.1562	37.5699	
alpha	3.4761	3.4856	3.4951	3.5143	3.5143	3.5537	3.5339	3.5537	3.5637	3.5437	3.5437	3.5047	
util living area	0.7454	0.6534	0.5107	0.3664	0.2468	0.1382	0.0795	0.0863	0.1988	0.3938	0.6198	0.7687	(86)
MIT	20.5388	20.7125	20.8864	20.9684	20.9938	20.9995	21.0000	20.9999	20.9980	20.9681	20.8083	20.4985	(87)
Th 2	20.2987	20.3012	20.3037	20.3087	20.3087	20.3187	20.3137	20.3187	20.3212	20.3162	20.3162	20.3062	(88)
util rest of house	0.7259	0.6317	0.4869	0.3431	0.2234	0.1158	0.0558	0.0618	0.1725	0.3645	0.5939	0.7500	(89)
MIT 2	19.7091	19.9410	20.1681	20.2737	20.3027	20.3183	20.3137	20.3186	20.3196	20.2826	20.0849	19.6619	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	20.0237	20.2336	20.4405	20.5372	20.5648	20.5767	20.5739	20.5770	20.5769	20.5426	20.3593	19.9792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0237	20.2336	20.4405	20.5372	20.5648	20.5767	20.5739	20.5770	20.5769	20.5426	20.3593	19.9792	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7178	0.6295	0.4917	0.3508	0.2321	0.1243	0.0648	0.0711	0.1825	0.3742	0.5955	0.7406	(94)
Useful gains	702.3103	734.8759	681.9305	563.1341	392.2973	216.5165	108.3257	113.3947	266.7059	459.1837	610.9477	678.6134	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	847.3562	827.0376	718.6192	573.1021	394.1112	216.6316	108.3321	113.4034	267.2179	468.8894	671.3979	835.0983	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	107.9142	61.9327	27.2964	7.1769	1.3495	0.0000	0.0000	0.0000	0.0000	7.2210	43.5241	116.4248	(98)
Space heating												372.8397	(98)
RHI space heating demand												373	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.7000	1.1450	31.7176			(27)
External Wall 1	38.6100	27.7000	10.9100	0.1500	1.6365			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3541			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	42.7141	(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	19.1392	18.9146	18.6899	17.5667	17.3420	16.2188	16.2188	15.9941	16.6681	17.3420	17.7913	18.2406	(38)
Heat transfer coeff	61.8533	61.6286	61.4040	60.2807	60.0561	58.9328	58.9328	58.7082	59.3821	60.0561	60.5054	60.9547	(39)
Average = Sum(39)m / 12 =												60.2246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7820	0.7791	0.7763	0.7621	0.7592	0.7450	0.7450	0.7422	0.7507	0.7592	0.7649	0.7706	(40)
HLP (average)												0.7614	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (64)
Total per year (kWh/year) = Sum(64)m = 2102.7967 (64)
Heat gains from water heating, kWh/month
94.2750 83.7191 89.3955 82.1788 82.0112 75.4046 74.4391 78.8966 77.8843 85.1147 87.4331 92.6956 (65)

---

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	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4867	43.0654	35.0232	26.5148	19.8201	16.7330	18.0806	23.5018	31.5441	40.0525	46.7471	49.8343	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	126.7136	124.5819	120.1553	114.1372	110.2301	104.7286	100.0525	106.0439	108.1726	114.4014	121.4349	124.5909	(72)
Total internal gains													
	600.9309	596.7474	575.7877	543.1855	509.7664	479.7327	462.0776	470.1207	488.7825	521.5954	558.1409	585.8291	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	24.7000	36.7938	0.6800	0.8000	0.7700	342.6132	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	355.3740	609.5719	845.3014	1066.2403	1211.5025	1210.3181	1163.7228	1054.1924	921.6344	676.7424	426.4280	303.6266	(83)
Total gains	956.3049	1206.3193	1421.0890	1609.4258	1721.2689	1690.0507	1625.8003	1524.3131	1410.4169	1198.3378	984.5688	889.4557	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.5231	35.6526	35.7831	36.4498	36.5862	37.2835	37.2835	37.4262	37.0014	36.5862	36.3145	36.0468	
alpha	3.3682	3.3768	3.3855	3.4300	3.4391	3.4856	3.4856	3.4951	3.4668	3.4391	3.4210	3.4031	
util living area													
	0.7998	0.6912	0.5714	0.4363	0.3199	0.2222	0.1593	0.1768	0.2877	0.4931	0.7094	0.8240	(86)
MIT	20.3061	20.5895	20.7966	20.9289	20.9793	20.9959	20.9990	20.9986	20.9895	20.9120	20.6285	20.2429	(87)
Th 2	20.2690	20.2715	20.2739	20.2863	20.2888	20.3012	20.3012	20.3037	20.2962	20.2888	20.2838	20.2789	(88)
util rest of house													
	0.7834	0.6711	0.5488	0.4130	0.2963	0.1982	0.1341	0.1502	0.2590	0.4639	0.6866	0.8088	(89)
MIT 2	19.3644	19.7486	20.0237	20.2035	20.2668	20.2975	20.3006	20.3027	20.2863	20.1893	19.8193	19.2861	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	19.7215	20.0675	20.3168	20.4786	20.5370	20.5624	20.5655	20.5666	20.5530	20.4634	20.1262	19.6490	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7215	20.0675	20.3168	20.4786	20.5370	20.5624	20.5655	20.5666	20.5530	20.4634	20.1262	19.6490	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7701	0.6653	0.5502	0.4193	0.3046	0.2072	0.1436	0.1603	0.2695	0.4711	0.6814	0.7944	(94)
Useful gains	736.4410	802.5094	781.8448	674.8889	524.2634	350.2113	233.4645	244.2729	380.1373	564.5870	670.8482	706.5985	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	953.8719	934.7527	848.4079	697.9693	530.7168	351.3791	233.6963	244.6160	383.1928	592.3573	788.1567	941.6873	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	161.7686	88.8675	49.5230	16.6179	4.8013	0.0000	0.0000	0.0000	0.0000	20.6611	84.4621	174.9061	(98)
Space heating												601.6076	(98)
Space heating per m2											(98) / (4) =	7.6057	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	553.9686	436.1029	446.1822	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9902	0.9948	0.9931	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	548.5515	433.8285	443.1195	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1894.3902	1822.2730	1702.2936	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	969.0039	1033.0027	936.8255	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2938.8321	(104)
Cooled fraction										fC = cooled area / (4) =		0.7585	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	183.7555	195.8918	177.6534	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												557.3007	(107)
Space cooling per m2												7.0455	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	601.6076	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	221.0908	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	410.5972	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2102.7967	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	772.7778	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.1588	(310b)
Electricity used for heat distribution	28.3962	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	129.0048	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.1318	(330a)
Total electricity for the above, kWh/year	179.1318	(331)
Electricity for lighting (calculated in Appendix L)	342.5160	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3490.2772	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	221.0908	4.2400	9.3742	(340a)
Space heating from Combined Heat and Power	410.5972	2.9700	12.1947	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	772.7778	4.2400	32.7658	(342a)
Water heating from Combined Heat and Power	1435.1588	2.9700	42.6242	(342b)
Space cooling	129.0048	13.1900	17.0157	(348)
Mechanical ventilation fans	179.1318	13.1900	23.6275	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	342.5160	13.1900	45.1779	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			263.2101	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8908	(357)
SAP value	87.5733	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1046.1775	0.2160	225.9743 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	746.5404	0.2160	161.2527 (363)
less credit emissions for electricity	-261.2891	0.5190	-135.6091 (364)
Water heating from Combined Heat and Power	2609.3796	0.2160	563.6260 (365)
less credit emissions for electricity	-913.2828	0.5190	-473.9938 (366)
Electrical energy for heat distribution	28.3962	0.5190	14.7377 (372)
Total CO2 associated with community systems			355.9878 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			355.9878 (376)
Space cooling	129.0048	0.5190	66.9535 (377)
Pumps and fans	179.1318	0.5190	92.9694 (378)
Energy for lighting	342.5160	0.5190	177.7658 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			537.9766 (383)
CO2 emissions per m2			6.8000 (384)
EI value			94.1911 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1000 (1b)	x	2.7000 (2b)	=	213.5700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.7000	1.1450	31.7176			(27)
External Wall 1	38.6100	27.7000	10.9100	0.1500	1.6365			(29a)
Total net area of external elements Aum(A, m2)			38.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.3541			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	42.7141	(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	16.4434	16.2188	15.9941	15.5448	15.5448	14.6462	15.0955	14.6462	14.4216	14.8709	14.8709	15.7695	(38)
Heat transfer coeff	59.1575	58.9328	58.7082	58.2589	58.2589	57.3603	57.8096	57.3603	57.1356	57.5849	57.5849	58.4835	(39)
Average = Sum(39)m / 12 =												58.0530	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7479	0.7450	0.7422	0.7365	0.7365	0.7252	0.7308	0.7252	0.7223	0.7280	0.7280	0.7394	(40)
HLP (average)												0.7339	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8137 181.5879 191.1387 171.9413 168.9302 151.5679 146.1570 159.5631 159.0255 178.2640 187.7438 201.0637 (64)
Total per year (kWh/year) = Sum(64)m = 2102.7967 (64)
Heat gains from water heating, kWh/month
94.2750 83.7191 89.3955 82.1788 82.0112 75.4046 74.4391 78.8966 77.8843 85.1147 87.4331 92.6956 (65)

---

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	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4867	43.0654	35.0232	26.5148	19.8201	16.7330	18.0806	23.5018	31.5441	40.0525	46.7471	49.8343	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	126.7136	124.5819	120.1553	114.1372	110.2301	104.7286	100.0525	106.0439	108.1726	114.4014	121.4349	124.5909	(72)
Total internal gains													
	600.9309	596.7474	575.7877	543.1855	509.7664	479.7327	462.0776	470.1207	488.7825	521.5954	558.1409	585.8291	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	24.7000	39.0225	0.6800	0.8000	0.7700	363.3656	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	377.4898	570.6457	811.2198	1062.0724	1180.6038	1262.1642	1209.2755	1125.2218	972.9602	705.3783	467.7396	330.4512	(83)
Total gains	978.4208	1167.3931	1387.0075	1605.2579	1690.3702	1741.8969	1671.3531	1595.3426	1461.7426	1226.9737	1025.8805	916.2803	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.1419	37.2835	37.4262	37.7148	37.7148	38.3056	38.0079	38.3056	38.4562	38.1562	38.1562	37.5699	
alpha	3.4761	3.4856	3.4951	3.5143	3.5143	3.5537	3.5339	3.5537	3.5637	3.5437	3.5437	3.5047	
util living area													
	0.7454	0.6534	0.5107	0.3664	0.2468	0.1382	0.0795	0.0863	0.1988	0.3938	0.6198	0.7687	(86)
MIT	20.5388	20.7125	20.8864	20.9684	20.9938	20.9995	21.0000	20.9999	20.9980	20.9681	20.8083	20.4985	(87)
Th 2	20.2987	20.3012	20.3037	20.3087	20.3087	20.3187	20.3137	20.3187	20.3212	20.3162	20.3162	20.3062	(88)
util rest of house													
	0.7259	0.6317	0.4869	0.3431	0.2234	0.1158	0.0558	0.0618	0.1725	0.3645	0.5939	0.7500	(89)
MIT 2	19.7091	19.9410	20.1681	20.2737	20.3027	20.3183	20.3137	20.3186	20.3196	20.2826	20.0849	19.6619	(90)
Living area fraction									fLA = Living area / (4) =			0.3793	(91)
MIT	20.0237	20.2336	20.4405	20.5372	20.5648	20.5767	20.5739	20.5770	20.5769	20.5426	20.3593	19.9792	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0237	20.2336	20.4405	20.5372	20.5648	20.5767	20.5739	20.5770	20.5769	20.5426	20.3593	19.9792	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7178	0.6295	0.4917	0.3508	0.2321	0.1243	0.0648	0.0711	0.1825	0.3742	0.5955	0.7406	(94)
Useful gains	702.3103	734.8759	681.9305	563.1341	392.2973	216.5165	108.3257	113.3947	266.7059	459.1837	610.9477	678.6134	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	847.3562	827.0376	718.6192	573.1021	394.1112	216.6316	108.3321	113.4034	267.2179	468.8894	671.3979	835.0983	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	107.9142	61.9327	27.2964	7.1769	1.3495	0.0000	0.0000	0.0000	0.0000	7.2210	43.5241	116.4248	(98)
Space heating												372.8397	(98)
Space heating per m2											(98) / (4) =	4.7135	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	412.9941	306.3908	309.7456	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9969	0.9986	0.9984	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	411.6946	305.9659	309.2385	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1954.9895	1875.5165	1785.3151	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1111.1724	1167.7457	1098.2010	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												3377.1190	(104)
Cooled fraction										fC = cooled area / (4) =		0.7585	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	210.7154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												210.7154	(107)
Space cooling per m2												2.6639	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	372.8397	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	137.0186	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	254.4631	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2102.7967	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	772.7778	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.1588	(310b)
Electricity used for heat distribution	25.9942	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	48.7767	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.1318	(330a)
Total electricity for the above, kWh/year	179.1318	(331)
Electricity for lighting (calculated in Appendix L)	342.5160	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3169.8428	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	137.0186	5.0000	6.8509	(340a)
Space heating from Combined Heat and Power	254.4631	3.5000	8.9062	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	772.7778	5.0000	38.6389	(342a)
Water heating from Combined Heat and Power	1435.1588	3.5000	50.2306	(342b)
Space cooling	48.7767	15.7000	7.6579	(348)
Mechanical ventilation fans	179.1318	15.7000	28.1237	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	342.5160	15.7000	53.7750	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			236.0832	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	957.6804	0.2160	206.8590	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	462.6601	0.2160	99.9346	(363)
less credit emissions for electricity	-161.9310	0.5190	-84.0422	(364)
Water heating from Combined Heat and Power	2609.3796	0.2160	563.6260	(365)
less credit emissions for electricity	-913.2828	0.5190	-473.9938	(366)
Electrical energy for heat distribution	25.9942	0.5190	13.4910	(372)
Total CO2 associated with community systems			325.8745	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			325.8745	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	48.7767	0.5190	25.3151 (377)
Pumps and fans	179.1318	0.5190	92.9694 (378)
Energy for lighting	342.5160	0.5190	177.7658 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			466.2249 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	957.6804	1.2200	1168.3701	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	462.6601	1.2200	564.4453	(363)
less credit emissions for electricity	-161.9310	3.0700	-497.1283	(364)
Water heating from Combined Heat and Power	2609.3796	1.2200	3183.4431	(365)
less credit emissions for electricity	-913.2828	3.0700	-2803.7783	(366)
Electrical energy for heat distribution	25.9942	3.0700	79.8021	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1695.1540	(373)
Space and water heating			1695.1540	(376)
Space cooling	48.7767	3.0700	149.7445	(377)
Pumps and fans	179.1318	3.0700	549.9347	(378)
Energy for lighting	342.5160	3.0700	1051.5242	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2525.3574	(383)
Primary energy kWh/m2/year			31.9261	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£90	£90	£0
Community scheme	£194	£194	£0
Space heating	£133	£133	£0
Space cooling	£8	£8	£0
Water heating	£89	£89	£0
Lighting	£54	£54	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£237	£237	£0
Total cost of uses	£237	£237	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	32 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	422.87 (P1)
Transmission heat loss coefficient	42.71 (37)
Summer heat loss coefficient	465.58 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South West	0.000	1.000	None
South West	1.000	0.360	Wide overhang
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)
South West	0.920	0.90	0.360	0.239 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	24.7000	119.9223	0.6800	0.8000	0.9000	1305.2118
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						1376.3519

	Jun	Jul	Aug	
Solar gains	1447	1376	1276	(P3)
Internal gains	480	462	470	
Total summer gains	1927	1838	1746	(P5)
Summer gain/loss ratio	4.14	3.95	3.75	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	21.44	23.15	22.85	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007031	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0M02
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	7.04	**TER**	14.49
Environmental	94 A	**% DER<TER**	51.42		
CO_2 Emissions (t/year)	0.46	**DFEE**	30.32	**TFEE**	34.81
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.91		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               19, 79.2, 2.7
Living Area:                   30 m2, fraction: 37.9%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                27.6, 51.3, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.70,
     Under Balcony             Window, External Wall 1, South West, , Light-coloured curtain or roller blind, 1, True, 0, 0, 0, 8.00, 20
     Window                    Window, External Wall 1, North East, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.182
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.04 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.3 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing North East:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South East:		12.70 m², No overhang	
Windows facing South West:		8.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.7000	1.1450	27.1374			(27)
External Wall 1	51.3000	23.7000	27.6000	0.1500	4.1400			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2774			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.6374	(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	19.1634	18.9385	18.7135	17.5889	17.3639	16.2393	16.2393	16.0143	16.6891	17.3639	17.8138	18.2637	(38)
Heat transfer coeff	59.8008	59.5759	59.3509	58.2263	58.0013	56.8767	56.8767	56.6517	57.3265	58.0013	58.4512	58.9011	(39)
Average = Sum(39)m / 12 =												58.1700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7551	0.7522	0.7494	0.7352	0.7323	0.7181	0.7181	0.7153	0.7238	0.7323	0.7380	0.7437	(40)
HLP (average)												0.7345	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4475 (42)
Average daily hot water use (litres/day)	92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5918	19.7590	20.3895	17.7760	17.0565	14.7185	13.6388	15.6508	15.8377	18.4573	20.1476	21.8790	(46)

Water storage loss:	
Store volume	110.0000 (47)

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (56)
If cylinder contains dedicated solar storage
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (57)
Primary loss    23.2624   21.0112   23.2624   22.5120   23.2624   22.5120   23.2624   23.2624   22.5120   23.2624   22.5120   23.2624 (59)
Total heat required for water heating calculated for each month
   205.8890  181.6538  191.2066  172.0006  168.9870  151.6169  146.2024  159.6153  159.0783  178.3255  187.8110  201.1367 (62)
Solar input      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                          Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   205.8890  181.6538  191.2066  172.0006  168.9870  151.6169  146.2024  159.6153  159.0783  178.3255  187.8110  201.1367 (64)
                                                                            Total per year (kWh/year) = Sum(64)m =   2103.5231 (64)
Heat gains from water heating, kWh/month
    94.3000   83.7410   89.4181   82.1985   82.0301   75.4209   74.4542   78.9140   77.9018   85.1351   87.4554   92.7198 (65)
```

---

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     122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753  122.3753 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    19.4135   17.2429   14.0229   10.6162    7.9357    6.6997    7.2393    9.4099   12.6299   16.0365   18.7170   19.9531 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   217.7604  220.0201  214.3258  202.2033  186.9008  172.5187  162.9105  160.6508  166.3451  178.4676  193.7701  208.1523 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375   35.2375 (69)
Pumps, fans      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
   -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003  -97.9003 (71)
Water heating gains (Table 5)
   126.7473  124.6145  120.1856  114.1646  110.2555  104.7513  100.0729  106.0672  108.1970  114.4289  121.4659  124.6235 (72)
Total internal gains
   423.6338  421.5901  408.2469  386.6967  364.8047  343.6823  329.9352  335.8405  346.8846  368.6457  393.6656  412.4414 (73)
```

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	12.7000	36.7938	0.6800	0.8000	0.7700	176.1615	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

```
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Solar gains   299.8900  515.0623  715.9891  906.0162 1032.0382 1032.1515  991.9512  896.7749  781.6166  572.2891  359.9710  256.1439 (83)
Total gains   723.5239  936.6524 1124.2360 1292.7129 1396.8428 1375.8338 1321.8864 1232.6153 1128.5012  940.9348  753.6366  668.5853 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                   21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau        36.7888   36.9277   37.0676   37.7836   37.9302   38.6802   38.6802   38.8338   38.3766   37.9302   37.6382   37.3508
alpha       3.4526    3.4618    3.4712    3.5189    3.5287    3.5787    3.5787    3.5889    3.5584    3.5287    3.5092    3.4901
util living area
    0.8812    0.7850    0.6637    0.5137    0.3778    0.2629    0.1889    0.2108    0.3450    0.5858    0.8065    0.9003 (86)

MIT        20.0562   20.4142   20.7002   20.8934   20.9692   20.9939   20.9986   20.9979   20.9836   20.8627   20.4615   19.9824 (87)
Th 2       20.2924   20.2949   20.2974   20.3099   20.3124   20.3248   20.3248   20.3273   20.3198   20.3124   20.3074   20.3024 (88)
util rest of house
    0.8694    0.7677    0.6415    0.4887    0.3515    0.2356    0.1601    0.1802    0.3124    0.5551    0.7875    0.8900 (89)
MIT 2      19.0394   19.5356   19.9225   20.1839   20.2791   20.3193   20.3239   20.3258   20.3041   20.1540   19.6194   18.9436 (90)
Living area fraction                                                                  fLA = Living area / (4) =     0.3788 (91)
MIT        19.4246   19.8684   20.2171   20.4526   20.5405   20.5748   20.5794   20.5804   20.5615   20.4224   19.9384   19.3370 (92)
Temperature adjustment                                                                                          0.0000
adjusted MIT   19.4246   19.8684   20.2171   20.4526   20.5405   20.5748   20.5794   20.5804   20.5615   20.4224   19.9384   19.3370 (93)
```

---

8. Space heating requirement

```
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.8530    0.7565    0.6389    0.4939    0.3602    0.2457    0.1710    0.1917    0.3240    0.5601    0.7766    0.8737 (94)
Useful gains  617.1903  708.5328  718.2195  638.4929  503.2084  338.1078  225.9981  236.3133  365.6600  527.0495  585.2471  584.1651 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
   904.4621  891.7571  814.1210  672.6674  512.7612  339.8273  226.3373  236.8273  370.4133  569.7143  750.4190  891.5885 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   213.7302  123.1267   71.3507   24.6056    7.1073    0.0000    0.0000    0.0000    0.0000   31.7427  118.9238  228.7230 (98)
Space heating                                                                                                 819.3100 (98)
Space heating per m2                                                                                 (98) / (4) =    10.3448 (99)
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	534.6408	420.8874	430.5533	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9887	0.9941	0.9922	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	528.6255	418.3868	427.1966	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1686.4846	1621.8272	1518.6303	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	833.6586	895.3597	812.0266	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2541.0449	(104)
Cooled fraction											fC = cooled area / (4) =	0.7576	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	157.8899	169.5757	153.7929	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												481.2585	(107)
Space cooling per m2												6.0765	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	819.3100	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	301.0964	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	559.1790	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2103.5231	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	773.0448	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.6545	(310b)
Electricity used for heat distribution	30.6897	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	111.4024	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.3583	(330a)
Total electricity for the above, kWh/year	179.3583	(331)
Electricity for lighting (calculated in Appendix L)	342.8485	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3702.5840	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1130.6749	0.2160	244.2258	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1016.6892	0.2160	219.6049	(363)
less credit emissions for electricity	-355.8412	0.5190	-184.6816	(364)
Water heating from Combined Heat and Power	2610.2810	0.2160	563.8207	(365)
less credit emissions for electricity	-913.5983	0.5190	-474.1575	(366)
Electrical energy for heat distribution	30.6897	0.5190	15.9280	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			384.7402	(373)
Space and water heating			384.7402	(376)
Space cooling	111.4024	0.5190	57.8179	(377)
Pumps and fans	179.3583	0.5190	93.0870	(378)
Energy for lighting	342.8485	0.5190	177.9384	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			557.8834	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.0400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.0400	ZC1
Total Floor Area	TFA	79.2000	
Assumed number of occupants	N	2.4475	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2930	ZC2
CO2 emissions from cooking, equation (L16)		2.2442	ZC3
Total CO2 emissions		25.5772	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.5772	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1403	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3903	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3317	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4230	0.4147	0.4064	0.3649	0.3566	0.3152	0.3152	0.3069	0.3317	0.3566	0.3732	0.3898	(22b)
Effective ac	0.5895	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.8000	1.3258	26.2500			(27)
External Wall 1	51.3000	19.8000	31.5000	0.1800	5.6700			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.9200			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	37.3200	(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	41.5962	41.3511	41.1108	39.9823	39.7711	38.7882	38.7882	38.6062	39.1668	39.7711	40.1983	40.6448	(38)
Heat transfer coeff	78.9162	78.6711	78.4308	77.3023	77.0911	76.1082	76.1082	75.9262	76.4868	77.0911	77.5183	77.9648	(39)
Average = Sum(39)m / 12 =												77.3013	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9964	0.9933	0.9903	0.9760	0.9734	0.9610	0.9610	0.9587	0.9657	0.9734	0.9788	0.9844	(40)
HLP (average)												0.9760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4475 (42)
Average daily hot water use (litres/day)	92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5918	19.7590	20.3895	17.7760	17.0565	14.7185	13.6388	15.6508	15.8377	18.4573	20.1476	21.8790	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	197.2071	173.8121	182.5247	163.5988	160.3051	143.2151	137.5205	150.9334	150.6765	169.6436	179.4091	192.4548	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	197.2071	173.8121	182.5247	163.5988	160.3051	143.2151	137.5205	150.9334	150.6765	169.6436	179.4091	192.4548	(64)
								Total per year (kWh/year) = Sum(64)m =				2001.3008	(64)
Heat gains from water heating, kWh/month													
	87.3545	77.4676	82.4726	75.4770	75.0846	68.6995	67.5087	71.9685	71.1804	78.1896	80.7340	85.7743	(65)

---

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	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4135	17.2429	14.0229	10.6162	7.9357	6.6997	7.2393	9.4099	12.6299	16.0365	18.7170	19.9531	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.7604	220.0201	214.3258	202.2033	186.9008	172.5187	162.9105	160.6508	166.3451	178.4676	193.7701	208.1523	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	(71)
Water heating gains (Table 5)													
	117.4119	115.2792	110.8503	104.8292	100.9201	95.4159	90.7375	96.7318	98.8616	105.0936	112.1305	115.2881	(72)
Total internal gains													
	417.2985	415.2548	401.9115	380.3613	358.4693	337.3469	323.5998	329.5051	340.5492	362.3103	387.3302	406.1060	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5100	11.2829	0.6300	0.7000	0.7700	8.6550	(75)
Southeast	10.6100	36.7938	0.6300	0.7000	0.7700	119.3060	(77)
Southwest	6.6800	36.7938	0.6300	0.7000	0.7700	75.1144	(79)

Solar gains	203.0754	348.7874	484.8623	613.5671	698.9289	699.0134	671.7850	607.3157	529.3114	387.5433	243.7611	173.4515	(83)
Total gains	620.3739	764.0422	886.7738	993.9284	1057.3982	1036.3603	995.3848	936.8208	869.8607	749.8536	631.0913	579.5575	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.6942	69.9113	70.1255	71.1493	71.3441	72.2656	72.2656	72.4388	71.9078	71.3441	70.9510	70.5446	
alpha	5.6463	5.6608	5.6750	5.7433	5.7563	5.8177	5.8177	5.8293	5.7939	5.7563	5.7301	5.7030	
util living area													
	0.9924	0.9765	0.9337	0.8246	0.6529	0.4669	0.3360	0.3721	0.5931	0.8789	0.9801	0.9946	(86)
MIT	20.1433	20.3646	20.6223	20.8583	20.9674	20.9961	20.9995	20.9991	20.9854	20.8252	20.4383	20.1033	(87)
Th 2	20.0863	20.0889	20.0914	20.1033	20.1056	20.1160	20.1160	20.1179	20.1120	20.1056	20.1011	20.0963	(88)
util rest of house													
	0.9901	0.9698	0.9164	0.7873	0.5981	0.4038	0.2687	0.3011	0.5223	0.8420	0.9733	0.9930	(89)
MIT 2	18.9579	19.2773	19.6382	19.9536	20.0777	20.1136	20.1158	20.1176	20.1022	19.9236	19.3955	18.9075	(90)
Living area fraction										fLA = Living area / (4) =		0.3788	(91)
MIT	19.4069	19.6892	20.0110	20.2963	20.4147	20.4479	20.4506	20.4515	20.4367	20.2651	19.7905	19.3605	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4069	19.6892	20.0110	20.2963	20.4147	20.4479	20.4506	20.4515	20.4367	20.2651	19.7905	19.3605	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9878	0.9662	0.9146	0.7958	0.6175	0.4277	0.2942	0.3280	0.5487	0.8493	0.9703	0.9912	(94)
Useful gains	612.8322	738.2117	811.0671	791.0159	652.9469	443.2081	292.8905	307.3027	477.2922	636.8231	612.3705	574.4418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1192.1801	1163.4795	1059.6764	880.9569	671.8271	445.0725	293.0588	307.6161	484.6761	745.0940	983.7432	1181.9832	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	431.0349	285.7800	184.9653	64.7575	14.0469	0.0000	0.0000	0.0000	0.0000	80.5535	267.3883	452.0109	(98)
Space heating												1780.5373	(98)
Space heating per m2											(98) / (4) =	22.4815	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1904.3180	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	431.0349	285.7800	184.9653	64.7575	14.0469	0.0000	0.0000	0.0000	0.0000	80.5535	267.3883	452.0109	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	460.9998	305.6470	197.8239	69.2594	15.0234	0.0000	0.0000	0.0000	0.0000	86.1535	285.9768	483.4341	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	197.2071	173.8121	182.5247	163.5988	160.3051	143.2151	137.5205	150.9334	150.6765	169.6436	179.4091	192.4548	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8447	86.1323	84.8493	82.5684	80.5674	79.8000	79.8000	79.8000	79.8000	82.9579	85.8763	87.0158	(217)
Fuel for water heating, kWh/month													
	227.0801	201.7967	215.1165	198.1373	198.9701	179.4676	172.3315	189.1396	188.8176	204.4937	208.9157	221.1723	(219)
Water heating fuel used												2405.4386	(219)
Annual totals kWh/year													
Space heating fuel - main system												1904.3180	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.8485	(232)
Total delivered energy for all uses												4727.6050	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1904.3180	0.2160	411.3327	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2405.4386	0.2160	519.5747	(264)
Space and water heating			930.9074	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.8485	0.5190	177.9384	(268)
Total CO2, kg/m2/year			1147.7708	(272)
Emissions per m2 for space and water heating			11.7539	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2467	(272b)
Emissions per m2 for pumps and fans			0.4915	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.7539 * 1.00) + 2.2467 + 0.4915, rounded to 2 d.p.			14.4900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1403	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2903	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2467	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3146	0.3084	0.3023	0.2714	0.2653	0.2344	0.2344	0.2282	0.2467	0.2653	0.2776	0.2899	(22b)
Effective ac	0.5495	0.5476	0.5457	0.5368	0.5352	0.5275	0.5275	0.5260	0.5304	0.5352	0.5385	0.5420	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.7000	1.1450	27.1374			(27)
External Wall 1	51.3000	23.7000	27.6000	0.1500	4.1400			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2774			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.3600 (36)
Total fabric heat loss	(33) + (36) =	40.6374 (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	38.7758	38.6402	38.5073	37.8830	37.7661	37.2224	37.2224	37.1217	37.4318	37.7661	38.0025	38.2495	(38)
Heat transfer coeff	79.4132	79.2776	79.1447	78.5204	78.4036	77.8598	77.8598	77.7591	78.0692	78.4036	78.6399	78.8869	(39)
Average = Sum(39)m / 12 =												78.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0027	1.0010	0.9993	0.9914	0.9899	0.9831	0.9831	0.9818	0.9857	0.9899	0.9929	0.9960	(40)
HLP (average)												0.9914	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4475 (42)
Average daily hot water use (litres/day)		92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	32.0051	27.9919	28.8851	25.1827	24.1634	20.8512	19.3217	22.1719	22.4367	26.1478	28.5424	30.9952 (65)

---

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	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	(66)

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

	19.4135	17.2429	14.0229	10.6162	7.9357	6.6997	7.2393	9.4099	12.6299	16.0365	18.7170	19.9531	(67)

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

	217.7604	220.0201	214.3258	202.2033	186.9008	172.5187	162.9105	160.6508	166.3451	178.4676	193.7701	208.1523	(68)

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

	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	(71)

Water heating gains (Table 5)

	43.0176	41.6545	38.8240	34.9760	32.4777	28.9600	25.9700	29.8010	31.1621	35.1450	39.6423	41.6602	(72)

Total internal gains

	339.9041	338.6301	326.8853	307.5081	287.0269	267.8910	255.8324	259.5743	269.8497	289.3617	311.8420	329.4782	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	12.7000	36.7938	0.6800	0.8000	0.7700	176.1615	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	299.8900	515.0623	715.9891	906.0162	1032.0382	1032.1515	991.9512	896.7749	781.6166	572.2891	359.9710	256.1439	(83)
Total gains	639.7941	853.6924	1042.8744	1213.5243	1319.0651	1300.0425	1247.7836	1156.3491	1051.4664	861.6508	671.8130	585.6221	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.7032	27.7506	27.7972	28.0182	28.0600	28.2559	28.2559	28.2925	28.1801	28.0600	27.9756	27.8880	
alpha	2.8469	2.8500	2.8531	2.8679	2.8707	2.8837	2.8837	2.8862	2.8787	2.8707	2.8650	2.8592	
util living area	0.9308	0.8663	0.7748	0.6453	0.5026	0.3680	0.2697	0.3020	0.4729	0.7208	0.8873	0.9436	(86)
MIT	19.2632	19.7232	20.1917	20.6012	20.8421	20.9525	20.9856	20.9798	20.9010	20.5360	19.8143	19.1587	(87)
Th 2	20.0811	20.0825	20.0839	20.0905	20.0917	20.0975	20.0975	20.0985	20.0952	20.0917	20.0892	20.0866	(88)
util rest of house	0.9219	0.8511	0.7516	0.6131	0.4624	0.3202	0.2161	0.2453	0.4200	0.6851	0.8715	0.9361	(89)
MIT 2	18.5042	18.9478	19.3907	19.7690	19.9770	20.0692	20.0911	20.0892	20.0321	19.7243	19.0492	18.4066	(90)
Living area fraction									fLA = Living area / (4) =			0.3788	(91)
MIT	18.7917	19.2415	19.6942	20.0842	20.3047	20.4038	20.4299	20.4265	20.3612	20.0318	19.3390	18.6915	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7917	19.2415	19.6942	20.0842	20.3047	20.4038	20.4299	20.4265	20.3612	20.0318	19.3390	18.6915	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9068	0.8352	0.7410	0.6129	0.4721	0.3366	0.2360	0.2662	0.4360	0.6826	0.8564	0.9221	(94)
Useful gains	580.1527	713.0292	772.7268	743.7165	622.6698	437.6464	294.5255	307.8054	458.4104	588.1495	575.3500	539.9796	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1150.8295	1136.9626	1044.2471	878.1908	674.6378	451.8806	298.1979	313.0975	488.8068	739.4833	962.4728	1143.1876	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	424.5836	284.8832	202.0111	96.8215	38.6642	0.0000	0.0000	0.0000	0.0000	112.5924	278.7284	448.7867	(98)
Space heating												1887.0712	(98)
Space heating per m2											(98) / (4) =	23.8267	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	731.8819	576.1624	590.9690	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9411	0.9629	0.9536	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	688.8073	554.7713	563.5555	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1610.6933	1547.7243	1442.3641	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	663.7579	738.7570	653.8336	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2056.3485	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	165.9395	184.6893	163.4584	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												514.0871 (107)
Space cooling per m2												6.4910 (108)
Energy for space heating												23.8267 (99)
Energy for space cooling												6.4910 (108)
Total												30.3177 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1403	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3903	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3317	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4230	0.4147	0.4064	0.3649	0.3566	0.3152	0.3152	0.3069	0.3317	0.3566	0.3732	0.3898	(22b)
Effective ac	0.5895	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5696	0.5760	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.8000	1.3258	26.2500			(27)
External Wall 1	51.3000	19.8000	31.5000	0.1800	5.6700			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.9200			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		37.3200	(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	41.5962	41.3511	41.1108	39.9823	39.7711	38.7882	38.7882	38.6062	39.1668	39.7711	40.1983	40.6448	(38)
Heat transfer coeff	78.9162	78.6711	78.4308	77.3023	77.0911	76.1082	76.1082	75.9262	76.4868	77.0911	77.5183	77.9648	(39)
Average = Sum(39)m / 12 =												77.3013	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9964	0.9933	0.9903	0.9760	0.9734	0.9610	0.9610	0.9587	0.9657	0.9734	0.9788	0.9844	(40)
HLP (average)												0.9760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4475 (42)
Average daily hot water use (litres/day)		92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.0051	27.9919	28.8851	25.1827	24.1634	20.8512	19.3217	22.1719	22.4367	26.1478	28.5424	30.9952	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	122.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4135	17.2429	14.0229	10.6162	7.9357	6.6997	7.2393	9.4099	12.6299	16.0365	18.7170	19.9531	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.7604	220.0201	214.3258	202.2033	186.9008	172.5187	162.9105	160.6508	166.3451	178.4676	193.7701	208.1523	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	35.2375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	(71)
Water heating gains (Table 5)													
	43.0176	41.6545	38.8240	34.9760	32.4777	28.9600	25.9700	29.8010	31.1621	35.1450	39.6423	41.6602	(72)
Total internal gains													
	339.9041	338.6301	326.8853	307.5081	287.0269	267.8910	255.8324	259.5743	269.8497	289.3617	311.8420	329.4782	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5100	11.2829	0.6300	0.7000	0.7700	8.6550	(75)
Southeast	10.6100	36.7938	0.6300	0.7000	0.7700	119.3060	(77)
Southwest	6.6800	36.7938	0.6300	0.7000	0.7700	75.1144	(79)

Solar gains	203.0754	348.7874	484.8623	613.5671	698.9289	699.0134	671.7850	607.3157	529.3114	387.5433	243.7611	173.4515	(83)
Total gains	542.9795	687.4176	811.7476	921.0753	985.9558	966.9044	927.6174	866.8899	799.1612	676.9050	555.6030	502.9296	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.6942	69.9113	70.1255	71.1493	71.3441	72.2656	72.2656	72.4388	71.9078	71.3441	70.9510	70.5446	
alpha	5.6463	5.6608	5.6750	5.7433	5.7563	5.8177	5.8177	5.8293	5.7939	5.7563	5.7301	5.7030	
util living area													
	0.9961	0.9854	0.9528	0.8582	0.6913	0.4991	0.3604	0.4017	0.6388	0.9137	0.9890	0.9974	(86)
MIT	20.0520	20.2807	20.5557	20.8225	20.9567	20.9945	20.9993	20.9987	20.9789	20.7755	20.3537	20.0118	(87)
Th 2	20.0863	20.0889	20.0914	20.1033	20.1056	20.1160	20.1160	20.1179	20.1120	20.1056	20.1011	20.0963	(88)
util rest of house													
	0.9948	0.9809	0.9393	0.8242	0.6359	0.4323	0.2883	0.3253	0.5652	0.8836	0.9849	0.9965	(89)
MIT 2	19.2255	19.4534	19.7208	19.9725	20.0798	20.1137	20.1158	20.1176	20.1020	19.9405	19.5373	19.1938	(90)
Living area fraction									fLA = Living area / (4) =			0.3788	(91)
MIT	19.5386	19.7668	20.0370	20.2945	20.4119	20.4473	20.4505	20.4513	20.4341	20.2568	19.8466	19.5037	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5386	19.7668	20.0370	20.2945	20.4119	20.4473	20.4505	20.4513	20.4341	20.2568	19.8466	19.5037	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9790	0.9384	0.8320	0.6554	0.4575	0.3157	0.3543	0.5926	0.8893	0.9835	0.9958	(94)
Useful gains	539.6195	673.0096	761.7647	766.3535	646.2262	442.3854	292.8065	307.1301	473.6170	601.9780	546.4334	500.8140	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1202.5702	1169.5880	1061.7202	880.8193	671.6126	445.0292	293.0525	307.6032	484.4787	744.4546	988.0910	1193.1469	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	493.2353	333.7007	223.1669	82.4154	18.8875	0.0000	0.0000	0.0000	0.0000	106.0026	317.9934	515.0957	(98)
Space heating												2090.4975	(98)
Space heating per m2											(98) / (4) =	26.3952	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	715.4170	563.2006	577.0388	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9811	0.9927	0.9890	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	701.8647	559.0812	570.6903	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1221.3111	1173.5041	1104.0351	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	374.0014	457.1307	396.8086	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1227.9407	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	93.5004	114.2827	99.2021	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												306.9852 (107)
Space cooling per m2												3.8761 (108)
Energy for space heating												26.3952 (99)
Energy for space cooling												3.8761 (108)
Total												30.2712 (109)
Target Fabric Energy Efficiency (TFEE)												34.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.7000	1.1450	27.1374			(27)
External Wall 1	51.3000	23.7000	27.6000	0.1500	4.1400			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2774			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.6374	(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	16.4642	16.2393	16.0143	15.5645	15.5645	14.6647	15.1146	14.6647	14.4398	14.8897	14.8897	15.7894	(38)
Heat transfer coeff	57.1016	56.8767	56.6517	56.2019	56.2019	55.3022	55.7520	55.3022	55.0772	55.5271	55.5271	56.4268	(39)
Average = Sum(39)m / 12 =												55.9957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7210	0.7181	0.7153	0.7096	0.7096	0.6983	0.7039	0.6983	0.6954	0.7011	0.7011	0.7125	(40)
HLP (average)												0.7070	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4475 (42)
Average daily hot water use (litres/day)	92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5918	19.7590	20.3895	17.7760	17.0565	14.7185	13.6388	15.6508	15.8377	18.4573	20.1476	21.8790	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             205.8890   181.6538   191.2066   172.0006   168.9870   151.6169   146.2024   159.6153   159.0783   178.3255   187.8110   201.1367 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             205.8890   181.6538   191.2066   172.0006   168.9870   151.6169   146.2024   159.6153   159.0783   178.3255   187.8110   201.1367 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   2103.5231 (64)
RHI water heating demand                                                                                      2104 (64)
Heat gains from water heating, kWh/month
              94.3000    83.7410    89.4181    82.1985    82.0301    75.4209    74.4542    78.9140    77.9018    85.1351    87.4554    92.7198 (65)


------------------------------------------------------------------------------------------------------------
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        146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504   146.8504 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              48.5338    43.1072    35.0572    26.5405    19.8394    16.7492    18.0981    23.5246    31.5747    40.0913    46.7925    49.8827 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             325.0156   328.3882   319.8892   301.7960   278.9565   257.4906   243.1500   239.7774   248.2763   266.3696   289.2091   310.6750 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325    52.1325 (69)
Pumps, fans    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003   -97.9003 (71)
Water heating gains (Table 5)
             126.7473   124.6145   120.1856   114.1646   110.2555   104.7513   100.0729   106.0672   108.1970   114.4289   121.4659   124.6235 (72)
Total internal gains
             601.3793   597.1927   576.2147   543.5838   510.1340   480.0738   462.4037   470.4519   489.1307   521.9726   558.5502   586.2638 (73)


------------------------------------------------------------------------------------------------------------
6. Solar gains
------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g              FF          Access          Gains
                                           m2           Table 6a     Specific data     Specific data      factor              W
                                                          W/m2      or Table 6b       or Table 6c        Table 6d
------------------------------------------------------------------------------------------------------------
Northeast                                3.0000          12.4885          0.6800            0.8000          0.7700          14.1242 (75)
Southeast                               12.7000          39.0225          0.6800            0.8000          0.7700         186.8317 (77)
Southwest                                8.0000          39.0225          0.6800            0.8000          0.7700         117.6893 (79)
------------------------------------------------------------------------------------------------------------

Solar gains  318.6452   482.3584   687.4771   902.9910  1006.2387  1076.8686  1031.2872   957.7334   825.6025   596.7676   394.9696   278.8469 (83)
Total gains  920.0245  1079.5510  1263.6918  1446.5748  1516.3727  1556.9424  1493.6909  1428.1853  1314.7332  1118.7402   953.5198   865.1107 (84)


------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          38.5278    38.6802    38.8338    39.1446    39.1446    39.7815    39.4605    39.7815    39.9439    39.6203    39.6203    38.9886
alpha         3.5685     3.5787     3.5889     3.6096     3.6096     3.6521     3.6307     3.6521     3.6629     3.6414     3.6414     3.5992
util living area
              0.7605     0.6760     0.5377     0.3912     0.2652     0.1491     0.0858     0.0929     0.2131     0.4156     0.6397     0.7818 (86)

MIT          20.5390    20.7030    20.8787    20.9656    20.9933    20.9995    21.0000    20.9999    20.9979    20.9664    20.8050    20.5027 (87)
Th 2         20.3223    20.3248    20.3273    20.3323    20.3323    20.3424    20.3374    20.3424    20.3449    20.3399    20.3399    20.3298 (88)
util rest of house
              0.7418     0.6550     0.5140     0.3674     0.2410     0.1258     0.0611     0.0675     0.1859     0.3859     0.6144     0.7639 (89)
MIT 2        19.7304    19.9508    20.1816    20.2939    20.3258    20.3420    20.3373    20.3424    20.3432    20.3042    20.1032    19.6886 (90)
Living area fraction                                                                                fLA = Living area / (4) =     0.3788 (91)
MIT          20.0367    20.2357    20.4456    20.5483    20.5787    20.5911    20.5883    20.5914    20.5912    20.5550    20.3690    19.9970 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT 20.0367    20.2357    20.4456    20.5483    20.5787    20.5911    20.5883    20.5914    20.5912    20.5550    20.3690    19.9970 (93)


------------------------------------------------------------------------------------------------------------
8. Space heating requirement
------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.7334     0.6521     0.5182     0.3752     0.2500     0.1346     0.0705     0.0771     0.1961     0.3957     0.6155     0.7544 (94)
Useful gains 674.7795   704.0042   654.8943   542.7098   379.0215   209.5343   105.2719   110.1222   257.8431   442.6655   586.9379   652.6825 (95)
Ext temp.     5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
             818.6488   798.3058   693.7366   553.4952   380.9736   209.6541   105.2784   110.1309   258.3792   452.8251   647.9476   806.7320 (97)
Month fracti  1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             107.0387    63.3706    28.8987     7.7655     1.4524     0.0000     0.0000     0.0000     0.0000     7.5587    43.9270   114.6128 (98)
Space heating                                                                                               374.6246 (98)
RHI space heating demand                                                                                    375 (98)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.7000	1.1450	27.1374			(27)
External Wall 1	51.3000	23.7000	27.6000	0.1500	4.1400			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2774			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.6374	(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	19.1634	18.9385	18.7135	17.5889	17.3639	16.2393	16.2393	16.0143	16.6891	17.3639	17.8138	18.2637	(38)
Heat transfer coeff	59.8008	59.5759	59.3509	58.2263	58.0013	56.8767	56.8767	56.6517	57.3265	58.0013	58.4512	58.9011	(39)
Average = Sum(39)m / 12 =												58.1700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7551	0.7522	0.7494	0.7352	0.7323	0.7181	0.7181	0.7153	0.7238	0.7323	0.7380	0.7437	(40)
HLP (average)												0.7345	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4475 (42)
Average daily hot water use (litres/day)	92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5918	19.7590	20.3895	17.7760	17.0565	14.7185	13.6388	15.6508	15.8377	18.4573	20.1476	21.8790	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8890 181.6538 191.2066 172.0006 168.9870 151.6169 146.2024 159.6153 159.0783 178.3255 187.8110 201.1367 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8890 181.6538 191.2066 172.0006 168.9870 151.6169 146.2024 159.6153 159.0783 178.3255 187.8110 201.1367 (64)
Total per year (kWh/year) = Sum(64)m = 2103.5231 (64)
Heat gains from water heating, kWh/month
94.3000 83.7410 89.4181 82.1985 82.0301 75.4209 74.4542 78.9140 77.9018 85.1351 87.4554 92.7198 (65)

---

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	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.5338 43.1072 35.0572 26.5405 19.8394 16.7492 18.0981 23.5246 31.5747 40.0913 46.7925 49.8827 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
325.0156 328.3882 319.8892 301.7960 278.9565 257.4906 243.1500 239.7774 248.2763 266.3696 289.2091 310.6750 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 52.1325 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 -97.9003 (71)
Water heating gains (Table 5)
126.7473 124.6145 120.1856 114.1646 110.2555 104.7513 100.0729 106.0672 108.1970 114.4289 121.4659 124.6235 (72)
Total internal gains
601.3793 597.1927 576.2147 543.5838 510.1340 480.0738 462.4037 470.4519 489.1307 521.9726 558.5502 586.2638 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	12.7000	36.7938	0.6800	0.8000	0.7700	176.1615	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	299.8900	515.0623	715.9891	906.0162	1032.0382	1032.1515	991.9512	896.7749	781.6166	572.2891	359.9710	256.1439	(83)
Total gains	901.2693	1112.2549	1292.2039	1449.6000	1542.1722	1512.2253	1454.3549	1367.2267	1270.7473	1094.2617	918.5212	842.4077	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.7888	36.9277	37.0676	37.7836	37.9302	38.6802	38.6802	38.8338	38.3766	37.9302	37.6382	37.3508	
alpha	3.4526	3.4618	3.4712	3.5189	3.5287	3.5787	3.5787	3.5889	3.5584	3.5287	3.5092	3.4901	
util living area	0.8134	0.7153	0.6012	0.4655	0.3441	0.2396	0.1718	0.1902	0.3079	0.5188	0.7283	0.8353	(86)
MIT	20.3060	20.5721	20.7807	20.9217	20.9771	20.9955	20.9990	20.9985	20.9886	20.9064	20.6223	20.2494	(87)
Th 2	20.2924	20.2949	20.2974	20.3099	20.3124	20.3248	20.3248	20.3273	20.3198	20.3124	20.3074	20.3024	(88)
util rest of house	0.7978	0.6960	0.5789	0.4419	0.3198	0.2146	0.1455	0.1625	0.2784	0.4896	0.7064	0.8209	(89)
MIT 2	19.3841	19.7470	20.0259	20.2180	20.2878	20.3208	20.3241	20.3263	20.3090	20.2057	19.8326	19.3146	(90)
Living area fraction									fLA = Living area / (4) =			0.3788	(91)
MIT	19.7333	20.0595	20.3118	20.4845	20.5489	20.5763	20.5798	20.5809	20.5664	20.4711	20.1317	19.6687	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7333	20.0595	20.3118	20.4845	20.5489	20.5763	20.5798	20.5809	20.5664	20.4711	20.1317	19.6687	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7845	0.6893	0.5794	0.4479	0.3282	0.2239	0.1555	0.1730	0.2891	0.4964	0.7005	0.8067	(94)
Useful gains	707.0695	766.6991	748.7122	649.2988	506.1422	338.6517	226.1096	236.4934	367.4104	543.2151	643.4505	679.5842	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	922.9252	903.1428	819.7439	674.5246	513.2468	339.9147	226.3552	236.8561	370.6982	572.5370	761.7203	911.1210	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	160.5966	91.6902	52.8476	18.1625	5.2858	0.0000	0.0000	0.0000	0.0000	21.8155	85.1542	172.2634	(98)
Space heating												607.8158	(98)
Space heating per m2											(98) / (4) =	7.6744	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	534.6408	420.8874	430.5533	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9887	0.9941	0.9922	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	528.6255	418.3868	427.1966	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1686.4846	1621.8272	1518.6303	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	833.6586	895.3597	812.0266	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2541.0449	(104)
Cooled fraction										fC = cooled area / (4) =		0.7576	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	157.8899	169.5757	153.7929	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												481.2585	(107)
Space cooling per m2												6.0765	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	607.8158	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	223.3723	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	414.8343	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2103.5231	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	773.0448	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.6545	(310b)
Electricity used for heat distribution	28.4691	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	111.4024	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.3583	(330a)
Total electricity for the above, kWh/year	179.3583	(331)
Electricity for lighting (calculated in Appendix L)	342.8485	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3480.5151	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	223.3723	4.2400	9.4710	(340a)
Space heating from Combined Heat and Power	414.8343	2.9700	12.3206	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	773.0448	4.2400	32.7771	(342a)
Water heating from Combined Heat and Power	1435.6545	2.9700	42.6389	(342b)
Space cooling	111.4024	13.1900	14.6940	(348)
Mechanical ventilation fans	179.3583	13.1900	23.6574	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	342.8485	13.1900	45.2217	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			261.2107	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8833	(357)
SAP value	87.6777	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1048.8601	0.2160	226.5538 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	754.2442	0.2160	162.9167 (363)
less credit emissions for electricity	-263.9855	0.5190	-137.0085 (364)
Water heating from Combined Heat and Power	2610.2810	0.2160	563.8207 (365)
less credit emissions for electricity	-913.5983	0.5190	-474.1575 (366)
Electrical energy for heat distribution	28.4691	0.5190	14.7754 (372)
Total CO2 associated with community systems			356.9007 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			356.9007 (376)
Space cooling	111.4024	0.5190	57.8179 (377)
Pumps and fans	179.3583	0.5190	93.0870 (378)
Energy for lighting	342.8485	0.5190	177.9384 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			530.0438 (383)
CO2 emissions per m2			6.6900 (384)
EI value			94.2813 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.2000 (1b)	x	2.7000 (2b)	=	213.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.7000	1.1450	27.1374			(27)
External Wall 1	51.3000	23.7000	27.6000	0.1500	4.1400			(29a)
Total net area of external elements Aum(A, m2)			51.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2774			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.6374	(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	16.4642	16.2393	16.0143	15.5645	15.5645	14.6647	15.1146	14.6647	14.4398	14.8897	14.8897	15.7894	(38)
Heat transfer coeff	57.1016	56.8767	56.6517	56.2019	56.2019	55.3022	55.7520	55.3022	55.0772	55.5271	55.5271	56.4268	(39)
Average = Sum(39)m / 12 =												55.9957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7210	0.7181	0.7153	0.7096	0.7096	0.6983	0.7039	0.6983	0.6954	0.7011	0.7011	0.7125	(40)
HLP (average)												0.7070	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4475 (42)
Average daily hot water use (litres/day)	92.3283 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5611	97.8680	94.1748	90.4817	86.7886	83.0955	83.0955	86.7886	90.4817	94.1748	97.8680	101.5611	(44)
Energy conte	150.6122	131.7264	135.9298	118.5069	113.7102	98.1233	90.9256	104.3385	105.5846	123.0487	134.3173	145.8599	(45)
Energy content (annual)										Total = Sum(45)m =		1452.6834	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5918	19.7590	20.3895	17.7760	17.0565	14.7185	13.6388	15.6508	15.8377	18.4573	20.1476	21.8790	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
205.8890 181.6538 191.2066 172.0006 168.9870 151.6169 146.2024 159.6153 159.0783 178.3255 187.8110 201.1367 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
205.8890 181.6538 191.2066 172.0006 168.9870 151.6169 146.2024 159.6153 159.0783 178.3255 187.8110 201.1367 (64)
Total per year (kWh/year) = Sum(64)m = 2103.5231 (64)
Heat gains from water heating, kWh/month
94.3000 83.7410 89.4181 82.1985 82.0301 75.4209 74.4542 78.9140 77.9018 85.1351 87.4554 92.7198 (65)

---

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	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	146.8504	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.5338	43.1072	35.0572	26.5405	19.8394	16.7492	18.0981	23.5246	31.5747	40.0913	46.7925	49.8827	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	325.0156	328.3882	319.8892	301.7960	278.9565	257.4906	243.1500	239.7774	248.2763	266.3696	289.2091	310.6750	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	52.1325	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	-97.9003	(71)
Water heating gains (Table 5)													
	126.7473	124.6145	120.1856	114.1646	110.2555	104.7513	100.0729	106.0672	108.1970	114.4289	121.4659	124.6235	(72)
Total internal gains													
	601.3793	597.1927	576.2147	543.5838	510.1340	480.0738	462.4037	470.4519	489.1307	521.9726	558.5502	586.2638	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(75)
Southeast	12.7000	39.0225	0.6800	0.8000	0.7700	186.8317	(77)
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)

Solar gains	318.6452	482.3584	687.4771	902.9910	1006.2387	1076.8686	1031.2872	957.7334	825.6025	596.7676	394.9696	278.8469	(83)
Total gains	920.0245	1079.5510	1263.6918	1446.5748	1516.3727	1556.9424	1493.6909	1428.1853	1314.7332	1118.7402	953.5198	865.1107	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.5278	38.6802	38.8338	39.1446	39.1446	39.7815	39.4605	39.7815	39.9439	39.6203	39.6203	38.9886	
alpha	3.5685	3.5787	3.5889	3.6096	3.6096	3.6521	3.6307	3.6521	3.6629	3.6414	3.6414	3.5992	
util living area													
	0.7605	0.6760	0.5377	0.3912	0.2652	0.1491	0.0858	0.0929	0.2131	0.4156	0.6397	0.7818	(86)
MIT	20.5390	20.7030	20.8787	20.9656	20.9933	20.9995	21.0000	20.9999	20.9979	20.9664	20.8050	20.5027	(87)
Th 2	20.3223	20.3248	20.3273	20.3323	20.3323	20.3424	20.3374	20.3424	20.3449	20.3399	20.3399	20.3298	(88)
util rest of house													
	0.7418	0.6550	0.5140	0.3674	0.2410	0.1258	0.0611	0.0675	0.1859	0.3859	0.6144	0.7639	(89)
MIT 2	19.7304	19.9508	20.1816	20.2939	20.3258	20.3420	20.3373	20.3424	20.3432	20.3042	20.1032	19.6886	(90)
Living area fraction									fLA = Living area / (4) =			0.3788	(91)
MIT	20.0367	20.2357	20.4456	20.5483	20.5787	20.5911	20.5883	20.5914	20.5912	20.5550	20.3690	19.9970	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0367	20.2357	20.4456	20.5483	20.5787	20.5911	20.5883	20.5914	20.5912	20.5550	20.3690	19.9970	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7334	0.6521	0.5182	0.3752	0.2500	0.1346	0.0705	0.0771	0.1961	0.3957	0.6155	0.7544	(94)
Useful gains	674.7795	704.0042	654.8943	542.7098	379.0215	209.5343	105.2719	110.1222	257.8431	442.6655	586.9379	652.6825	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	818.6488	798.3058	693.7366	553.4952	380.9736	209.6541	105.2784	110.1309	258.3792	452.8251	647.9476	806.7320	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	107.0387	63.3706	28.8987	7.7655	1.4524	0.0000	0.0000	0.0000	0.0000	7.5587	43.9270	114.6128	(98)
Space heating												374.6246	(98)
Space heating per m2											(98) / (4) =	4.7301	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	398.1755	295.4857	298.6316	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9965	0.9985	0.9982	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	396.7641	295.0316	298.0912	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1738.7514	1667.8043	1589.8806	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	966.2308	1021.3429	961.0913	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2948.6650	(104)
Cooled fraction											fC = cooled area / (4) =	0.7576	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	182.9983	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												182.9983	(107)
Space cooling per m2												2.3106	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	374.6246	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	137.6745	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	255.6813	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2103.5231	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	773.0448	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1435.6545	(310b)
Electricity used for heat distribution	26.0206	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	42.3607	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	179.3583	(330a)
Total electricity for the above, kWh/year	179.3583	(331)
Electricity for lighting (calculated in Appendix L)	342.8485	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3166.6226	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	137.6745	5.0000	6.8837	(340a)
Space heating from Combined Heat and Power	255.6813	3.5000	8.9488	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	773.0448	5.0000	38.6522	(342a)
Water heating from Combined Heat and Power	1435.6545	3.5000	50.2479	(342b)
Space cooling	42.3607	15.7000	6.6506	(348)
Mechanical ventilation fans	179.3583	15.7000	28.1593	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	342.8485	15.7000	53.8272	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			235.2698	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	958.6519	0.2160	207.0688	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	464.8750	0.2160	100.4130	(363)
less credit emissions for electricity	-162.7063	0.5190	-84.4446	(364)
Water heating from Combined Heat and Power	2610.2810	0.2160	563.8207	(365)
less credit emissions for electricity	-913.5983	0.5190	-474.1575	(366)
Electrical energy for heat distribution	26.0206	0.5190	13.5047	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			326.2051	(373)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space and water heating			326.2051 (376)
Space cooling	42.3607	0.5190	21.9852 (377)
Pumps and fans	179.3583	0.5190	93.0870 (378)
Energy for lighting	342.8485	0.5190	177.9384 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			463.5156 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	958.6519	1.2200	1169.5553	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	464.8750	1.2200	567.1476	(363)
less credit emissions for electricity	-162.7063	3.0700	-499.5082	(364)
Water heating from Combined Heat and Power	2610.2810	1.2200	3184.5428	(365)
less credit emissions for electricity	-913.5983	3.0700	-2804.7469	(366)
Electrical energy for heat distribution	26.0206	3.0700	79.8831	(372)
Total CO2 associated with community systems			1696.8736	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1696.8736	(376)
Space cooling	42.3607	3.0700	130.0474	(377)
Pumps and fans	179.3583	3.0700	550.6300	(378)
Energy for lighting	342.8485	3.0700	1052.5448	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2509.0958	(383)
Primary energy kWh/m2/year			31.6805	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£89	£89	£0
Community scheme	£194	£194	£0
Space heating	£133	£133	£0
Space cooling	£7	£7	£0
Water heating	£89	£89	£0
Lighting	£54	£54	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£236	£236	£0
Total cost of uses	£236	£236	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	32 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	423.40 (P1)
Transmission heat loss coefficient	40.64 (37)
Summer heat loss coefficient	464.04 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	1.000	0.590	Wide overhang
South East	0.000	1.000	None
South West	1.000	0.360	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	0.590	0.490 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	0.920	0.90	0.360	0.239 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
South East	12.7000	119.9223	0.6800	0.8000	0.9000	671.1008
South West	8.0000	119.9223	0.6800	0.8000	0.2392	112.3551
total:						854.5960

	Jun	Jul	Aug	
Solar gains	899	855	789	(P3)
Internal gains	480	462	470	
Total summer gains	1379	1317	1260	(P5)
Summer gain/loss ratio	2.97	2.84	2.71	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.27	22.04	21.81	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007032	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0M03
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	89 B	**DER**	6.38	**TER**	13.43
Environmental	95 A	**% DER<TER**	52.48		
CO_2 Emissions (t/year)	0.48	**DFEE**	26.51	**TFEE**	31.81
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.65		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, Mid-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               14.9, 88.7, 2.7
Living Area:                   30 m2, fraction: 33.8%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                21.23, 40.23, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 16.00,
     Window                    Window, External Wall 1, North East, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.233
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	6.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	
Cooled Area	60.00
Data Source	SAP table
Type	Split or Multi-Split
Class	A
Control	Modulating
Light Fittings:	10
LEL Fittings:	10
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	None
Main Heating 2	None
Heating Systems Interaction	Each system heats separate parts of dwelling
Smoke Control Area	Unknown
Community Heating	
Type	Space and Water Combined
PCDF Index	n/a
Distribution Loss	Piping system >= 1991, pre-insulated, low temp, variable flow
Controls	CCJ
Ctrl SAP Code	2310
Community Heating Heat Sources:	Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
1	Boilers, Space and Water, 35, 95
2	Combined Heat and Power, Space and Water, 65, 90
Secondary Heating	None
Water Heating	
Type	CommunityHeating
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	More Dwellings, One Block
Apportioned Energy	300
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---

DWELLING AS DESIGNED

Mid-floor flat, total floor area 89 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.43 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)31.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)26.5 kWh/m²/yrOK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	(no floor)		

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South East:		16.00 m², No overhang	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1500	3.1845			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.9402			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	34.3002	(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	21.4620	21.2101	20.9582	19.6987	19.4467	18.1872	18.1872	17.9353	18.6910	19.4467	19.9506	20.4544	(38)
Heat transfer coeff	55.7623	55.5104	55.2584	53.9989	53.7470	52.4874	52.4874	52.2355	52.9912	53.7470	54.2508	54.7546	(39)
Average = Sum(39)m / 12 =												53.9359	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6287	0.6258	0.6230	0.6088	0.6059	0.5917	0.5917	0.5889	0.5974	0.6059	0.6116	0.6173	(40)
HLP (average)												0.6081	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6075 (42)
Average daily hot water use (litres/day)	96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5216	20.5722	21.2286	18.5076	17.7585	15.3243	14.2002	16.2949	16.4895	19.2170	20.9768	22.7795	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (64)
Total per year (kWh/year) = Sum(64)m = 2163.3114 (64)
Heat gains from water heating, kWh/month
96.3611 85.5436 91.2783 83.8202 83.5862 76.7637 75.6985 80.3418 79.3467 86.8190 89.2935 94.7159 (65)

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	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1306	18.7680	15.2632	11.5552	8.6377	7.2923	7.8796	10.2421	13.7470	17.4550	20.3725	21.7179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	236.6656	239.1215	232.9328	219.7579	203.1269	187.4962	177.0538	174.5980	180.7867	193.9616	210.5926	226.2233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)
Water heating gains (Table 5)													
	129.5176	127.2970	122.6859	116.4170	112.3470	106.6163	101.7453	107.9863	110.2038	116.6922	124.0188	127.3063	(72)
Total internal gains													
	449.4264	447.2991	432.9944	409.8427	386.2242	363.5173	348.7913	354.9391	366.8500	390.2213	417.0964	437.3601	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	16.0000	36.7938	0.6800	0.8000	0.7700	221.9357	(77)

Solar gains	234.6964	404.0134	564.0473	717.7529	821.1676	822.8058	790.1196	711.8093	617.0957	449.5565	281.8841	200.3518	(83)
Total gains	684.1228	851.3126	997.0417	1127.5955	1207.3917	1186.3231	1138.9109	1066.7484	983.9457	839.7778	698.9806	637.7119	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1856	44.3861	44.5885	45.6285	45.8424	46.9425	46.9425	47.1689	46.4962	45.8424	45.4166	44.9987	
alpha	3.9457	3.9591	3.9726	4.0419	4.0562	4.1295	4.1295	4.1446	4.0997	4.0562	4.0278	3.9999	
util living area													
	0.8995	0.8173	0.7037	0.5508	0.4071	0.2821	0.2026	0.2249	0.3675	0.6167	0.8303	0.9156	(86)
MIT	20.2236	20.5128	20.7546	20.9198	20.9794	20.9967	20.9994	20.9990	20.9900	20.8980	20.5698	20.1701	(87)
Th 2	20.4043	20.4068	20.4094	20.4221	20.4247	20.4374	20.4374	20.4400	20.4323	20.4247	20.4196	20.4145	(88)
util rest of house													
	0.8899	0.8027	0.6843	0.5282	0.3832	0.2576	0.1767	0.1976	0.3383	0.5895	0.8142	0.9073	(89)
MIT 2	19.3630	19.7673	20.0979	20.3257	20.4020	20.4343	20.4370	20.4392	20.4225	20.3046	19.8629	19.2957	(90)
Living area fraction									fLA = Living area / (4) =			0.3382	(91)
MIT	19.6541	20.0195	20.3200	20.5267	20.5973	20.6245	20.6272	20.6286	20.6144	20.5053	20.1020	19.5915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6541	20.0195	20.3200	20.5267	20.5973	20.6245	20.6272	20.6286	20.6144	20.5053	20.1020	19.5915	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8763	0.7926	0.6813	0.5324	0.3904	0.2657	0.1855	0.2068	0.3477	0.5934	0.8047	0.8939	(94)
Useful gains	599.4883	674.7764	679.2942	600.2954	471.3925	315.2248	211.2119	220.6254	342.1350	498.2973	562.4919	570.0548	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	856.1789	839.2861	763.6715	627.8273	478.2019	316.2124	211.3762	220.8818	345.2082	532.3803	705.3681	842.7532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	190.9778	110.5505	62.7767	19.8230	5.0661	0.0000	0.0000	0.0000	0.0000	25.3577	102.8709	202.8876	(98)
Space heating												720.3103	(98)
Space heating per m2											(98) / (4) =	8.1207	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	493.3815	388.4067	396.9897	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9927	0.9965	0.9953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	489.7732	387.0504	395.1380	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1471.8157	1414.6227	1331.5733	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	707.0706	764.5138	696.7078	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2168.2922	(104)
Cooled fraction										fC = cooled area / (4) =		0.6764	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.5723	129.2864	117.8198	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												366.6785	(107)
Space cooling per m2												4.1339	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	720.3103	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	264.7140	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	491.6118	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2163.3114	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.0169	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1476.4600	(310b)
Electricity used for heat distribution	30.2780	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	84.8793	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	200.8722	(330a)
Total electricity for the above, kWh/year	200.8722	(331)
Electricity for lighting (calculated in Appendix L)	373.1732	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3686.7275	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1115.5063	0.2160	240.9494	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	893.8396	0.2160	193.0694	(363)
less credit emissions for electricity	-312.8439	0.5190	-162.3660	(364)
Water heating from Combined Heat and Power	2684.4728	0.2160	579.8461	(365)
less credit emissions for electricity	-939.5655	0.5190	-487.6345	(366)
Electrical energy for heat distribution	30.2780	0.5190	15.7143	(372)
Total CO2 associated with community systems			379.5787	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			379.5787	(376)
Space cooling	84.8793	0.5190	44.0523	(377)
Pumps and fans	200.8722	0.5190	104.2527	(378)
Energy for lighting	373.1732	0.5190	193.6769	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			565.8606	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.3800	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.3800	ZC1
Total Floor Area	TFA	88.7000	
Assumed number of occupants	N	2.6075	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.8109	ZC2
CO2 emissions from cooking, equation (L16)		2.0471	ZC3
Total CO2 emissions		24.2381	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.2381	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1253	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3190	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4067	0.3987	0.3907	0.3509	0.3429	0.3030	0.3030	0.2951	0.3190	0.3429	0.3588	0.3748	(22b)
Effective ac	0.5827	0.5795	0.5763	0.5616	0.5588	0.5459	0.5459	0.5435	0.5509	0.5588	0.5644	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.0000	1.3258	25.1894			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1800	3.8214			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0108			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		34.4108	(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	46.0518	45.7980	45.5492	44.3807	44.1621	43.1444	43.1444	42.9560	43.5364	44.1621	44.6044	45.0668	(38)
Heat transfer coeff	80.4626	80.2088	79.9600	78.7915	78.5729	77.5552	77.5552	77.3667	77.9472	78.5729	79.0152	79.4775	(39)
Average = Sum(39)m / 12 =												78.7905	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9071	0.9043	0.9015	0.8883	0.8858	0.8744	0.8744	0.8722	0.8788	0.8858	0.8908	0.8960	(40)
HLP (average)												0.8883	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6075 (42)
Average daily hot water use (litres/day)		96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5216	20.5722	21.2286	18.5076	17.7585	15.3243	14.2002	16.2949	16.4895	19.2170	20.9768	22.7795	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	203.4059	179.2336	188.1192	168.4762	164.9851	147.2536	141.2628	155.2277	155.0220	174.7079	184.9372	198.4579	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	203.4059	179.2336	188.1192	168.4762	164.9851	147.2536	141.2628	155.2277	155.0220	174.7079	184.9372	198.4579	(64)
								Total per year (kWh/year) = Sum(64)m =				2061.0890	(64)
Heat gains from water heating, kWh/month													
	89.4156	79.2702	84.3328	77.0988	76.6407	70.0422	68.7530	73.3963	72.6253	79.8735	82.5721	87.7704	(65)

---

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	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1306	18.7680	15.2632	11.5552	8.6377	7.2923	7.8796	10.2421	13.7470	17.4550	20.3725	21.7179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	236.6656	239.1215	232.9328	219.7579	203.1269	187.4962	177.0538	174.5980	180.7867	193.9616	210.5926	226.2233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)
Water heating gains (Table 5)													
	120.1822	117.9617	113.3505	107.0816	103.0116	97.2809	92.4099	98.6510	100.8684	107.3569	114.6834	117.9709	(72)
Total internal gains													
	443.0910	440.9637	426.6591	403.5073	379.8888	357.1819	342.4559	348.6037	360.5146	383.8860	410.7611	431.0247	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(75)
Southeast	16.0000	36.7938	0.6300	0.7000	0.7700	179.9148	(77)

Solar gains	190.2594	327.5182	457.2516	581.8548	665.6891	667.0172	640.5197	577.0366	500.2559	364.4383	228.5127	162.4175	(83)
Total gains	633.3505	768.4820	883.9106	985.3621	1045.5779	1024.1991	982.9757	925.6403	860.7706	748.3242	639.2737	593.4422	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5539	76.7961	77.0350	78.1775	78.3950	79.4237	79.4237	79.6172	79.0243	78.3950	77.9562	77.5027	
alpha	6.1036	6.1197	6.1357	6.2118	6.2263	6.2949	6.2949	6.3078	6.2683	6.2263	6.1971	6.1668	
util living area													
	0.9946	0.9827	0.9474	0.8467	0.6744	0.4820	0.3469	0.3839	0.6121	0.8965	0.9851	0.9962	(86)
MIT	20.2093	20.4057	20.6429	20.8676	20.9716	20.9970	20.9997	20.9994	20.9878	20.8373	20.4793	20.1740	(87)
Th 2	20.1614	20.1639	20.1663	20.1775	20.1796	20.1894	20.1894	20.1912	20.1856	20.1796	20.1753	20.1709	(88)
util rest of house													
	0.9930	0.9777	0.9333	0.8131	0.6227	0.4222	0.2831	0.3167	0.5451	0.8641	0.9799	0.9951	(89)
MIT 2	19.1111	19.3960	19.7313	20.0352	20.1548	20.1875	20.1892	20.1909	20.1772	20.0068	19.5133	19.0672	(90)
Living area fraction									fLA = Living area / (4) =			0.3382	(91)
MIT	19.4825	19.7375	20.0396	20.3167	20.4310	20.4613	20.4633	20.4644	20.4513	20.2877	19.8400	19.4415	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4825	19.7375	20.0396	20.3167	20.4310	20.4613	20.4633	20.4644	20.4513	20.2877	19.8400	19.4415	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9745	0.9308	0.8192	0.6389	0.4423	0.3047	0.3395	0.5674	0.8689	0.9772	0.9937	(94)
Useful gains	627.7647	748.8816	822.7771	807.1951	668.0603	453.0500	299.5049	314.2187	488.3866	650.1816	624.7272	589.7047	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1221.6226	1190.0974	1082.6279	899.5429	686.0239	454.5750	299.6226	314.4477	495.0700	761.1884	1006.6562	1211.3586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	441.8302	296.4970	193.3290	66.4904	13.3650	0.0000	0.0000	0.0000	0.0000	82.5891	274.9889	462.5105	(98)
Space heating												1831.6001	(98)
Space heating per m2											(98) / (4) =	20.6494	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1958.9306	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	441.8302	296.4970	193.3290	66.4904	13.3650	0.0000	0.0000	0.0000	0.0000	82.5891	274.9889	462.5105	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	472.5457	317.1091	206.7690	71.1127	14.2941	0.0000	0.0000	0.0000	0.0000	88.3306	294.1058	494.6636	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	203.4059	179.2336	188.1192	168.4762	164.9851	147.2536	141.2628	155.2277	155.0220	174.7079	184.9372	198.4579	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8298	86.1480	84.8867	82.5623	80.5133	79.8000	79.8000	79.8000	79.8000	82.9480	85.8702	86.9975	(217)
Fuel for water heating, kWh/month													
	234.2582	208.0530	221.6121	204.0594	204.9165	184.5283	177.0210	194.5209	194.2632	210.6235	215.3683	228.1191	(219)
Water heating fuel used												2477.3435	(219)
Annual totals kWh/year													
Space heating fuel - main system												1958.9306	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												373.1732	(232)
Total delivered energy for all uses												4884.4472	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1958.9306	0.2160	423.1290	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2477.3435	0.2160	535.1062	(264)
Space and water heating			958.2352	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.1732	0.5190	193.6769	(268)
Total CO2, kg/m2/year			1190.8371	(272)
Emissions per m2 for space and water heating			10.8031	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1835	(272b)
Emissions per m2 for pumps and fans			0.4388	(272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8031 * 1.00) + 2.1835 + 0.4388, rounded to 2 d.p.			13.4300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1253	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2340	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2983	0.2925	0.2866	0.2574	0.2515	0.2223	0.2223	0.2164	0.2340	0.2515	0.2632	0.2749	(22b)
Effective ac	0.5445	0.5428	0.5411	0.5331	0.5316	0.5247	0.5247	0.5234	0.5274	0.5316	0.5346	0.5378	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1500	3.1845			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.9402			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	34.3002	(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	43.0325	42.8960	42.7621	42.1334	42.0158	41.4682	41.4682	41.3668	41.6791	42.0158	42.2538	42.5025	(38)
Heat transfer coeff	77.3328	77.1962	77.0624	76.4337	76.3160	75.7684	75.7684	75.6670	75.9794	76.3160	76.5540	76.8028	(39)
Average = Sum(39)m / 12 =												76.4331	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8718	0.8703	0.8688	0.8617	0.8604	0.8542	0.8542	0.8531	0.8566	0.8604	0.8631	0.8659	(40)
HLP (average)												0.8617	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6075	(42)
Average daily hot water use (litres/day)	96.1282	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	33.3223	29.1439	30.0739	26.2192	25.1579	21.7094	20.1169	23.0845	23.3602	27.2240	29.7171	32.2709 (65)

---

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	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	(66)

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

	21.1306	18.7680	15.2632	11.5552	8.6377	7.2923	7.8796	10.2421	13.7470	17.4550	20.3725	21.7179	(67)

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

	236.6656	239.1215	232.9328	219.7579	203.1269	187.4962	177.0538	174.5980	180.7867	193.9616	210.5926	226.2233	(68)

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

	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)

Water heating gains (Table 5)

	44.7881	43.3689	40.4219	36.4155	33.8144	30.1519	27.0389	31.0275	32.4447	36.5914	41.2738	43.3749	(72)

Total internal gains

	364.6969	363.3710	350.7305	329.8412	307.6916	287.0529	274.0848	277.9802	289.0909	310.1205	334.3515	353.4287	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	16.0000	36.7938	0.6800	0.8000	0.7700	221.9357	(77)

Solar gains	234.6964	404.0134	564.0473	717.7529	821.1676	822.8058	790.1196	711.8093	617.0957	449.5565	281.8841	200.3518	(83)
Total gains	599.3933	767.3845	914.7778	1047.5941	1128.8591	1109.8587	1064.2044	989.7895	906.1866	759.6770	616.2356	553.7804	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.8609	31.9172	31.9727	32.2357	32.2853	32.5187	32.5187	32.5622	32.4284	32.2853	32.1850	32.0807	
alpha	3.1241	3.1278	3.1315	3.1490	3.1524	3.1679	3.1679	3.1708	3.1619	3.1524	3.1457	3.1387	
util living area	0.9491	0.9019	0.8277	0.7098	0.5655	0.4185	0.3078	0.3433	0.5304	0.7755	0.9158	0.9586	(86)
MIT	19.3894	19.7717	20.1961	20.5943	20.8401	20.9541	20.9869	20.9813	20.9022	20.5421	19.8822	19.3034	(87)
Th 2	20.1915	20.1928	20.1941	20.2002	20.2013	20.2066	20.2066	20.2076	20.2046	20.2013	20.1990	20.1966	(88)
util rest of house	0.9427	0.8905	0.8091	0.6815	0.5273	0.3713	0.2542	0.2869	0.4798	0.7453	0.9039	0.9532	(89)
MIT 2	18.7116	19.0840	19.4908	19.8649	20.0815	20.1780	20.2004	20.1984	20.1395	19.8284	19.2020	18.6312	(90)
Living area fraction										fLA = Living area / (4) =		0.3382	(91)
MIT	18.9409	19.3166	19.7294	20.1116	20.3381	20.4405	20.4664	20.4632	20.3974	20.0698	19.4321	18.8585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9409	19.3166	19.7294	20.1116	20.3381	20.4405	20.4664	20.4632	20.3974	20.0698	19.4321	18.8585	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9304	0.8763	0.7973	0.6782	0.5340	0.3854	0.2719	0.3053	0.4924	0.7399	0.8906	0.9421	(94)
Useful gains	557.6901	672.4326	729.3798	710.4324	602.8654	427.7505	289.3705	302.2065	446.2364	562.0880	548.8021	521.7296	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1132.2207	1112.9048	1019.4851	856.9453	659.2244	442.5237	292.9534	307.4486	478.4749	722.6970	944.0710	1125.8142	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	427.4507	295.9973	215.8383	105.4893	41.9311	0.0000	0.0000	0.0000	0.0000	119.4931	284.5936	449.4389	(98)
Space heating												1940.2324	(98)
Space heating per m2											(98) / (4) =	21.8741	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	712.2234	560.6865	575.0695	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9381	0.9622	0.9525	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	668.1319	539.4852	547.7610	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1395.3513	1339.9163	1254.6144	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	523.5980	595.5208	525.8990	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1645.0177	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   130.8995   148.8802   131.4747     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          411.2544 (107)
Space cooling per m2                                                                                                                     4.6365 (108)
Energy for space heating                                                                                                                21.8741 (99)
Energy for space cooling                                                                                                                 4.6365 (108)
Total                                                                                                                                   26.5106 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   26.5 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1253	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3190	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4067	0.3987	0.3907	0.3509	0.3429	0.3030	0.3030	0.2951	0.3190	0.3429	0.3588	0.3748	(22b)
Effective ac	0.5827	0.5795	0.5763	0.5616	0.5588	0.5459	0.5459	0.5435	0.5509	0.5588	0.5644	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.0000	1.3258	25.1894			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1800	3.8214			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.0108			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		34.4108	(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	46.0518	45.7980	45.5492	44.3807	44.1621	43.1444	43.1444	42.9560	43.5364	44.1621	44.6044	45.0668	(38)
Heat transfer coeff	80.4626	80.2088	79.9600	78.7915	78.5729	77.5552	77.5552	77.3667	77.9472	78.5729	79.0152	79.4775	(39)
Average = Sum(39)m / 12 =												78.7905	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9071	0.9043	0.9015	0.8883	0.8858	0.8744	0.8744	0.8722	0.8788	0.8858	0.8908	0.8960	(40)
HLP (average)												0.8883	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6075 (42)
Average daily hot water use (litres/day)		96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.3223	29.1439	30.0739	26.2192	25.1579	21.7094	20.1169	23.0845	23.3602	27.2240	29.7171	32.2709	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	130.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1306	18.7680	15.2632	11.5552	8.6377	7.2923	7.8796	10.2421	13.7470	17.4550	20.3725	21.7179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	236.6656	239.1215	232.9328	219.7579	203.1269	187.4962	177.0538	174.5980	180.7867	193.9616	210.5926	226.2233	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	36.0375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)
Water heating gains (Table 5)													
	44.7881	43.3689	40.4219	36.4155	33.8144	30.1519	27.0389	31.0275	32.4447	36.5914	41.2738	43.3749	(72)
Total internal gains													
	364.6969	363.3710	350.7305	329.8412	307.6916	287.0529	274.0848	277.9802	289.0909	310.1205	334.3515	353.4287	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(75)
Southeast	16.0000	36.7938	0.6300	0.7000	0.7700	179.9148	(77)

Solar gains	190.2594	327.5182	457.2516	581.8548	665.6891	667.0172	640.5197	577.0366	500.2559	364.4383	228.5127	162.4175	(83)
Total gains	554.9563	690.8893	807.9821	911.6960	973.3807	954.0701	914.6046	855.0168	789.3468	674.5588	562.8641	515.8462	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.5539	76.7961	77.0350	78.1775	78.3950	79.4237	79.4237	79.6172	79.0243	78.3950	77.9562	77.5027	
alpha	6.1036	6.1197	6.1357	6.2118	6.2263	6.2949	6.2949	6.3078	6.2683	6.2263	6.1971	6.1668	
util living area													
	0.9973	0.9898	0.9642	0.8798	0.7148	0.5161	0.3726	0.4153	0.6605	0.9295	0.9922	0.9983	(86)
MIT	20.1246	20.3266	20.5782	20.8318	20.9611	20.9956	20.9995	20.9991	20.9816	20.7885	20.4001	20.0894	(87)
Th 2	20.1614	20.1639	20.1663	20.1775	20.1796	20.1894	20.1894	20.1912	20.1856	20.1796	20.1753	20.1709	(88)
util rest of house													
	0.9965	0.9866	0.9538	0.8500	0.6627	0.4526	0.3042	0.3428	0.5908	0.9041	0.9893	0.9977	(89)
MIT 2	19.3602	19.5624	19.8090	20.0512	20.1560	20.1875	20.1892	20.1909	20.1767	20.0207	19.6460	19.3331	(90)
Living area fraction										fLA = Living area / (4) =		0.3382	(91)
MIT	19.6187	19.8209	20.0692	20.3152	20.4283	20.4608	20.4633	20.4643	20.4489	20.2804	19.9011	19.5889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6187	19.8209	20.0692	20.3152	20.4283	20.4608	20.4633	20.4643	20.4489	20.2804	19.9011	19.5889	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9851	0.9523	0.8554	0.6790	0.4741	0.3274	0.3673	0.6140	0.9076	0.9881	0.9972	(94)
Useful gains	552.6084	680.5613	769.4809	779.8950	660.9299	452.2915	299.4388	314.0763	484.6469	612.2588	556.1610	514.3894	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1232.5850	1196.7843	1084.9903	899.4215	685.8067	454.5378	299.6180	314.4380	494.8825	760.6151	1011.4780	1223.0694	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.9026	346.9019	234.7391	86.0591	18.5083	0.0000	0.0000	0.0000	0.0000	110.3771	327.8282	527.2579	(98)
Space heating												2157.5741	(98)
Space heating per m2											(98) / (4) =	24.3244	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	729.0190	573.9086	587.9873	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9834	0.9941	0.9908	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	716.9404	570.5126	582.5936	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1213.2607	1165.0593	1097.0879	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	357.3506	442.3427	382.7838	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1182.4771	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	89.3377	110.5857	95.6959	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	295.6193 (107)
Space cooling per m2	3.3328 (108)
Energy for space heating	24.3244 (99)
Energy for space cooling	3.3328 (108)
Total	27.6572 (109)
Target Fabric Energy Efficiency (TFEE)	31.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1500	3.1845			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.9402			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	34.3002	(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	18.4391	18.1872	17.9353	17.4314	17.4314	16.4238	16.9276	16.4238	16.1719	16.6757	16.6757	17.6833	(38)
Heat transfer coeff	52.7393	52.4874	52.2355	51.7317	51.7317	50.7240	51.2278	50.7240	50.4721	50.9759	50.9759	51.9836	(39)
Average = Sum(39)m / 12 =												51.5007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5946	0.5917	0.5889	0.5832	0.5832	0.5719	0.5775	0.5719	0.5690	0.5747	0.5747	0.5861	(40)
HLP (average)												0.5806	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6075 (42)
Average daily hot water use (litres/day)	96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5216	20.5722	21.2286	18.5076	17.7585	15.3243	14.2002	16.2949	16.4895	19.2170	20.9768	22.7795	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (64)
Total per year (kWh/year) = Sum(64)m = 2163.3114 (64)
RHI water heating demand 2163 (64)
Heat gains from water heating, kWh/month
96.3611 85.5436 91.2783 83.8202 83.5862 76.7637 75.6985 80.3418 79.3467 86.8190 89.2935 94.7159 (65)

---
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	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.8265	46.9201	38.1580	28.8880	21.5941	18.2307	19.6989	25.6054	34.3675	43.6374	50.9313	54.2947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	353.2323	356.8977	347.6609	327.9969	303.1745	279.8450	264.2595	260.5940	269.8308	289.4949	314.3172	337.6468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)
Water heating gains (Table 5)													
	129.5176	127.2970	122.6859	116.4170	112.3470	106.6163	101.7453	107.9863	110.2038	116.6922	124.0188	127.3063	(72)
Total internal gains													
	640.9790	636.5175	613.9074	578.7045	542.5183	510.0946	491.1063	499.5884	519.8047	555.2272	594.6700	624.6504	(73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(75)
Southeast	16.0000	39.0225	0.6800	0.8000	0.7700	235.3786	(77)

Solar gains	249.5028	378.6207	542.0793	716.0704	801.3596	859.1464	822.1509	760.9346	652.4572	469.1501	309.4649	218.2118	(83)
Total gains	890.4818	1015.1382	1155.9867	1294.7749	1343.8779	1369.2410	1313.2572	1260.5229	1172.2619	1024.3773	904.1349	842.8623	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.7183	46.9425	47.1689	47.6283	47.6283	48.5744	48.0967	48.5744	48.8169	48.3344	48.3344	47.3975	
alpha	4.1146	4.1295	4.1446	4.1752	4.1752	4.2383	4.2064	4.2383	4.2545	4.2223	4.2223	4.1598	
util living area													
	0.7630	0.6855	0.5516	0.4055	0.2762	0.1555	0.0897	0.0966	0.2193	0.4211	0.6403	0.7821	(86)
MIT	20.6820	20.7979	20.9225	20.9805	20.9968	20.9998	21.0000	21.0000	20.9992	20.9823	20.8790	20.6592	(87)
Th 2	20.4349	20.4374	20.4400	20.4451	20.4451	20.4554	20.4503	20.4554	20.4580	20.4528	20.4528	20.4426	(88)
util rest of house													
	0.7462	0.6669	0.5308	0.3847	0.2552	0.1354	0.0683	0.0747	0.1961	0.3956	0.6181	0.7661	(89)
MIT 2	20.0235	20.1805	20.3456	20.4229	20.4420	20.4553	20.4503	20.4554	20.4573	20.4336	20.3045	20.0000	(90)
Living area fraction									fLA = Living area / (4) =			0.3382	(91)
MIT	20.2462	20.3893	20.5407	20.6115	20.6296	20.6394	20.6362	20.6396	20.6406	20.6192	20.4988	20.2230	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2462	20.3893	20.5407	20.6115	20.6296	20.6394	20.6362	20.6396	20.6406	20.6192	20.4988	20.2230	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7404	0.6653	0.5346	0.3910	0.2622	0.1422	0.0755	0.0821	0.2039	0.4034	0.6200	0.7594	(94)
Useful gains	659.3066	675.3864	617.9621	506.2102	352.3221	194.7093	99.1847	103.4533	239.0461	413.2448	560.5767	640.0925	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	767.1565	744.7614	644.6244	512.7394	353.3075	194.7522	99.1865	103.4557	239.2667	418.9792	601.4558	754.9570	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	80.2403	46.6200	19.8367	4.7010	0.7332	0.0000	0.0000	0.0000	0.0000	4.2664	29.4329	85.4592	(98)
Space heating												271.2897	(98)
RHI space heating demand												271	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1500	3.1845			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.9402			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	34.3002	(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	21.4620	21.2101	20.9582	19.6987	19.4467	18.1872	18.1872	17.9353	18.6910	19.4467	19.9506	20.4544	(38)
Heat transfer coeff	55.7623	55.5104	55.2584	53.9989	53.7470	52.4874	52.4874	52.2355	52.9912	53.7470	54.2508	54.7546	(39)
Average = Sum(39)m / 12 =												53.9359	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6287	0.6258	0.6230	0.6088	0.6059	0.5917	0.5917	0.5889	0.5974	0.6059	0.6116	0.6173	(40)
HLP (average)												0.6081	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6075 (42)
Average daily hot water use (litres/day)	96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5216	20.5722	21.2286	18.5076	17.7585	15.3243	14.2002	16.2949	16.4895	19.2170	20.9768	22.7795	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (64)
Total per year (kWh/year) = Sum(64)m = 2163.3114 (64)
Heat gains from water heating, kWh/month
96.3611 85.5436 91.2783 83.8202 83.5862 76.7637 75.6985 80.3418 79.3467 86.8190 89.2935 94.7159 (65)

---

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	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.8265	46.9201	38.1580	28.8880	21.5941	18.2307	19.6989	25.6054	34.3675	43.6374	50.9313	54.2947	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	353.2323	356.8977	347.6609	327.9969	303.1745	279.8450	264.2595	260.5940	269.8308	289.4949	314.3172	337.6468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)
Water heating gains (Table 5)													
	129.5176	127.2970	122.6859	116.4170	112.3470	106.6163	101.7453	107.9863	110.2038	116.6922	124.0188	127.3063	(72)
Total internal gains													
	640.9790	636.5175	613.9074	578.7045	542.5183	510.0946	491.1063	499.5884	519.8047	555.2272	594.6700	624.6504	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	16.0000	36.7938	0.6800	0.8000	0.7700	221.9357	(77)

Solar gains	234.6964	404.0134	564.0473	717.7529	821.1676	822.8058	790.1196	711.8093	617.0957	449.5565	281.8841	200.3518	(83)
Total gains	875.6755	1040.5309	1177.9547	1296.4574	1363.6859	1332.9004	1281.2259	1211.3977	1136.9005	1004.7837	876.5541	825.0022	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1856	44.3861	44.5885	45.6285	45.8424	46.9425	46.9425	47.1689	46.4962	45.8424	45.4166	44.9987	
alpha	3.9457	3.9591	3.9726	4.0419	4.0562	4.1295	4.1295	4.1446	4.0997	4.0562	4.0278	3.9999	
util living area													
	0.8216	0.7336	0.6250	0.4878	0.3626	0.2514	0.1801	0.1982	0.3195	0.5322	0.7368	0.8410	(86)
MIT	20.4793	20.6791	20.8398	20.9480	20.9865	20.9979	20.9996	20.9994	20.9941	20.9399	20.7319	20.4417	(87)
Th 2	20.4043	20.4068	20.4094	20.4221	20.4247	20.4374	20.4374	20.4400	20.4323	20.4247	20.4196	20.4145	(88)
util rest of house													
	0.8077	0.7166	0.6053	0.4667	0.3409	0.2295	0.1571	0.1741	0.2938	0.5064	0.7173	0.8282	(89)
MIT 2	19.7177	19.9918	20.2085	20.3601	20.4099	20.4354	20.4371	20.4395	20.4265	20.3550	20.0793	19.6745	(90)
Living area fraction									fLA = Living area / (4) =			0.3382	(91)
MIT	19.9753	20.2242	20.4221	20.5590	20.6049	20.6257	20.6274	20.6289	20.6185	20.5528	20.3000	19.9340	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9753	20.2242	20.4221	20.5590	20.6049	20.6257	20.6274	20.6289	20.6185	20.5528	20.3000	19.9340	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7971	0.7112	0.6057	0.4718	0.3477	0.2368	0.1649	0.1822	0.3022	0.5122	0.7132	0.8169	(94)
Useful gains	697.9837	740.0028	713.4756	611.6289	474.1444	315.6367	211.2828	220.7425	343.5981	514.7002	625.1216	673.9693	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	874.0887	850.6539	769.3109	629.5708	478.6110	316.2718	211.3864	220.8987	345.4219	534.9315	716.1111	861.5075	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	131.0222	74.3575	41.5415	12.9182	3.3231	0.0000	0.0000	0.0000	0.0000	15.0521	65.5124	139.5284	(98)
Space heating												483.2553	(98)
Space heating per m2											(98) / (4) =	5.4482	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	493.3815	388.4067	396.9897	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9927	0.9965	0.9953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	489.7732	387.0504	395.1380	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1471.8157	1414.6227	1331.5733	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	707.0706	764.5138	696.7078	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2168.2922	(104)
Cooled fraction										fC = cooled area / (4) =		0.6764	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	119.5723	129.2864	117.8198	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												366.6785	(107)
Space cooling per m2												4.1339	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	483.2553	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	177.5963	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	329.8218	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2163.3114	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.0169	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1476.4600	(310b)
Electricity used for heat distribution	27.7890	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	84.8793	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	200.8722	(330a)
Total electricity for the above, kWh/year	200.8722	(331)
Electricity for lighting (calculated in Appendix L)	373.1732	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3437.8198	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	177.5963	4.2400	7.5301	(340a)
Space heating from Combined Heat and Power	329.8218	2.9700	9.7957	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	795.0169	4.2400	33.7087	(342a)
Water heating from Combined Heat and Power	1476.4600	2.9700	43.8509	(342b)
Space cooling	84.8793	13.1900	11.1956	(348)
Mechanical ventilation fans	200.8722	13.1900	26.4950	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	373.1732	13.1900	49.2215	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			262.2275	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8238	(357)
SAP value	88.5087	
SAP rating (Section 12)	89	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1023.8034	0.2160	221.1415 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	599.6759	0.2160	129.5300 (363)
less credit emissions for electricity	-209.8866	0.5190	-108.9311 (364)
Water heating from Combined Heat and Power	2684.4728	0.2160	579.8461 (365)
less credit emissions for electricity	-939.5655	0.5190	-487.6345 (366)
Electrical energy for heat distribution	27.7890	0.5190	14.4225 (372)
Total CO2 associated with community systems			348.3745 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			348.3745 (376)
Space cooling	84.8793	0.5190	44.0523 (377)
Pumps and fans	200.8722	0.5190	104.2527 (378)
Energy for lighting	373.1732	0.5190	193.6769 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			534.6565 (383)
CO2 emissions per m2			6.0300 (384)
EI value			94.6414 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	88.7000 (1b)	x	2.7000 (2b)	=	239.4900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	88.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.4900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	40.2300	19.0000	21.2300	0.1500	3.1845			(29a)
Total net area of external elements Aum(A, m2)			40.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.9402			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	34.3002	(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	18.4391	18.1872	17.9353	17.4314	17.4314	16.4238	16.9276	16.4238	16.1719	16.6757	16.6757	17.6833	(38)
Heat transfer coeff	52.7393	52.4874	52.2355	51.7317	51.7317	50.7240	51.2278	50.7240	50.4721	50.9759	50.9759	51.9836	(39)
Average = Sum(39)m / 12 =												51.5007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5946	0.5917	0.5889	0.5832	0.5832	0.5719	0.5775	0.5719	0.5690	0.5747	0.5747	0.5861	(40)
HLP (average)												0.5806	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6075 (42)
Average daily hot water use (litres/day)	96.1282 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.7411	101.8959	98.0508	94.2057	90.3606	86.5154	86.5154	90.3606	94.2057	98.0508	101.8959	105.7411	(44)
Energy conte	156.8110	137.1479	141.5243	123.3843	118.3902	102.1617	94.6679	108.6328	109.9302	128.1130	139.8454	151.8630	(45)
Energy content (annual)										Total = Sum(45)m =		1512.4716	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5216	20.5722	21.2286	18.5076	17.7585	15.3243	14.2002	16.2949	16.4895	19.2170	20.9768	22.7795	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.0878 187.0753 196.8011 176.8780 173.6670 155.6554 149.9447 163.9096 163.4239 183.3898 193.3391 207.1398 (64)
Total per year (kWh/year) = Sum(64)m = 2163.3114 (64)
Heat gains from water heating, kWh/month
96.3611 85.5436 91.2783 83.8202 83.5862 76.7637 75.6985 80.3418 79.3467 86.8190 89.2935 94.7159 (65)

---

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	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	156.4503	(66)

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

	52.8265	46.9201	38.1580	28.8880	21.5941	18.2307	19.6989	25.6054	34.3675	43.6374	50.9313	54.2947	(67)

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

	353.2323	356.8977	347.6609	327.9969	303.1745	279.8450	264.2595	260.5940	269.8308	289.4949	314.3172	337.6468	(68)

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

	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	53.2525	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	-104.3002	(71)

Water heating gains (Table 5)

	129.5176	127.2970	122.6859	116.4170	112.3470	106.6163	101.7453	107.9863	110.2038	116.6922	124.0188	127.3063	(72)

Total internal gains

	640.9790	636.5175	613.9074	578.7045	542.5183	510.0946	491.1063	499.5884	519.8047	555.2272	594.6700	624.6504	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(75)
Southeast	16.0000	39.0225	0.6800	0.8000	0.7700	235.3786	(77)

Solar gains	249.5028	378.6207	542.0793	716.0704	801.3596	859.1464	822.1509	760.9346	652.4572	469.1501	309.4649	218.2118	(83)
Total gains	890.4818	1015.1382	1155.9867	1294.7749	1343.8779	1369.2410	1313.2572	1260.5229	1172.2619	1024.3773	904.1349	842.8623	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.7183	46.9425	47.1689	47.6283	47.6283	48.5744	48.0967	48.5744	48.8169	48.3344	48.3344	47.3975	
alpha	4.1146	4.1295	4.1446	4.1752	4.1752	4.2383	4.2064	4.2383	4.2545	4.2223	4.2223	4.1598	
util living area	0.7630	0.6855	0.5516	0.4055	0.2762	0.1555	0.0897	0.0966	0.2193	0.4211	0.6403	0.7821	(86)
MIT	20.6820	20.7979	20.9225	20.9805	20.9968	20.9998	21.0000	21.0000	20.9992	20.9823	20.8790	20.6592	(87)
Th 2	20.4349	20.4374	20.4400	20.4451	20.4451	20.4554	20.4503	20.4554	20.4580	20.4528	20.4528	20.4426	(88)
util rest of house	0.7462	0.6669	0.5308	0.3847	0.2552	0.1354	0.0683	0.0747	0.1961	0.3956	0.6181	0.7661	(89)
MIT 2	20.0235	20.1805	20.3456	20.4229	20.4420	20.4553	20.4503	20.4554	20.4573	20.4336	20.3045	20.0000	(90)
Living area fraction									fLA = Living area / (4) =			0.3382	(91)
MIT	20.2462	20.3893	20.5407	20.6115	20.6296	20.6394	20.6362	20.6396	20.6406	20.6192	20.4988	20.2230	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2462	20.3893	20.5407	20.6115	20.6296	20.6394	20.6362	20.6396	20.6406	20.6192	20.4988	20.2230	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7404	0.6653	0.5346	0.3910	0.2622	0.1422	0.0755	0.0821	0.2039	0.4034	0.6200	0.7594	(94)
Useful gains	659.3066	675.3864	617.9621	506.2102	352.3221	194.7093	99.1847	103.4533	239.0461	413.2448	560.5767	640.0925	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	767.1565	744.7614	644.6244	512.7394	353.3075	194.7522	99.1865	103.4557	239.2667	418.9792	601.4558	754.9570	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	80.2403	46.6200	19.8367	4.7010	0.7332	0.0000	0.0000	0.0000	0.0000	4.2664	29.4329	85.4592	(98)
Space heating												271.2897	(98)
Space heating per m2										(98) / (4) =		3.0585	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	365.2128	271.5075	273.9096	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9982	0.9993	0.9992	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	364.5443	271.3166	273.6837	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1514.2916	1452.0619	1388.9924	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	827.8181	878.4745	829.7897	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2536.0823	(104)
Cooled fraction										fC = cooled area / (4) =		0.6764	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	139.9918	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												139.9918	(107)
Space cooling per m2												1.5783	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	271.2897	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	99.6990	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	185.1552	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2163.3114	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.0169	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1476.4600	(310b)
Electricity used for heat distribution	25.5633	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	32.4055	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	200.8722	(330a)
Total electricity for the above, kWh/year	200.8722	(331)
Electricity for lighting (calculated in Appendix L)	373.1732	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3162.7821	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	99.6990	5.0000	4.9849	(340a)
Space heating from Combined Heat and Power	185.1552	3.5000	6.4804	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	795.0169	5.0000	39.7508	(342a)
Water heating from Combined Heat and Power	1476.4600	3.5000	51.6761	(342b)
Space cooling	32.4055	15.7000	5.0877	(348)
Mechanical ventilation fans	200.8722	15.7000	31.5369	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	373.1732	15.7000	58.5882	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			240.0051	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	941.8062	0.2160	203.4301	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	336.6458	0.2160	72.7155	(363)
less credit emissions for electricity	-117.8260	0.5190	-61.1517	(364)
Water heating from Combined Heat and Power	2684.4728	0.2160	579.8461	(365)
less credit emissions for electricity	-939.5655	0.5190	-487.6345	(366)
Electrical energy for heat distribution	25.5633	0.5190	13.2674	(372)
Total CO2 associated with community systems			320.4729	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			320.4729	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	32.4055	0.5190	16.8185 (377)
Pumps and fans	200.8722	0.5190	104.2527 (378)
Energy for lighting	373.1732	0.5190	193.6769 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			479.5210 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	941.8062	1.2200	1149.0036	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	336.6458	1.2200	410.7079	(363)
less credit emissions for electricity	-117.8260	3.0700	-361.7260	(364)
Water heating from Combined Heat and Power	2684.4728	1.2200	3275.0568	(365)
less credit emissions for electricity	-939.5655	3.0700	-2884.4660	(366)
Electrical energy for heat distribution	25.5633	3.0700	78.4794	(372)
Total CO2 associated with community systems			1667.0557	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1667.0557	(376)
Space cooling	32.4055	3.0700	99.4849	(377)
Pumps and fans	200.8722	3.0700	616.6778	(378)
Energy for lighting	373.1732	3.0700	1145.6418	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2607.8601	(383)
Primary energy kWh/m2/year			29.4009	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£95	£95	£0
Community scheme	£192	£192	£0
Space heating	£132	£132	£0
Space cooling	£5	£5	£0
Water heating	£91	£91	£0
Lighting	£59	£59	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£240	£240	£0
Total cost of uses	£240	£240	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	29 kWh/m²	29 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	474.19 (P1)
Transmission heat loss coefficient	34.30 (37)
Summer heat loss coefficient	508.49 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	1.000	0.590	Wide overhang
South East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	0.590	0.490 (P8)
South East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
South East	16.0000	119.9223	0.6800	0.8000	0.9000	845.4813
total:						916.6215

	Jun	Jul	Aug	
Solar gains	964	917	847	(P3)
Internal gains	510	491	500	
Total summer gains	1474	1408	1347	(P5)
Summer gain/loss ratio	2.90	2.77	2.65	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.20	21.97	21.75	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007033	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0M04
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	89 B	**DER**	6.47	**TER**	13.77
Environmental	94 A	**% DER<TER**	53.03		
CO_2 Emissions (t/year)	0.56	**DFEE**	30.68	**TFEE**	38.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.80		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               21.1, 104, 2.7
Living Area:                   30 m2, fraction: 28.8%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                29.97, 56.97, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 12.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
     SE                        Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.164
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 104 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.77 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.47 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)38.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.7 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing North East:		12.00 m², No overhang	
Windows facing South East:		12.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.9700	27.0000	29.9700	0.1500	4.4955			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4115			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7715	(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	25.1641	24.8687	24.5733	23.0965	22.8011	21.3243	21.3243	21.0289	21.9150	22.8011	23.3919	23.9826	(38)
Heat transfer coeff	69.9356	69.6402	69.3449	67.8680	67.5727	66.0958	66.0958	65.8005	66.6866	67.5727	68.1634	68.7541	(39)
Average = Sum(39)m / 12 =												67.7942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6725	0.6696	0.6668	0.6526	0.6497	0.6355	0.6355	0.6327	0.6412	0.6497	0.6554	0.6611	(40)
HLP (average)												0.6519	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7736 (42)
Average daily hot water use (litres/day)	100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4869	21.4164	22.0998	19.2671	18.4873	15.9531	14.7829	16.9636	17.1662	20.0055	21.8376	23.7142	(46)

Water storage loss:		
Store volume	110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
218.5226 192.7033 202.6087 181.9412 178.5252 159.8477 153.8294 168.3674 167.9349 188.6470 199.0777 213.3717 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
218.5226 192.7033 202.6087 181.9412 178.5252 159.8477 153.8294 168.3674 167.9349 188.6470 199.0777 213.3717 (64)
Total per year (kWh/year) = Sum(64)m = 2225.3769 (64)
Heat gains from water heating, kWh/month
98.5007 87.4149 93.2093 85.5037 85.2015 78.1577 76.9902 81.8241 80.8467 88.5670 91.2016 96.7880 (65)

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	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.4143	20.7963	16.9127	12.8040	9.5712	8.0804	8.7311	11.3491	15.2327	19.3414	22.5742	24.0650	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)													
	132.3934	130.0817	125.2813	118.7552	114.5182	108.5523	103.4814	109.9786	112.2870	119.0417	126.6689	130.0914	(72)
Total internal gains													
	483.0485	480.8442	465.2924	440.0369	414.1110	389.3083	373.2999	379.6896	392.7495	418.2336	447.5497	469.8090	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	713.3039	894.2474	1087.2211	1304.9914	1469.0547	1474.5056	1403.7810	1262.6387	1097.9258	890.3101	727.2021	664.3623	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.3078	41.4830	41.6597	42.5663	42.7523	43.7076	43.7076	43.9038	43.3204	42.7523	42.3818	42.0177	
alpha	3.7539	3.7655	3.7773	3.8378	3.8502	3.9138	3.9138	3.9269	3.8880	3.8502	3.8255	3.8012	
util living area													
	0.9324	0.8691	0.7587	0.5851	0.4183	0.2853	0.2068	0.2391	0.4107	0.6913	0.8828	0.9442	(86)
MIT	19.9649	20.2910	20.6274	20.8805	20.9711	20.9952	20.9990	20.9982	20.9808	20.8187	20.3667	19.9084	(87)
Th 2	20.3652	20.3677	20.3703	20.3829	20.3854	20.3981	20.3981	20.4007	20.3930	20.3854	20.3804	20.3753	(88)
util rest of house													
	0.9250	0.8567	0.7397	0.5609	0.3924	0.2589	0.1787	0.2081	0.3766	0.6631	0.8696	0.9380	(89)
MIT 2	18.9672	19.4288	19.8941	20.2391	20.3537	20.3937	20.3974	20.3993	20.3740	20.1697	19.5518	18.8941	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	19.2550	19.6775	20.1056	20.4241	20.5318	20.5672	20.5709	20.5721	20.5491	20.3569	19.7869	19.1867	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2550	19.6775	20.1056	20.4241	20.5318	20.5672	20.5709	20.5721	20.5491	20.3569	19.7869	19.1867	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9098	0.8418	0.7313	0.5626	0.3986	0.2664	0.1868	0.2170	0.3854	0.6617	0.8553	0.9237	(94)
Useful gains	648.9483	752.7437	795.1162	734.1540	585.6020	392.7473	262.1595	273.9875	423.1549	589.1460	621.9698	613.6959	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1045.8843	1029.1098	943.4786	782.1170	596.7892	394.4067	262.4609	274.5245	430.0659	659.3027	864.7797	1030.3985	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	295.3204	185.7181	110.3817	34.5334	8.3232	0.0000	0.0000	0.0000	0.0000	52.1966	174.8232	310.0268	(98)
Space heating												1171.3233	(98)
Space heating per m2											(98) / (4) =	11.2627	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	621.3008	489.1092	500.0835	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9901	0.9949	0.9923	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	615.1455	486.6197	496.2513	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1817.6075	1732.9136	1569.4479	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	865.7726	927.2427	798.4583	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling	2591.4736	(104)
Cooled fraction	fC = cooled area / (4) = 0.5769	(105)

Intermittency factor (Table 10b)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	124.8711	133.7369	115.1623	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling	373.7702	(107)
Space cooling per m2	3.5939	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1171.3233	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	430.4613	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	799.4281	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2225.3769	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	817.8260	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1518.8197	(310b)
Electricity used for heat distribution	35.6654	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	86.5209	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	235.5210	(330a)
Total electricity for the above, kWh/year	235.5210	(331)
Electricity for lighting (calculated in Appendix L)	413.5033	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4302.0803	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1313.9866	0.2160	283.8211	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1453.5057	0.2160	313.9572	(363)
less credit emissions for electricity	-508.7270	0.5190	-264.0293	(364)
Water heating from Combined Heat and Power	2761.4904	0.2160	596.4819	(365)
less credit emissions for electricity	-966.5216	0.5190	-501.6247	(366)
Electrical energy for heat distribution	35.6654	0.5190	18.5103	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			447.1165	(373)
Space and water heating			447.1165	(376)
Space cooling	86.5209	0.5190	44.9043	(377)
Pumps and fans	235.5210	0.5190	122.2354	(378)
Energy for lighting	413.5033	0.5190	214.6082	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			673.1645	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4700	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4700	ZC1
Total Floor Area	TFA	104.0000	
Assumed number of occupants	N	2.7736	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.9647	ZC2
CO2 emissions from cooking, equation (L16)		1.7843	ZC3
Total CO2 emissions		23.2190	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.2190	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3336	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			26.0100	1.3258	34.4830			(27)
External Wall 1	56.9700	26.0100	30.9600	0.1800	5.5728			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.0558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		45.4558	(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	54.7132	54.3878	54.0688	52.5704	52.2901	50.9850	50.9850	50.7433	51.4877	52.2901	52.8572	53.4501	(38)
Heat transfer coeff	100.1690	99.8435	99.5245	98.0262	97.7458	96.4408	96.4408	96.1991	96.9435	97.7458	98.3129	98.9058	(39)
Average = Sum(39)m / 12 =												98.0248	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9632	0.9600	0.9570	0.9426	0.9399	0.9273	0.9273	0.9250	0.9321	0.9399	0.9453	0.9510	(40)
HLP (average)												0.9425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7736 (42)
Average daily hot water use (litres/day)		100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4869	21.4164	22.0998	19.2671	18.4873	15.9531	14.7829	16.9636	17.1662	20.0055	21.8376	23.7142	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	209.8407	184.8616	193.9268	173.5393	169.8433	151.4459	145.1475	159.6855	159.5331	179.9651	190.6759	204.6898	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	209.8407	184.8616	193.9268	173.5393	169.8433	151.4459	145.1475	159.6855	159.5331	179.9651	190.6759	204.6898	(64)
									Total per year (kWh/year) = Sum(64)m =			2123.1545	(64)
Heat gains from water heating, kWh/month													
	91.5552	81.1415	86.2638	78.7823	78.2560	71.4362	70.0447	74.8785	74.1252	81.6215	84.4802	89.8425	(65)

---

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	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.4143	20.7963	16.9127	12.8040	9.5712	8.0804	8.7311	11.3491	15.2327	19.3414	22.5742	24.0650	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)													
	123.0580	120.7463	115.9459	109.4198	105.1828	99.2169	94.1461	100.6432	102.9517	109.7064	117.3336	120.7560	(72)
Total internal gains													
	476.7131	474.5089	458.9570	433.7015	407.7756	382.9729	366.9645	373.3543	386.4141	411.8982	441.2143	463.4736	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.5600	11.2829	0.6300	0.7000	0.7700	39.8613	(75)
Southeast	11.5600	36.7938	0.6300	0.7000	0.7700	129.9884	(77)
Northwest	2.8900	11.2829	0.6300	0.7000	0.7700	9.9653	(81)

Solar gains	179.8151	322.8420	485.6875	675.4754	823.8451	847.4713	804.7414	689.5281	550.6987	368.6622	218.3910	151.9340	(83)
Total gains	656.5282	797.3509	944.6445	1109.1769	1231.6207	1230.4442	1171.7059	1062.8823	937.1128	780.5605	659.6054	615.4076	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.1004	72.3354	72.5673	73.6765	73.8878	74.8876	74.8876	75.0758	74.4993	73.8878	73.4616	73.0212	
alpha	5.8067	5.8224	5.8378	5.9118	5.9259	5.9925	5.9925	6.0051	5.9666	5.9259	5.8974	5.8681	
util living area													
	0.9973	0.9914	0.9692	0.8824	0.7017	0.4976	0.3616	0.4151	0.6836	0.9422	0.9929	0.9981	(86)
MIT	20.0483	20.2358	20.5062	20.8053	20.9579	20.9953	20.9994	20.9987	20.9734	20.7360	20.3325	20.0186	(87)
Th 2	20.1141	20.1168	20.1193	20.1315	20.1337	20.1443	20.1443	20.1463	20.1403	20.1337	20.1292	20.1244	(88)
util rest of house													
	0.9965	0.9887	0.9598	0.8521	0.6475	0.4329	0.2916	0.3387	0.6101	0.9196	0.9902	0.9975	(89)
MIT 2	18.8409	19.1154	19.5041	19.9173	20.0967	20.1415	20.1441	20.1458	20.1212	19.8393	19.2667	18.8053	(90)
Living area fraction										fLA = Living area / (4) =		0.2885	(91)
MIT	19.1892	19.4386	19.7932	20.1735	20.3451	20.3878	20.3909	20.3918	20.3671	20.0980	19.5741	19.1553	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1892	19.4386	19.7932	20.1735	20.3451	20.3878	20.3909	20.3918	20.3671	20.0980	19.5741	19.1553	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9860	0.9555	0.8537	0.6612	0.4515	0.3118	0.3608	0.6303	0.9185	0.9879	0.9966	(94)
Useful gains	653.3827	786.1834	902.6384	946.9457	814.3119	555.4960	365.3586	383.4691	590.6261	716.9552	651.6302	613.3101	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1491.4369	1451.5823	1322.9972	1105.0941	845.0262	558.1803	365.5928	384.0122	607.5499	928.3908	1226.3676	1479.1697	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	623.5123	447.1481	312.7470	113.8668	22.8515	0.0000	0.0000	0.0000	0.0000	157.3081	413.8109	644.1995	(98)
Space heating												2735.4442	(98)
Space heating per m2											(98) / (4) =	26.3023	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2925.6087	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	623.5123	447.1481	312.7470	113.8668	22.8515	0.0000	0.0000	0.0000	0.0000	157.3081	413.8109	644.1995	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	666.8581	478.2333	334.4887	121.7827	24.4401	0.0000	0.0000	0.0000	0.0000	168.2440	442.5785	688.9835	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	209.8407	184.8616	193.9268	173.5393	169.8433	151.4459	145.1475	159.6855	159.5331	179.9651	190.6759	204.6898	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.5442	87.0846	86.0822	83.7217	80.9348	79.8000	79.8000	79.8000	79.8000	84.4574	86.8276	87.6656	(217)
Fuel for water heating, kWh/month													
	239.6968	212.2782	225.2809	207.2812	209.8521	189.7818	181.8891	200.1071	199.9162	213.0840	219.6028	233.4892	(219)
Water heating fuel used												2532.2593	(219)
Annual totals kWh/year													
Space heating fuel - main system												2925.6087	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												413.5033	(232)
Total delivered energy for all uses												5946.3713	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2925.6087	0.2160	631.9315	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2532.2593	0.2160	546.9680	(264)
Space and water heating			1178.8995	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	413.5033	0.5190	214.6082	(268)
Total CO2, kg/m2/year			1432.4327	(272)
Emissions per m2 for space and water heating			11.3356	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0635	(272b)
Emissions per m2 for pumps and fans			0.3743	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.3356 * 1.00) + 2.0635 + 0.3743, rounded to 2 d.p.			13.7700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2486	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3169	0.3107	0.3045	0.2734	0.2672	0.2362	0.2362	0.2299	0.2486	0.2672	0.2797	0.2921	(22b)
Effective ac	0.5502	0.5483	0.5464	0.5374	0.5357	0.5279	0.5279	0.5264	0.5309	0.5357	0.5391	0.5427	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.9700	27.0000	29.9700	0.1500	4.4955			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4115			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		44.7715	(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	50.9862	50.8055	50.6283	49.7962	49.6406	48.9159	48.9159	48.7817	49.1950	49.6406	49.9555	50.2847	(38)
Heat transfer coeff	95.7577	95.5770	95.3998	94.5678	94.4121	93.6874	93.6874	93.5532	93.9665	94.4121	94.7270	95.0563	(39)
Average = Sum(39)m / 12 =												94.5670	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9207	0.9190	0.9173	0.9093	0.9078	0.9008	0.9008	0.8995	0.9035	0.9078	0.9108	0.9140	(40)
HLP (average)												0.9093	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7736 (42)
Average daily hot water use (litres/day)		100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	34.6897	30.3399	31.3080	27.2951	26.1903	22.6002	20.9424	24.0318	24.3188	28.3412	30.9366	33.5952 (65)

---

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	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)

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

	23.4143	20.7963	16.9127	12.8040	9.5712	8.0804	8.7311	11.3491	15.2327	19.3414	22.5742	24.0650	(67)

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

	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)

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

	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)

Water heating gains (Table 5)

	46.6260	45.1486	42.0807	37.9099	35.2020	31.3892	28.1484	32.3007	33.7761	38.0930	42.9675	45.1548	(72)

Total internal gains

	397.2811	395.9111	382.0918	359.1915	334.7948	312.1452	297.9669	302.0118	314.2385	337.2849	363.8483	384.8724	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	627.5365	809.3143	1004.0205	1224.1461	1389.7385	1397.3425	1328.4480	1184.9609	1019.4149	809.3613	643.5007	579.4257	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.1687	30.2258	30.2819	30.5483	30.5987	30.8354	30.8354	30.8796	30.7438	30.5987	30.4970	30.3914	
alpha	3.0112	3.0151	3.0188	3.0366	3.0399	3.0557	3.0557	3.0586	3.0496	3.0399	3.0331	3.0261	
util living area	0.9628	0.9261	0.8561	0.7263	0.5635	0.4100	0.3043	0.3526	0.5667	0.8198	0.9383	0.9699	(86)
MIT	19.1433	19.5262	20.0213	20.5218	20.8220	20.9499	20.9849	20.9763	20.8672	20.4030	19.6646	19.0637	(87)
Th 2	20.1499	20.1514	20.1528	20.1596	20.1609	20.1668	20.1668	20.1679	20.1645	20.1609	20.1583	20.1556	(88)
util rest of house	0.9577	0.9167	0.8390	0.6976	0.5240	0.3615	0.2488	0.2923	0.5128	0.7919	0.9288	0.9657	(89)
MIT 2	18.4392	18.8148	19.2931	19.7645	20.0284	20.1360	20.1598	20.1564	20.0760	19.6700	18.9609	18.3650	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	18.6423	19.0200	19.5031	19.9829	20.2573	20.3707	20.3978	20.3929	20.3042	19.8815	19.1639	18.5665	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6423	19.0200	19.5031	19.9829	20.2573	20.3707	20.3978	20.3929	20.3042	19.8815	19.1639	18.5665	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9463	0.9017	0.8242	0.6912	0.5287	0.3736	0.2643	0.3089	0.5222	0.7815	0.9151	0.9556	(94)
Useful gains	593.8549	729.7698	827.4908	846.0886	734.7025	522.0414	351.1353	365.9905	532.3119	632.5210	588.8577	553.6941	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1373.3853	1349.5461	1240.4969	1048.0892	807.9170	540.6465	355.8090	373.5491	582.9912	876.2822	1142.7746	1365.6281	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	579.9706	416.4897	307.2765	145.4405	54.4716	0.0000	0.0000	0.0000	0.0000	181.3583	398.8202	604.0789	(98)
Space heating												2687.9064	(98)
Space heating per m2											(98) / (4) =	25.8453	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	880.6615	693.2867	711.0043	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9342	0.9582	0.9429	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	822.7427	664.3315	670.4221	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1740.4444	1657.5806	1491.7700	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	660.7453	738.9774	611.0829	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2010.8055	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	165.1863	184.7443	152.7707	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												502.7014 (107)
Space cooling per m2												4.8337 (108)
Energy for space heating												25.8453 (99)
Energy for space cooling												4.8337 (108)
Total												30.6789 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3336	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			26.0100	1.3258	34.4830			(27)
External Wall 1	56.9700	26.0100	30.9600	0.1800	5.5728			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.0558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		45.4558	(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	54.7132	54.3878	54.0688	52.5704	52.2901	50.9850	50.9850	50.7433	51.4877	52.2901	52.8572	53.4501	(38)
Heat transfer coeff	100.1690	99.8435	99.5245	98.0262	97.7458	96.4408	96.4408	96.1991	96.9435	97.7458	98.3129	98.9058	(39)
Average = Sum(39)m / 12 =												98.0248	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9632	0.9600	0.9570	0.9426	0.9399	0.9273	0.9273	0.9250	0.9321	0.9399	0.9453	0.9510	(40)
HLP (average)												0.9425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7736	(42)
Average daily hot water use (litres/day)	100.0729	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.6897	30.3399	31.3080	27.2951	26.1903	22.6002	20.9424	24.0318	24.3188	28.3412	30.9366	33.5952	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.4143	20.7963	16.9127	12.8040	9.5712	8.0804	8.7311	11.3491	15.2327	19.3414	22.5742	24.0650	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)													
	46.6260	45.1486	42.0807	37.9099	35.2020	31.3892	28.1484	32.3007	33.7761	38.0930	42.9675	45.1548	(72)
Total internal gains													
	397.2811	395.9111	382.0918	359.1915	334.7948	312.1452	297.9669	302.0118	314.2385	337.2849	363.8483	384.8724	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.5600	11.2829	0.6300	0.7000	0.7700	39.8613	(75)
Southeast	11.5600	36.7938	0.6300	0.7000	0.7700	129.9884	(77)
Northwest	2.8900	11.2829	0.6300	0.7000	0.7700	9.9653	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	179.8151	322.8420	485.6875	675.4754	823.8451	847.4713	804.7414	689.5281	550.6987	368.6622	218.3910	151.9340	(83)
Total gains	577.0962	718.7532	867.7792	1034.6670	1158.6399	1159.6165	1102.7083	991.5399	864.9372	705.9471	582.2393	536.8064	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	72.1004	72.3354	72.5673	73.6765	73.8878	74.8876	74.8876	75.0758	74.4993	73.8878	73.4616	73.0212	
alpha	5.8067	5.8224	5.8378	5.9118	5.9259	5.9925	5.9925	6.0051	5.9666	5.9259	5.8974	5.8681	
util living area													
	0.9986	0.9949	0.9789	0.9068	0.7352	0.5265	0.3840	0.4443	0.7280	0.9617	0.9962	0.9991	(86)
MIT	19.9749	20.1652	20.4444	20.7674	20.9463	20.9937	20.9992	20.9982	20.9631	20.6830	20.2623	19.9456	(87)
Th 2	20.1141	20.1168	20.1193	20.1315	20.1337	20.1443	20.1443	20.1463	20.1403	20.1337	20.1292	20.1244	(88)
util rest of house													
	0.9982	0.9932	0.9720	0.8805	0.6813	0.4587	0.3098	0.3629	0.6542	0.9452	0.9948	0.9988	(89)
MIT 2	19.1718	19.3634	19.6402	19.9532	20.1009	20.1417	20.1441	20.1458	20.1217	19.8853	19.4709	19.1510	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	19.4035	19.5947	19.8722	20.1881	20.3448	20.3875	20.3908	20.3917	20.3644	20.1154	19.6992	19.3802	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4035	19.5947	19.8722	20.1881	20.3448	20.3875	20.3908	20.3917	20.3644	20.1154	19.6992	19.3802	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9919	0.9697	0.8824	0.6950	0.4782	0.3312	0.3865	0.6744	0.9448	0.9938	0.9985	(94)
Useful gains	575.7695	712.9557	841.4951	912.9901	805.3023	554.5078	365.2598	383.2058	583.3217	666.9747	578.6233	535.9806	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1512.8981	1467.1692	1330.8592	1106.5245	844.9928	558.1492	365.5872	383.9968	607.2920	930.0893	1238.6627	1501.4087	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	697.2237	506.8315	364.0869	139.3447	29.5297	0.0000	0.0000	0.0000	0.0000	195.7572	475.2284	718.2785	(98)
Space heating												3126.2808	(98)
Space heating per m2											(98) / (4) =	30.0604	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	906.5433	713.6617	731.1132	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9776	0.9911	0.9840	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	886.2135	707.2942	719.4237	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1462.5828	1393.7289	1265.6935	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	414.9859	510.7075	406.4247	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1332.1181	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	103.7465	127.6769	101.6062	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												333.0295 (107)
Space cooling per m2												3.2022 (108)
Energy for space heating												30.0604 (99)
Energy for space cooling												3.2022 (108)
Total												33.2626 (109)
Target Fabric Energy Efficiency (TFEE)												38.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.9700	27.0000	29.9700	0.1500	4.4955			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4115			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7715	(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	21.6197	21.3243	21.0289	20.4382	20.4382	19.2567	19.8475	19.2567	18.9614	19.5521	19.5521	20.7336	(38)
Heat transfer coeff	66.3912	66.0958	65.8005	65.2097	65.2097	64.0283	64.6190	64.0283	63.7329	64.3236	64.3236	65.5051	(39)
Average = Sum(39)m / 12 =												64.9390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6384	0.6355	0.6327	0.6270	0.6270	0.6157	0.6213	0.6157	0.6128	0.6185	0.6185	0.6299	(40)
HLP (average)												0.6244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7736 (42)
Average daily hot water use (litres/day)	100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4869	21.4164	22.0998	19.2671	18.4873	15.9531	14.7829	16.9636	17.1662	20.0055	21.8376	23.7142	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
218.5226 192.7033 202.6087 181.9412 178.5252 159.8477 153.8294 168.3674 167.9349 188.6470 199.0777 213.3717 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
218.5226 192.7033 202.6087 181.9412 178.5252 159.8477 153.8294 168.3674 167.9349 188.6470 199.0777 213.3717 (64)
Total per year (kWh/year) = Sum(64)m = 2225.3769 (64)
RHI water heating demand 2225 (64)
Heat gains from water heating, kWh/month
98.5007 87.4149 93.2093 85.5037 85.2015 78.1577 76.9902 81.8241 80.8467 88.5670 91.2016 96.7880 (65)

---

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	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	(66)

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

	58.5357	51.9909	42.2818	32.0100	23.9279	20.2009	21.8278	28.3726	38.0817	48.3534	56.4356	60.1626	(67)

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

	391.9953	396.0630	385.8126	363.9906	336.4443	310.5547	293.2588	289.1911	299.4415	321.2635	348.8098	374.6994	(68)

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

	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)

Water heating gains (Table 5)

	132.3934	130.0817	125.2813	118.7552	114.5182	108.5523	103.4814	109.9786	112.2870	119.0417	126.6689	130.0914	(72)

Total internal gains

	692.8115	688.0227	663.2628	624.6430	584.7775	549.1950	528.4552	537.4294	559.6974	598.5458	641.8015	674.8405	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856	(83)
Total gains	939.9664	1080.2410	1270.0319	1500.6109	1627.3678	1694.9023	1613.4077	1494.7997	1316.9028	1097.9155	952.0362	888.6261	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5131	43.7076	43.9038	44.3015	44.3015	45.1190	44.7065	45.1190	45.3281	44.9118	44.9118	44.1017	
alpha	3.9009	3.9138	3.9269	3.9534	3.9534	4.0079	3.9804	4.0079	4.0219	3.9941	3.9941	3.9401	
util living area	0.8256	0.7552	0.6119	0.4371	0.2870	0.1586	0.0921	0.1028	0.2462	0.4871	0.7199	0.8425	(86)
MIT	20.4994	20.6605	20.8636	20.9669	20.9948	20.9997	21.0000	21.0000	20.9981	20.9613	20.7772	20.4687	(87)
Th 2	20.3956	20.3981	20.4007	20.4057	20.4057	20.4159	20.4108	20.4159	20.4185	20.4134	20.4134	20.4032	(88)
util rest of house	0.8105	0.7370	0.5893	0.4136	0.2637	0.1366	0.0685	0.0778	0.2183	0.4570	0.6973	0.8284	(89)
MIT 2	19.7417	19.9625	20.2338	20.3682	20.4007	20.4157	20.4108	20.4159	20.4169	20.3713	20.1371	19.7064	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	19.9603	20.1638	20.4155	20.5409	20.5721	20.5842	20.5808	20.5844	20.5846	20.5415	20.3217	19.9263	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9603	20.1638	20.4155	20.5409	20.5721	20.5842	20.5808	20.5844	20.5846	20.5415	20.3217	19.9263	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7988	0.7296	0.5898	0.4190	0.2702	0.1429	0.0753	0.0850	0.2263	0.4637	0.6936	0.8161	(94)
Useful gains	750.8548	788.1486	749.0902	628.7500	439.7471	242.2088	121.5300	127.0513	297.9719	509.0878	660.3652	725.1898	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	946.7585	922.9521	803.7828	641.7225	441.6040	242.2942	121.5338	127.0573	298.5627	523.6895	747.5520	931.8940	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	145.7524	90.5880	40.6914	9.3402	1.3815	0.0000	0.0000	0.0000	0.0000	10.8637	62.7745	153.7879	(98)

Space heating 515.1795 (98)
RHI space heating demand 515 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.9700	27.0000	29.9700	0.1500	4.4955			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4115			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7715	(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	25.1641	24.8687	24.5733	23.0965	22.8011	21.3243	21.3243	21.0289	21.9150	22.8011	23.3919	23.9826	(38)
Heat transfer coeff	69.9356	69.6402	69.3449	67.8680	67.5727	66.0958	66.0958	65.8005	66.6866	67.5727	68.1634	68.7541	(39)
Average = Sum(39)m / 12 =												67.7942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6725	0.6696	0.6668	0.6526	0.6497	0.6355	0.6355	0.6327	0.6412	0.6497	0.6554	0.6611	(40)
HLP (average)												0.6519	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7736 (42)
Average daily hot water use (litres/day)	100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4869	21.4164	22.0998	19.2671	18.4873	15.9531	14.7829	16.9636	17.1662	20.0055	21.8376	23.7142	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (56)
If cylinder contains dedicated solar storage
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (57)
Primary loss    23.2624   21.0112   23.2624   22.5120   23.2624   22.5120   23.2624   23.2624   22.5120   23.2624   22.5120   23.2624 (59)
Total heat required for water heating calculated for each month
   218.5226  192.7033  202.6087  181.9412  178.5252  159.8477  153.8294  168.3674  167.9349  188.6470  199.0777  213.3717 (62)
Solar input      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   218.5226  192.7033  202.6087  181.9412  178.5252  159.8477  153.8294  168.3674  167.9349  188.6470  199.0777  213.3717 (64)
                                                                    Total per year (kWh/year) = Sum(64)m =   2225.3769 (64)
Heat gains from water heating, kWh/month
    98.5007   87.4149   93.2093   85.5037   85.2015   78.1577   76.9902   81.8241   80.8467   88.5670   91.2016   96.7880 (65)
```

---

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       166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159  166.4159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    58.5357   51.9909   42.2818   32.0100   23.9279   20.2009   21.8278   28.3726   38.0817   48.3534   56.4356   60.1626 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   391.9953  396.0630  385.8126  363.9906  336.4443  310.5547  293.2588  289.1911  299.4415  321.2635  348.8098  374.6994 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152   54.4152 (69)
Pumps, fans      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
  -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 -110.9439 (71)
Water heating gains (Table 5)
   132.3934  130.0817  125.2813  118.7552  114.5182  108.5523  103.4814  109.9786  112.2870  119.0417  126.6689  130.0914 (72)
Total internal gains
   692.8115  688.0227  663.2628  624.6430  584.7775  549.1950  528.4552  537.4294  559.6974  598.5458  641.8015  674.8405 (73)
```

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

```
Solar gains   230.2554  413.4032  621.9287  864.9545 1054.9437 1085.1974 1030.4811  882.9491  705.1763  472.0765  279.6524  194.5533 (83)
Total gains   923.0669 1101.4259 1285.1915 1489.5975 1639.7213 1634.3924 1558.9363 1420.3785 1264.8737 1070.6223  921.4539  869.3938 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          41.3078   41.4830   41.6597   42.5663   42.7523   43.7076   43.7076   43.9038   43.3204   42.7523   42.3818   42.0177
alpha         3.7539    3.7655    3.7773    3.8378    3.8502    3.9138    3.9138    3.9269    3.8880    3.8502    3.8255    3.8012
util living area
    0.8712    0.7971    0.6848    0.5246    0.3773    0.2579    0.1863    0.2127    0.3592    0.6052    0.8037    0.8872 (86)

MIT          20.2513   20.4987   20.7412   20.9176   20.9797   20.9967   20.9993   20.9988   20.9879   20.8860   20.5710   20.2063 (87)
Th 2         20.3652   20.3677   20.3703   20.3829   20.3854   20.3981   20.3981   20.4007   20.3930   20.3854   20.3804   20.3753 (88)
util rest of house
    0.8595    0.7813    0.6643    0.5015    0.3535    0.2339    0.1609    0.1851    0.3287    0.5767    0.7857    0.8765 (89)
MIT 2        19.3698   19.7138   20.0438   20.2846   20.3633   20.3950   20.3976   20.3998   20.3812   20.2522   19.8299   19.3149 (90)
Living area fraction                                                                 fLA = Living area / (4) =     0.2885 (91)
MIT          19.6241   19.9402   20.2450   20.4672   20.5411   20.5686   20.5712   20.5726   20.5563   20.4350   20.0437   19.5721 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT 19.6241   19.9402   20.2450   20.4672   20.5411   20.5686   20.5712   20.5726   20.5563   20.4350   20.0437   19.5721 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation      0.8442    0.7698    0.6601    0.5047    0.3596    0.2407    0.1682    0.1931    0.3370    0.5791    0.7752    0.8612 (94)
Useful gains   779.2482  847.9290  848.3978  751.7604  589.5764  393.3500  262.2739  274.2097  426.2219  619.9702  714.3178  748.7325 (95)
Ext temp.        4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
  1071.6968 1047.4032  953.1429  785.0430  597.4197  394.4993  262.4784  274.5585  430.5455  664.5796  882.2873 1056.8920 (97)
Month fracti     1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   217.5818  134.0467   77.9304   23.9634    5.8355    0.0000    0.0000    0.0000    0.0000   33.1894  120.9380  229.2707 (98)
Space heating                                                                                                 842.7558 (98)
Space heating per m2                                                                                 (98) / (4) =     8.1034 (99)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	621.3008	489.1092	500.0835	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9901	0.9949	0.9923	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	615.1455	486.6197	496.2513	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1817.6075	1732.9136	1569.4479	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	865.7726	927.2427	798.4583	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2591.4736	(104)
Cooled fraction										fC = cooled area / (4) =		0.5769	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	124.8711	133.7369	115.1623	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												373.7702	(107)
Space cooling per m2												3.5939	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	842.7558	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	309.7128	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	575.1808	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2225.3769	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	817.8260	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1518.8197	(310b)
Electricity used for heat distribution	32.2154	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	86.5209	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	235.5210	(330a)
Total electricity for the above, kWh/year	235.5210	(331)
Electricity for lighting (calculated in Appendix L)	413.5033	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3957.0845	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	309.7128	4.2400	13.1318	(340a)
Space heating from Combined Heat and Power	575.1808	2.9700	17.0829	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	817.8260	4.2400	34.6758	(342a)
Water heating from Combined Heat and Power	1518.8197	2.9700	45.1089	(342b)
Space cooling	86.5209	13.1900	11.4121	(348)
Mechanical ventilation fans	235.5210	13.1900	31.0652	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	413.5033	13.1900	54.5411	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			287.4479	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.4200	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8103	(357)
SAP value		88.6969	
SAP rating (Section 12)		89	(358)
SAP band		B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1186.8829	0.2160	256.3667 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	1045.7833	0.2160	225.8892 (363)
less credit emissions for electricity	-366.0242	0.5190	-189.9665 (364)
Water heating from Combined Heat and Power	2761.4904	0.2160	596.4819 (365)
less credit emissions for electricity	-966.5216	0.5190	-501.6247 (366)
Electrical energy for heat distribution	32.2154	0.5190	16.7198 (372)
Total CO2 associated with community systems			403.8663 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			403.8663 (376)
Space cooling	86.5209	0.5190	44.9043 (377)
Pumps and fans	235.5210	0.5190	122.2354 (378)
Energy for lighting	413.5033	0.5190	214.6082 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			629.9143 (383)
CO2 emissions per m2			6.0600 (384)
EI value			94.3350 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	104.0000 (1b)	x	2.7000 (2b)	=	280.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.8000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.9700	27.0000	29.9700	0.1500	4.4955			(29a)
Total net area of external elements Aum(A, m2)			56.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4115			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7715	(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	21.6197	21.3243	21.0289	20.4382	20.4382	19.2567	19.8475	19.2567	18.9614	19.5521	19.5521	20.7336	(38)
Heat transfer coeff	66.3912	66.0958	65.8005	65.2097	65.2097	64.0283	64.6190	64.0283	63.7329	64.3236	64.3236	65.5051	(39)
Average = Sum(39)m / 12 =												64.9390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6384	0.6355	0.6327	0.6270	0.6270	0.6157	0.6213	0.6157	0.6128	0.6185	0.6185	0.6299	(40)
HLP (average)												0.6244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7736 (42)
Average daily hot water use (litres/day)	100.0729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.0802	106.0773	102.0744	98.0715	94.0686	90.0657	90.0657	94.0686	98.0715	102.0744	106.0773	110.0802	(44)
Energy conte	163.2458	142.7758	147.3319	128.4475	123.2484	106.3540	98.5526	113.0906	114.4413	133.3702	145.5841	158.0949	(45)
Energy content (annual)										Total = Sum(45)m =		1574.5371	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4869	21.4164	22.0998	19.2671	18.4873	15.9531	14.7829	16.9636	17.1662	20.0055	21.8376	23.7142	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	218.5226	192.7033	202.6087	181.9412	178.5252	159.8477	153.8294	168.3674	167.9349	188.6470	199.0777	213.3717 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	218.5226	192.7033	202.6087	181.9412	178.5252	159.8477	153.8294	168.3674	167.9349	188.6470	199.0777	213.3717 (64)

Total per year (kWh/year) = Sum(64)m = 2225.3769 (64)

Heat gains from water heating, kWh/month

	98.5007	87.4149	93.2093	85.5037	85.2015	78.1577	76.9902	81.8241	80.8467	88.5670	91.2016	96.7880 (65)

---

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	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	166.4159	(66)

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

	58.5357	51.9909	42.2818	32.0100	23.9279	20.2009	21.8278	28.3726	38.0817	48.3534	56.4356	60.1626 (67)

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

	391.9953	396.0630	385.8126	363.9906	336.4443	310.5547	293.2588	289.1911	299.4415	321.2635	348.8098	374.6994 (68)

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

	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152	54.4152 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439 (71)

Water heating gains (Table 5)

	132.3934	130.0817	125.2813	118.7552	114.5182	108.5523	103.4814	109.9786	112.2870	119.0417	126.6689	130.0914 (72)

Total internal gains

	692.8115	688.0227	663.2628	624.6430	584.7775	549.1950	528.4552	537.4294	559.6974	598.5458	641.8015	674.8405 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856 (83)
Total gains	939.9664	1080.2410	1270.0319	1500.6109	1627.3678	1694.9023	1613.4077	1494.7997	1316.9028	1097.9155	952.0362	888.6261 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5131	43.7076	43.9038	44.3015	44.3015	45.1190	44.7065	45.1190	45.3281	44.9118	44.9118	44.1017	
alpha	3.9009	3.9138	3.9269	3.9534	3.9534	4.0079	3.9804	4.0079	4.0219	3.9941	3.9941	3.9401	
util living area													
	0.8256	0.7552	0.6119	0.4371	0.2870	0.1586	0.0921	0.1028	0.2462	0.4871	0.7199	0.8425	(86)
MIT	20.4994	20.6605	20.8636	20.9669	20.9948	20.9997	21.0000	21.0000	20.9981	20.9613	20.7772	20.4687	(87)
Th 2	20.3956	20.3981	20.4007	20.4057	20.4057	20.4159	20.4108	20.4159	20.4185	20.4134	20.4134	20.4032	(88)
util rest of house													
	0.8105	0.7370	0.5893	0.4136	0.2637	0.1366	0.0685	0.0778	0.2183	0.4570	0.6973	0.8284	(89)
MIT 2	19.7417	19.9625	20.2338	20.3682	20.4007	20.4157	20.4108	20.4159	20.4169	20.3713	20.1371	19.7064	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	19.9603	20.1638	20.4155	20.5409	20.5721	20.5842	20.5808	20.5844	20.5846	20.5415	20.3217	19.9263	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9603	20.1638	20.4155	20.5409	20.5721	20.5842	20.5808	20.5844	20.5846	20.5415	20.3217	19.9263	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7988	0.7296	0.5898	0.4190	0.2702	0.1429	0.0753	0.0850	0.2263	0.4637	0.6936	0.8161	(94)
Useful gains	750.8548	788.1486	749.0902	628.7500	439.7471	242.2088	121.5300	127.0513	297.9719	509.0878	660.3652	725.1898	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	946.7585	922.9521	803.7828	641.7225	441.6040	242.2942	121.5338	127.0573	298.5627	523.6895	747.5520	931.8940	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	145.7524	90.5880	40.6914	9.3402	1.3815	0.0000	0.0000	0.0000	0.0000	10.8637	62.7745	153.7879	(98)
Space heating												515.1795	(98)
Space heating per m2											(98) / (4) =	4.9536	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	461.0035	342.4807	345.7526	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9973	0.9989	0.9985	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	459.7784	342.1025	345.2395	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1888.3333	1796.5815	1656.4336	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1028.5595	1082.1323	975.5284	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												3086.2203	(104)
Cooled fraction										fC = cooled area / (4) =		0.5769	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	148.3499	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												148.3499	(107)
Space cooling per m2												1.4264	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	515.1795	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	189.3284	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	351.6100	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2225.3769	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	817.8260	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1518.8197	(310b)
Electricity used for heat distribution	28.7758	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	34.3403	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	235.5210	(330a)
Total electricity for the above, kWh/year	235.5210	(331)
Electricity for lighting (calculated in Appendix L)	413.5033	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3560.9487	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	189.3284	5.0000	9.4664	(340a)
Space heating from Combined Heat and Power	351.6100	3.5000	12.3063	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	817.8260	5.0000	40.8913	(342a)
Water heating from Combined Heat and Power	1518.8197	3.5000	53.1587	(342b)
Space cooling	34.3403	15.7000	5.3914	(348)
Mechanical ventilation fans	235.5210	15.7000	36.9768	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	413.5033	15.7000	64.9200	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			265.0110	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1060.1626	0.2160	228.9951	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	639.2909	0.2160	138.0868	(363)
less credit emissions for electricity	-223.7518	0.5190	-116.1272	(364)
Water heating from Combined Heat and Power	2761.4904	0.2160	596.4819	(365)
less credit emissions for electricity	-966.5216	0.5190	-501.6247	(366)
Electrical energy for heat distribution	28.7758	0.5190	14.9347	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			360.7466	(373)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space and water heating			360.7466 (376)
Space cooling	34.3403	0.5190	17.8226 (377)
Pumps and fans	235.5210	0.5190	122.2354 (378)
Energy for lighting	413.5033	0.5190	214.6082 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			559.7128 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1060.1626	1.2200	1293.3983	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	639.2909	1.2200	779.9349	(363)
less credit emissions for electricity	-223.7518	3.0700	-686.9180	(364)
Water heating from Combined Heat and Power	2761.4904	1.2200	3369.0183	(365)
less credit emissions for electricity	-966.5216	3.0700	-2967.2214	(366)
Electrical energy for heat distribution	28.7758	3.0700	88.3418	(372)
Total CO2 associated with community systems			1876.5539	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1876.5539	(376)
Space cooling	34.3403	3.0700	105.4246	(377)
Pumps and fans	235.5210	3.0700	723.0495	(378)
Energy for lighting	413.5033	3.0700	1269.4551	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			3053.4830	(383)
Primary energy kWh/m2/year			29.3604	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 94

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£107	£107	£0
Community scheme	£205	£205	£0
Space heating	£148	£148	£0
Space cooling	£5	£5	£0
Water heating	£94	£94	£0
Lighting	£65	£65	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£265	£265	£0
Total cost of uses	£265	£265	£0
Delivered energy	34 kWh/m²	34 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	29 kWh/m²	29 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversha ding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	555.98 (P1)
Transmission heat loss coefficient	44.77 (37)
Summer heat loss coefficient	600.76 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	12.0000	98.8453	0.6800	0.8000	0.9000	522.6622
South East	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						1227.9133

	Jun	Jul	Aug	
Solar gains	1307	1228	1077	(P3)
Internal gains	549	528	537	
Total summer gains	1856	1756	1615	(P5)
Summer gain/loss ratio	3.09	2.92	2.69	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.39	22.12	21.79	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007034	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0101
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	87 B	**DER**	7.34	**TER**	16.49
Environmental	95 A	**% DER<TER**	55.48		
CO_2 Emissions (t/year)	0.32	**DFEE**	29.50	**TFEE**	33.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.44		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South West
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               7.8, 52.9, 2.7
Living Area:                   30 m2, fraction: 56.7%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                10.06, 21.06, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South West, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.444
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.34 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)29.5 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing South West:		8.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1500	1.5090			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1044			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.4644	(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	12.7998	12.6496	12.4993	11.7481	11.5979	10.8467	10.8467	10.6964	11.1472	11.5979	11.8984	12.1988	(38)
Heat transfer coeff	36.2642	36.1140	35.9637	35.2125	35.0623	34.3111	34.3111	34.1609	34.6116	35.0623	35.3628	35.6633	(39)
Average = Sum(39)m / 12 =												35.1750	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6855	0.6827	0.6798	0.6656	0.6628	0.6486	0.6486	0.6458	0.6543	0.6628	0.6685	0.6742	(40)
HLP (average)												0.6649	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756 (42)
Average daily hot water use (litres/day)	76.3708 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6872	16.3439	16.8655	14.7037	14.1086	12.1746	11.2816	12.9458	13.1004	15.2673	16.6654	18.0976	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (64)
Total per year (kWh/year) = Sum(64)m = 1852.4502 (64)
Heat gains from water heating, kWh/month
85.6447 76.1710 81.6066 75.3882 75.4955 69.7821 69.2290 72.9179 71.8342 78.0639 79.7366 84.3377 (65)

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	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.8448	12.2968	10.0004	7.5710	5.6594	4.7779	5.1627	6.7107	9.0070	11.4365	13.3481	14.2296	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.7588	156.3647	152.3179	143.7026	132.8274	122.6062	115.7779	114.1719	118.2188	126.8340	137.7093	147.9304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	115.1139	113.3497	109.6863	104.7059	101.4724	96.9195	93.0497	98.0080	99.7697	104.9245	110.7453	113.3571	(72)
Total internal gains													
	333.3517	331.6455	321.6388	305.6137	289.5934	273.9378	263.6244	268.5248	276.6297	292.8293	311.4368	325.1513	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	457.0802	546.6396	627.0616	702.9183	751.8322	740.4105	710.2009	665.4991	613.6899	533.4792	460.4070	430.5377	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.5205	40.6891	40.8591	41.7307	41.9095	42.8271	42.8271	43.0154	42.4553	41.9095	41.5534	41.2033	
alpha	3.7014	3.7126	3.7239	3.7820	3.7940	3.8551	3.8551	3.8677	3.8304	3.7940	3.7702	3.7469	
util living area													
	0.8820	0.8114	0.7104	0.5666	0.4232	0.2947	0.2121	0.2354	0.3827	0.6226	0.8154	0.8970	(86)
MIT	20.1851	20.4443	20.6934	20.8872	20.9679	20.9942	20.9988	20.9982	20.9838	20.8680	20.5293	20.1387	(87)
Th 2	20.3536	20.3562	20.3587	20.3713	20.3738	20.3865	20.3865	20.3890	20.3814	20.3738	20.3688	20.3637	(88)
util rest of house													
	0.8708	0.7960	0.6901	0.5423	0.3966	0.2669	0.1827	0.2044	0.3499	0.5937	0.7978	0.8869	(89)
MIT 2	19.2681	19.6297	19.9705	20.2361	20.3386	20.3810	20.3855	20.3876	20.3655	20.2192	19.7637	19.2110	(90)
Living area fraction									fLA = Living area / (4) =			0.5671	(91)
MIT	19.7881	20.0917	20.3805	20.6053	20.6955	20.7287	20.7333	20.7338	20.7162	20.5872	20.1979	19.7371	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7881	20.0917	20.3805	20.6053	20.6955	20.7287	20.7333	20.7338	20.7162	20.5872	20.1979	19.7371	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8600	0.7892	0.6908	0.5514	0.4103	0.2824	0.1994	0.2219	0.3677	0.6037	0.7927	0.8759	(94)
Useful gains	393.0950	431.4266	433.1711	387.6195	308.5125	209.1053	141.5902	147.7035	225.6782	322.0798	364.9788	377.1054	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	561.6643	548.6324	499.1936	412.1737	315.4015	210.2835	141.8182	148.0477	228.9961	350.1728	463.1775	554.1053	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	125.4155	78.7623	49.1208	17.6790	5.1254	0.0000	0.0000	0.0000	0.0000	20.9012	70.7031	131.6879	(98)
Space heating												499.3952	(98)
Space heating per m2											(98) / (4) =	9.4404	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	322.5244	253.9022	259.6226	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9885	0.9942	0.9924	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	318.8195	252.4213	257.6412	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	920.0280	883.6732	832.1280	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	432.8701	469.6514	427.4182	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1329.9397	(104)
Cooled fraction										fC = cooled area / (4) =		1.1342	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	122.7420	133.1715	121.1961	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												377.1096	(107)
Space cooling per m2												7.1287	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	499.3952	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	183.5277	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	340.8372	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1852.4502	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	680.7755	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1264.2973	(310b)
Electricity used for heat distribution	24.6944	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	87.2939	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.7987	(330a)
Total electricity for the above, kWh/year	119.7987	(331)
Electricity for lighting (calculated in Appendix L)	244.5032	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2921.0334	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	909.7929	0.2160	196.5153	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	619.7041	0.2160	133.8561	(363)
less credit emissions for electricity	-216.8964	0.5190	-112.5692	(364)
Water heating from Combined Heat and Power	2298.7223	0.2160	496.5240	(365)
less credit emissions for electricity	-804.5528	0.5190	-417.5629	(366)
Electrical energy for heat distribution	24.6944	0.5190	12.8164	(372)
Total CO2 associated with community systems			309.5796	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			309.5796	(376)
Space cooling	87.2939	0.5190	45.3055	(377)
Pumps and fans	119.7987	0.5190	62.1755	(378)
Energy for lighting	244.5032	0.5190	126.8971	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			388.2578	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.3400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.3400	ZC1
Total Floor Area	TFA	52.9000	
Assumed number of occupants	N	1.7756	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3359	ZC2
CO2 emissions from cooking, equation (L16)		3.0551	ZC3
Total CO2 emissions		27.7310	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7310	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1400	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3900	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3315	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4227	0.4144	0.4061	0.3647	0.3564	0.3149	0.3149	0.3067	0.3315	0.3564	0.3730	0.3895	(22b)
Effective ac	0.5893	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1800	1.8108			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3941			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	21.7941	(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	27.7776	27.6141	27.4538	26.7011	26.5602	25.9046	25.9046	25.7832	26.1571	26.5602	26.8451	27.1430	(38)
Heat transfer coeff	49.5717	49.4082	49.2480	48.4952	48.3544	47.6987	47.6987	47.5773	47.9513	48.3544	48.6393	48.9371	(39)
Average = Sum(39)m / 12 =												48.4945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9371	0.9340	0.9310	0.9167	0.9141	0.9017	0.9017	0.8994	0.9065	0.9141	0.9195	0.9251	(40)
HLP (average)												0.9167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756 (42)
Average daily hot water use (litres/day)	76.3708 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6872	16.3439	16.8655	14.7037	14.1086	12.1746	11.2816	12.9458	13.1004	15.2673	16.6654	18.0976	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	171.1762	151.0453	159.0315	143.1167	140.6521	126.2561	121.8055	132.9002	132.4279	148.3766	156.1945	167.2452	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.1762	151.0453	159.0315	143.1167	140.6521	126.2561	121.8055	132.9002	132.4279	148.3766	156.1945	167.2452	(64)
								Total per year (kWh/year) = Sum(64)m =				1750.2279	(64)
Heat gains from water heating, kWh/month													
	78.6992	69.8976	74.6611	68.6668	68.5500	63.0606	62.2834	65.9724	65.1127	71.1183	73.0151	77.3922	(65)

---

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	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.8448	12.2968	10.0004	7.5710	5.6594	4.7779	5.1627	6.7107	9.0070	11.4365	13.3481	14.2296	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.7588	156.3647	152.3179	143.7026	132.8274	122.6062	115.7779	114.1719	118.2188	126.8340	137.7093	147.9304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	105.7785	104.0143	100.3509	95.3705	92.1370	87.5841	83.7143	88.6726	90.4343	95.5892	101.4099	104.0217	(72)
Total internal gains													
	327.0163	325.3101	315.3034	299.2783	283.2580	267.6025	257.2891	262.1894	270.2943	286.4939	305.1014	318.8159	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	427.3183	499.5976	562.8980	621.3580	657.9774	645.7540	619.3115	584.0013	543.5361	481.5796	425.8659	404.2487	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1070	74.3522	74.5942	75.7521	75.9727	77.0170	77.0170	77.2135	76.6114	75.9727	75.5277	75.0679	
alpha	5.9405	5.9568	5.9729	6.0501	6.0648	6.1345	6.1345	6.1476	6.1074	6.0648	6.0352	6.0045	
util living area													
	0.9904	0.9758	0.9369	0.8325	0.6604	0.4702	0.3386	0.3742	0.5969	0.8763	0.9763	0.9928	(86)
MIT	20.2526	20.4308	20.6547	20.8711	20.9718	20.9970	20.9997	20.9994	20.9880	20.8500	20.5176	20.2210	(87)
Th 2	20.1361	20.1387	20.1413	20.1533	20.1556	20.1661	20.1661	20.1680	20.1620	20.1556	20.1510	20.1462	(88)
util rest of house													
	0.9875	0.9690	0.9205	0.7970	0.6078	0.4101	0.2746	0.3068	0.5293	0.8401	0.9685	0.9906	(89)
MIT 2	19.1540	19.4111	19.7251	20.0161	20.1312	20.1642	20.1660	20.1678	20.1539	19.9994	19.5475	19.1162	(90)
Living area fraction									fLA = Living area / (4) =			0.5671	(91)
MIT	19.7771	19.9894	20.2523	20.5010	20.6079	20.6365	20.6388	20.6394	20.6269	20.4818	20.0977	19.7427	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7771	19.9894	20.2523	20.5010	20.6079	20.6365	20.6388	20.6394	20.6269	20.4818	20.0977	19.7427	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9861	0.9676	0.9228	0.8122	0.6364	0.4441	0.3109	0.3450	0.5673	0.8551	0.9679	0.9893	(94)
Useful gains	421.3639	483.4144	519.4446	504.6743	418.7455	286.8044	192.5407	201.5073	308.3227	411.7862	412.2106	399.9409	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	767.2247	745.5398	677.2710	562.5906	430.7378	287.9327	192.6435	201.6990	312.9751	477.8266	632.1977	760.6170	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	257.3204	176.1483	117.4228	41.6997	8.9223	0.0000	0.0000	0.0000	0.0000	49.1341	158.3907	268.3430	(98)
Space heating												1077.3813	(98)
Space heating per m2											(98) / (4) =	20.3664	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1152.2794	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	257.3204	176.1483	117.4228	41.6997	8.9223	0.0000	0.0000	0.0000	0.0000	49.1341	158.3907	268.3430	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	275.2090	188.3939	125.5859	44.5986	9.5425	0.0000	0.0000	0.0000	0.0000	52.5498	169.4018	286.9979	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.1762	151.0453	159.0315	143.1167	140.6521	126.2561	121.8055	132.9002	132.4279	148.3766	156.1945	167.2452	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8989	85.2247	84.0193	81.9871	80.3668	79.8000	79.8000	79.8000	79.8000	82.2182	84.8511	86.0690	(217)
Fuel for water heating, kWh/month	199.2764	177.2319	189.2796	174.5600	175.0127	158.2156	152.6385	166.5416	165.9497	180.4668	184.0808	194.3154	(219)
Water heating fuel used												2117.5691	(219)
Annual totals kWh/year													
Space heating fuel - main system												1152.2794	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												244.5032	(232)
Total delivered energy for all uses												3589.3517	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1152.2794	0.2160	248.8924	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2117.5691	0.2160	457.3949	(264)
Space and water heating			706.2873	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	244.5032	0.5190	126.8971	(268)
Total CO2, kg/m2/year			872.1094	(272)
Emissions per m2 for space and water heating			13.3514	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3988	(272b)
Emissions per m2 for pumps and fans			0.7358	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3514 * 1.00) + 2.3988 + 0.7358, rounded to 2 d.p.			16.4900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1400	(8)
Pressure test			Yes	
Measured/design q50			3.0000	
Infiltration rate			0.2900	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2465	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3143	0.3082	0.3020	0.2712	0.2650	0.2342	0.2342	0.2280	0.2465	0.2650	0.2773	0.2897	(22b)
Effective ac	0.5494	0.5475	0.5456	0.5368	0.5351	0.5274	0.5274	0.5260	0.5304	0.5351	0.5385	0.5420	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1500	1.5090			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1044			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.4644	(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	25.8952	25.8048	25.7162	25.3000	25.2221	24.8595	24.8595	24.7924	24.9992	25.2221	25.3796	25.5443	(38)
Heat transfer coeff	49.3597	49.2693	49.1806	48.7644	48.6865	48.3240	48.3240	48.2568	48.4636	48.6865	48.8441	49.0088	(39)
Average = Sum(39)m / 12 =												48.7640	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9331	0.9314	0.9297	0.9218	0.9203	0.9135	0.9135	0.9122	0.9161	0.9203	0.9233	0.9264	(40)
HLP (average)												0.9218	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756	(42)
Average daily hot water use (litres/day)	76.3708	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.4735	23.1539	23.8928	20.8303	19.9872	17.2474	15.9823	18.3399	18.5589	21.6286	23.6093	25.6382 (65)

---

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	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	(66)

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

	13.8448	12.2968	10.0004	7.5710	5.6594	4.7779	5.1627	6.7107	9.0070	11.4365	13.3481	14.2296	(67)

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

	154.7588	156.3647	152.3179	143.7026	132.8274	122.6062	115.7779	114.1719	118.2188	126.8340	137.7093	147.9304	(68)

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

	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)

Water heating gains (Table 5)

	35.5827	34.4552	32.1139	28.9310	26.8645	23.9547	21.4815	24.6504	25.7763	29.0707	32.7907	34.4599	(72)

Total internal gains

	253.8205	252.7510	244.0664	229.8388	214.9855	200.9731	192.0563	195.1672	202.6363	216.9755	233.4823	246.2541	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	377.5491	467.7451	549.4893	627.1434	677.2243	667.4457	638.6327	592.1415	539.6965	457.6254	382.4525	351.6406	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.7701	29.8248	29.8785	30.1336	30.1818	30.4082	30.4082	30.4505	30.3206	30.1818	30.0844	29.9833	
alpha	2.9847	2.9883	2.9919	3.0089	3.0121	3.0272	3.0272	3.0300	3.0214	3.0121	3.0056	2.9989	
util living area	0.9448	0.9036	0.8373	0.7272	0.5863	0.4380	0.3249	0.3627	0.5546	0.7873	0.9135	0.9538	(86)
MIT	19.2925	19.6459	20.0749	20.5087	20.7956	20.9377	20.9811	20.9734	20.8711	20.4642	19.7921	19.2137	(87)
Th 2	20.1395	20.1409	20.1423	20.1490	20.1502	20.1560	20.1560	20.1571	20.1538	20.1502	20.1477	20.1451	(88)
util rest of house	0.9377	0.8920	0.8187	0.6983	0.5460	0.3866	0.2654	0.3003	0.5006	0.7567	0.9010	0.9477	(89)
MIT 2	18.5772	18.9216	19.3340	19.7433	19.9975	20.1176	20.1473	20.1442	20.0684	19.7148	19.0749	18.5043	(90)
Living area fraction										fLA = Living area / (4) =		0.5671	(91)
MIT	18.9829	19.3324	19.7542	20.1774	20.4501	20.5827	20.6202	20.6144	20.5236	20.1398	19.4817	18.9066	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9829	19.3324	19.7542	20.1774	20.4501	20.5827	20.6202	20.6144	20.5236	20.1398	19.4817	18.9066	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9261	0.8794	0.8095	0.6993	0.5606	0.4130	0.2984	0.3345	0.5248	0.7563	0.8897	0.9369	(94)
Useful gains	349.6467	411.3525	444.7900	438.5686	379.6820	275.6241	190.5552	198.0641	283.2538	346.0975	340.2559	329.4530	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	724.7417	711.0724	651.8493	549.9343	426.0128	289.1066	194.2697	203.3745	311.3128	464.4578	604.7703	720.7516	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	279.0707	201.4118	154.0521	80.1833	34.4701	0.0000	0.0000	0.0000	0.0000	88.0600	190.4504	291.1261	(98)
Space heating												1318.8245	(98)
Space heating per m2											(98) / (4) =	24.9305	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	454.2453	357.5974	366.7519	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9235	0.9515	0.9397	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	419.4793	340.2496	344.6359	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	847.0632	812.1050	758.7704	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	307.8604	351.0604	308.1161	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												967.0369	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    76.9651    87.7651    77.0290     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          241.7592 (107)
Space cooling per m2                                                                                                                     4.5701 (108)
Energy for space heating                                                                                                                24.9305 (99)
Energy for space cooling                                                                                                                 4.5701 (108)
Total                                                                                                                                   29.5006 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   29.5 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1400	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3900	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3315	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4227	0.4144	0.4061	0.3647	0.3564	0.3149	0.3149	0.3067	0.3315	0.3564	0.3730	0.3895	(22b)
Effective ac	0.5893	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1800	1.8108			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3941			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		21.7941	(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	27.7776	27.6141	27.4538	26.7011	26.5602	25.9046	25.9046	25.7832	26.1571	26.5602	26.8451	27.1430	(38)
Heat transfer coeff	49.5717	49.4082	49.2480	48.4952	48.3544	47.6987	47.6987	47.5773	47.9513	48.3544	48.6393	48.9371	(39)
Average = Sum(39)m / 12 =												48.4945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9371	0.9340	0.9310	0.9167	0.9141	0.9017	0.9017	0.8994	0.9065	0.9141	0.9195	0.9251	(40)
HLP (average)												0.9167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756	(42)
Average daily hot water use (litres/day)	76.3708	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	26.4735	23.1539	23.8928	20.8303	19.9872	17.2474	15.9823	18.3399	18.5589	21.6286	23.6093	25.6382	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	88.7807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.8448	12.2968	10.0004	7.5710	5.6594	4.7779	5.1627	6.7107	9.0070	11.4365	13.3481	14.2296	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.7588	156.3647	152.3179	143.7026	132.8274	122.6062	115.7779	114.1719	118.2188	126.8340	137.7093	147.9304	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	31.8781	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	35.5827	34.4552	32.1139	28.9310	26.8645	23.9547	21.4815	24.6504	25.7763	29.0707	32.7907	34.4599	(72)
Total internal gains													
	253.8205	252.7510	244.0664	229.8388	214.9855	200.9731	192.0563	195.1672	202.6363	216.9755	233.4823	246.2541	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	354.1225	427.0385	491.6611	551.9184	589.7048	579.1246	554.0787	516.9791	475.8781	412.0611	354.2467	331.6869	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.1070	74.3522	74.5942	75.7521	75.9727	77.0170	77.0170	77.2135	76.6114	75.9727	75.5277	75.0679	
alpha	5.9405	5.9568	5.9729	6.0501	6.0648	6.1345	6.1345	6.1476	6.1074	6.0648	6.0352	6.0045	
util living area													
	0.9963	0.9885	0.9638	0.8830	0.7215	0.5222	0.3782	0.4221	0.6704	0.9285	0.9903	0.9974	(86)
MIT	20.1226	20.3100	20.5558	20.8157	20.9551	20.9947	20.9994	20.9988	20.9780	20.7769	20.3972	20.0905	(87)
Th 2	20.1361	20.1387	20.1413	20.1533	20.1556	20.1661	20.1661	20.1680	20.1620	20.1556	20.1510	20.1462	(88)
util rest of house													
	0.9951	0.9849	0.9531	0.8533	0.6684	0.4564	0.3068	0.3464	0.5988	0.9026	0.9867	0.9966	(89)
MIT 2	19.3370	19.5246	19.7655	20.0146	20.1283	20.1638	20.1659	20.1677	20.1513	19.9884	19.6224	19.3136	(90)
Living area fraction										fLA = Living area / (4) =		0.5671	(91)
MIT	19.7826	19.9700	20.2137	20.4689	20.5972	20.6350	20.6386	20.6390	20.6201	20.4355	20.0618	19.7542	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7826	19.9700	20.2137	20.4689	20.5972	20.6350	20.6386	20.6390	20.6201	20.4355	20.0618	19.7542	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9841	0.9542	0.8651	0.6969	0.4936	0.3473	0.3894	0.6387	0.9121	0.9863	0.9961	(94)
Useful gains	352.1865	420.2576	469.1192	477.4599	410.9537	285.8605	192.4423	201.3037	303.9667	375.8384	349.3760	330.4066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	767.4971	744.5820	675.3716	561.0361	430.2175	287.8618	192.6349	201.6815	312.6490	475.5916	630.4514	761.1767	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	308.9911	217.9460	153.4518	60.1749	14.3323	0.0000	0.0000	0.0000	0.0000	74.2164	202.3743	320.4930	(98)
Space heating												1351.9797	(98)
Space heating per m2											(98) / (4) =	25.5573	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	448.3680	352.9705	361.5875	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9817	0.9932	0.9896	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	440.1652	350.5726	357.8128	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	743.8307	713.2757	670.9182	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	218.6391	269.8511	232.9504	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												721.4407	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	54.6598	67.4628	58.2376	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	180.3602 (107)
Space cooling per m2	3.4095 (108)
Energy for space heating	25.5573 (99)
Energy for space cooling	3.4095 (108)
Total	28.9667 (109)
Target Fabric Energy Efficiency (TFEE)	33.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1500	1.5090			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1044			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.4644	(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	10.9969	10.8467	10.6964	10.3960	10.3960	9.7950	10.0955	9.7950	9.6448	9.9453	9.9453	10.5462	(38)
Heat transfer coeff	34.4613	34.3111	34.1609	33.8604	33.8604	33.2594	33.5599	33.2594	33.1092	33.4097	33.4097	34.0106	(39)
Average = Sum(39)m / 12 =												33.7227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6514	0.6486	0.6458	0.6401	0.6401	0.6287	0.6344	0.6287	0.6259	0.6316	0.6316	0.6429	(40)
HLP (average)												0.6375	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756 (42)
Average daily hot water use (litres/day)	76.3708 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6872	16.3439	16.8655	14.7037	14.1086	12.1746	11.2816	12.9458	13.1004	15.2673	16.6654	18.0976	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (64)
Total per year (kWh/year) = Sum(64)m = 1852.4502 (64)
RHI water heating demand 1852 (64)
Heat gains from water heating, kWh/month
85.6447 76.1710 81.6066 75.3882 75.4955 69.7821 69.2290 72.9179 71.8342 78.0639 79.7366 84.3377 (65)

---

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	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.6120	30.7420	25.0011	18.9274	14.1485	11.9447	12.9067	16.7766	22.5176	28.5912	33.3702	35.5739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	230.9833	233.3802	227.3401	214.4815	198.2498	182.9944	172.8028	170.4059	176.4460	189.3045	205.5362	220.7917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	115.1139	113.3497	109.6863	104.7059	101.4724	96.9195	93.0497	98.0080	99.7697	104.9245	110.7453	113.3571	(72)
Total internal gains													
	463.6507	460.4135	444.9690	421.0564	396.8123	374.8002	361.7007	368.1321	381.6748	405.7619	432.5932	452.6643	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	131.8135	202.0460	294.5937	397.9076	452.6293	488.5552	466.1742	425.9578	357.7418	251.9288	163.9249	115.0032	(83)
Total gains	595.4642	662.4595	739.5628	818.9639	849.4416	863.3554	827.8749	794.0899	739.4166	657.6907	596.5182	567.6675	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6404	42.8271	43.0154	43.3971	43.3971	44.1813	43.7857	44.1813	44.3818	43.9826	43.9826	43.2054	
alpha	3.8427	3.8551	3.8677	3.8931	3.8931	3.9454	3.9190	3.9454	3.9588	3.9322	3.9322	3.8804	
util living area													
	0.7427	0.6780	0.5569	0.4169	0.2854	0.1617	0.0932	0.1005	0.2279	0.4272	0.6300	0.7592	(86)
MIT	20.6530	20.7602	20.8961	20.9699	20.9945	20.9996	21.0000	21.0000	20.9984	20.9739	20.8554	20.6337	(87)
Th 2	20.3839	20.3865	20.3890	20.3941	20.3941	20.4042	20.3991	20.4042	20.4068	20.4017	20.4017	20.3915	(88)
util rest of house													
	0.7246	0.6582	0.5346	0.3939	0.2618	0.1388	0.0689	0.0756	0.2015	0.3994	0.6064	0.7416	(89)
MIT 2	19.9380	20.0829	20.2631	20.3600	20.3886	20.4040	20.3991	20.4042	20.4055	20.3736	20.2255	19.9192	(90)
Living area fraction									fLA = Living area / (4) =			0.5671	(91)
MIT	20.3435	20.4670	20.6221	20.7059	20.7322	20.7418	20.7399	20.7421	20.7418	20.7140	20.5827	20.3244	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3435	20.4670	20.6221	20.7059	20.7322	20.7418	20.7399	20.7421	20.7418	20.7140	20.5827	20.3244	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7233	0.6609	0.5432	0.4058	0.2750	0.1518	0.0827	0.0897	0.2164	0.4140	0.6137	0.7395	(94)
Useful gains	430.7215	437.8046	401.7366	332.3243	233.5882	131.0356	68.4543	71.2391	160.0111	272.2782	366.0672	419.8163	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	504.6340	489.5163	424.3494	338.8045	234.7267	131.1011	68.4579	71.2439	160.3067	277.7689	396.9986	497.3842	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	54.9908	34.7503	16.8239	4.6658	0.8470	0.0000	0.0000	0.0000	0.0000	4.0851	22.2706	57.7105	(98)
Space heating												196.1440	(98)
RHI space heating demand												196	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1500	1.5090			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1044			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.4644	(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	12.7998	12.6496	12.4993	11.7481	11.5979	10.8467	10.8467	10.6964	11.1472	11.5979	11.8984	12.1988	(38)
Heat transfer coeff	36.2642	36.1140	35.9637	35.2125	35.0623	34.3111	34.3111	34.1609	34.6116	35.0623	35.3628	35.6633	(39)
Average = Sum(39)m / 12 =												35.1750	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6855	0.6827	0.6798	0.6656	0.6628	0.6486	0.6486	0.6458	0.6543	0.6628	0.6685	0.6742	(40)
HLP (average)												0.6649	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756 (42)
Average daily hot water use (litres/day)	76.3708 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6872	16.3439	16.8655	14.7037	14.1086	12.1746	11.2816	12.9458	13.1004	15.2673	16.6654	18.0976	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (64)
Total per year (kWh/year) = Sum(64)m = 1852.4502 (64)
Heat gains from water heating, kWh/month
85.6447 76.1710 81.6066 75.3882 75.4955 69.7821 69.2290 72.9179 71.8342 78.0639 79.7366 84.3377 (65)

---

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	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.6120	30.7420	25.0011	18.9274	14.1485	11.9447	12.9067	16.7766	22.5176	28.5912	33.3702	35.5739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	230.9833	233.3802	227.3401	214.4815	198.2498	182.9944	172.8028	170.4059	176.4460	189.3045	205.5362	220.7917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	115.1139	113.3497	109.6863	104.7059	101.4724	96.9195	93.0497	98.0080	99.7697	104.9245	110.7453	113.3571	(72)
Total internal gains													
	463.6507	460.4135	444.9690	421.0564	396.8123	374.8002	361.7007	368.1321	381.6748	405.7619	432.5932	452.6643	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	587.3793	675.4076	750.3919	818.3610	859.0511	841.2729	808.2772	765.1064	718.7350	646.4118	581.5634	558.0507	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.5205	40.6891	40.8591	41.7307	41.9095	42.8271	42.8271	43.0154	42.4553	41.9095	41.5534	41.2033	
alpha	3.7014	3.7126	3.7239	3.7820	3.7940	3.8551	3.8551	3.8677	3.8304	3.7940	3.7702	3.7469	
util living area													
	0.7992	0.7252	0.6283	0.4985	0.3736	0.2599	0.1865	0.2050	0.3290	0.5342	0.7194	0.8164	(86)
MIT	20.4518	20.6309	20.7984	20.9265	20.9790	20.9963	20.9992	20.9989	20.9904	20.9214	20.7034	20.4195	(87)
Th 2	20.3536	20.3562	20.3587	20.3713	20.3738	20.3865	20.3865	20.3890	20.3814	20.3738	20.3688	20.3637	(88)
util rest of house													
	0.7838	0.7072	0.6074	0.4757	0.3495	0.2353	0.1606	0.1779	0.3003	0.5066	0.6985	0.8019	(89)
MIT 2	19.6356	19.8808	20.1067	20.2841	20.3509	20.3830	20.3859	20.3881	20.3721	20.2832	19.9949	19.6001	(90)
Living area fraction										fLA = Living area / (4) =		0.5671	(91)
MIT	20.0985	20.3062	20.4989	20.6484	20.7071	20.7308	20.7337	20.7345	20.7227	20.6451	20.3967	20.0648	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0985	20.3062	20.4989	20.6484	20.7071	20.7308	20.7337	20.7345	20.7227	20.6451	20.3967	20.0648	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7774	0.7058	0.6120	0.4858	0.3624	0.2491	0.1753	0.1933	0.3162	0.5187	0.6995	0.7947	(94)
Useful gains	456.6143	476.6718	459.2682	397.5752	311.2888	209.5989	141.6896	147.8619	227.2546	335.2724	406.8050	443.5037	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	572.9190	556.3788	503.4545	413.6927	315.8090	210.3536	141.8323	148.0701	229.2232	352.2048	470.2091	565.7905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	86.5308	53.5631	32.8746	11.6046	3.3630	0.0000	0.0000	0.0000	0.0000	12.5977	45.6509	90.9814	(98)
Space heating												337.1662	(98)
Space heating per m2											(98) / (4) =	6.3737	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	322.5244	253.9022	259.6226	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9885	0.9942	0.9924	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	318.8195	252.4213	257.6412	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	920.0280	883.6732	832.1280	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	432.8701	469.6514	427.4182	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1329.9397	(104)
Cooled fraction										fC = cooled area / (4) =		1.1342	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	122.7420	133.1715	121.1961	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												377.1096	(107)
Space cooling per m2												7.1287	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	337.1662	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	123.9086	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	230.1159	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1852.4502	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	680.7755	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1264.2973	(310b)
Electricity used for heat distribution	22.9910	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	87.2939	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.7987	(330a)
Total electricity for the above, kWh/year	119.7987	(331)
Electricity for lighting (calculated in Appendix L)	244.5032	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2750.6929	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	123.9086	4.2400	5.2537	(340a)
Space heating from Combined Heat and Power	230.1159	2.9700	6.8344	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	680.7755	4.2400	28.8649	(342a)
Water heating from Combined Heat and Power	1264.2973	2.9700	37.5496	(342b)
Space cooling	87.2939	13.1900	11.5141	(348)
Mechanical ventilation fans	119.7987	13.1900	15.8014	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	244.5032	13.1900	32.2500	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			218.4981	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.9374	(357)
SAP value	86.9236	
SAP rating (Section 12)	87	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	847.0358	0.2160	182.9597 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	418.3926	0.2160	90.3728 (363)
less credit emissions for electricity	-146.4374	0.5190	-76.0010 (364)
Water heating from Combined Heat and Power	2298.7223	0.2160	496.5240 (365)
less credit emissions for electricity	-804.5528	0.5190	-417.5629 (366)
Electrical energy for heat distribution	22.9910	0.5190	11.9323 (372)
Total CO2 associated with community systems			288.2250 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			288.2250 (376)
Space cooling	87.2939	0.5190	45.3055 (377)
Pumps and fans	119.7987	0.5190	62.1755 (378)
Energy for lighting	244.5032	0.5190	126.8971 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			366.9031 (383)
CO2 emissions per m2			6.9400 (384)
EI value			94.9780 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.9000 (1b)	x	2.7000 (2b)	=	142.8300	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.8300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.0600	11.0000	10.0600	0.1500	1.5090			(29a)
Total net area of external elements Aum(A, m2)			21.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1044			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.4644	(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	10.9969	10.8467	10.6964	10.3960	10.3960	9.7950	10.0955	9.7950	9.6448	9.9453	9.9453	10.5462	(38)
Heat transfer coeff	34.4613	34.3111	34.1609	33.8604	33.8604	33.2594	33.5599	33.2594	33.1092	33.4097	33.4097	34.0106	(39)
Average = Sum(39)m / 12 =												33.7227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6514	0.6486	0.6458	0.6401	0.6401	0.6287	0.6344	0.6287	0.6259	0.6316	0.6316	0.6429	(40)
HLP (average)												0.6375	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7756 (42)
Average daily hot water use (litres/day)	76.3708 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.0079	80.9531	77.8982	74.8434	71.7886	68.7337	68.7337	71.7886	74.8434	77.8982	80.9531	84.0079	(44)
Energy conte	124.5813	108.9596	112.4365	98.0249	94.0572	81.1642	75.2106	86.3053	87.3360	101.7817	111.1027	120.6503	(45)
Energy content (annual)										Total = Sum(45)m =		1201.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6872	16.3439	16.8655	14.7037	14.1086	12.1746	11.2816	12.9458	13.1004	15.2673	16.6654	18.0976	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.8581 158.8870 167.7134 151.5186 149.3340 134.6579 130.4874 141.5821 140.8297 157.0585 164.5964 175.9271 (64)
Total per year (kWh/year) = Sum(64)m = 1852.4502 (64)
Heat gains from water heating, kWh/month
85.6447 76.1710 81.6066 75.3882 75.4955 69.7821 69.2290 72.9179 71.8342 78.0639 79.7366 84.3377 (65)

---

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	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	106.5368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.6120	30.7420	25.0011	18.9274	14.1485	11.9447	12.9067	16.7766	22.5176	28.5912	33.3702	35.5739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	230.9833	233.3802	227.3401	214.4815	198.2498	182.9944	172.8028	170.4059	176.4460	189.3045	205.5362	220.7917	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	47.4293	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	-71.0245	(71)
Water heating gains (Table 5)													
	115.1139	113.3497	109.6863	104.7059	101.4724	96.9195	93.0497	98.0080	99.7697	104.9245	110.7453	113.3571	(72)
Total internal gains													
	463.6507	460.4135	444.9690	421.0564	396.8123	374.8002	361.7007	368.1321	381.6748	405.7619	432.5932	452.6643	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	131.8135	202.0460	294.5937	397.9076	452.6293	488.5552	466.1742	425.9578	357.7418	251.9288	163.9249	115.0032	(83)
Total gains	595.4642	662.4595	739.5628	818.9639	849.4416	863.3554	827.8749	794.0899	739.4166	657.6907	596.5182	567.6675	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6404	42.8271	43.0154	43.3971	43.3971	44.1813	43.7857	44.1813	44.3818	43.9826	43.9826	43.2054	
alpha	3.8427	3.8551	3.8677	3.8931	3.8931	3.9454	3.9190	3.9454	3.9588	3.9322	3.9322	3.8804	
util living area													
	0.7427	0.6780	0.5569	0.4169	0.2854	0.1617	0.0932	0.1005	0.2279	0.4272	0.6300	0.7592	(86)
MIT	20.6530	20.7602	20.8961	20.9699	20.9945	20.9996	21.0000	21.0000	20.9984	20.9739	20.8554	20.6337	(87)
Th 2	20.3839	20.3865	20.3890	20.3941	20.3941	20.4042	20.3991	20.4042	20.4068	20.4017	20.4017	20.3915	(88)
util rest of house													
	0.7246	0.6582	0.5346	0.3939	0.2618	0.1388	0.0689	0.0756	0.2015	0.3994	0.6064	0.7416	(89)
MIT 2	19.9380	20.0829	20.2631	20.3600	20.3886	20.4040	20.3991	20.4042	20.4055	20.3736	20.2255	19.9192	(90)
Living area fraction									fLA = Living area / (4) =			0.5671	(91)
MIT	20.3435	20.4670	20.6221	20.7059	20.7322	20.7418	20.7399	20.7421	20.7418	20.7140	20.5827	20.3244	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3435	20.4670	20.6221	20.7059	20.7322	20.7418	20.7399	20.7421	20.7418	20.7140	20.5827	20.3244	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7233	0.6609	0.5432	0.4058	0.2750	0.1518	0.0827	0.0897	0.2164	0.4140	0.6137	0.7395	(94)
Useful gains	430.7215	437.8046	401.7366	332.3243	233.5882	131.0356	68.4543	71.2391	160.0111	272.2782	366.0672	419.8163	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	504.6340	489.5163	424.3494	338.8045	234.7267	131.1011	68.4579	71.2439	160.3067	277.7689	396.9986	497.3842	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	54.9908	34.7503	16.8239	4.6658	0.8470	0.0000	0.0000	0.0000	0.0000	4.0851	22.2706	57.7105	(98)
Space heating												196.1440	(98)
Space heating per m2											(98) / (4) =	3.7078	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	239.4679	177.8675	179.6009	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9967	0.9986	0.9984	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	238.6750	177.6258	179.3139	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	945.8388	906.5797	866.0048	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	509.1579	542.3417	510.8981	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1562.3977	(104)
Cooled fraction										fC = cooled area / (4) =		1.1342	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	144.3737	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												144.3737	(107)
Space cooling per m2												2.7292	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	196.1440	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	72.0829	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	133.8683	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1852.4502	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	680.7755	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1264.2973	(310b)
Electricity used for heat distribution	21.5102	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	33.4198	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.7987	(330a)
Total electricity for the above, kWh/year	119.7987	(331)
Electricity for lighting (calculated in Appendix L)	244.5032	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2548.7456	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	72.0829	5.0000	3.6041	(340a)
Space heating from Combined Heat and Power	133.8683	3.5000	4.6854	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	680.7755	5.0000	34.0388	(342a)
Water heating from Combined Heat and Power	1264.2973	3.5000	44.2504	(342b)
Space cooling	33.4198	15.7000	5.2469	(348)
Mechanical ventilation fans	119.7987	15.7000	18.8084	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	244.5032	15.7000	38.3870	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			190.9210	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	792.4825	0.2160	171.1762	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	243.3968	0.2160	52.5737	(363)
less credit emissions for electricity	-85.1889	0.5190	-44.2130	(364)
Water heating from Combined Heat and Power	2298.7223	0.2160	496.5240	(365)
less credit emissions for electricity	-804.5528	0.5190	-417.5629	(366)
Electrical energy for heat distribution	21.5102	0.5190	11.1638	(372)
Total CO2 associated with community systems			269.6618	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			269.6618	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	33.4198	0.5190	17.3449 (377)
Pumps and fans	119.7987	0.5190	62.1755 (378)
Energy for lighting	244.5032	0.5190	126.8971 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			320.3794 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	792.4825	1.2200	966.8286	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	243.3968	1.2200	296.9441	(363)
less credit emissions for electricity	-85.1889	3.0700	-261.5299	(364)
Water heating from Combined Heat and Power	2298.7223	1.2200	2804.4413	(365)
less credit emissions for electricity	-804.5528	3.0700	-2469.9772	(366)
Electrical energy for heat distribution	21.5102	3.0700	66.0364	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1402.7434	(373)
Space and water heating			1402.7434	(376)
Space cooling	33.4198	3.0700	102.5989	(377)
Pumps and fans	119.7987	3.0700	367.7819	(378)
Energy for lighting	244.5032	3.0700	750.6247	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			1702.7489	(383)
Primary energy kWh/m2/year			32.1881	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£62	£62	£0
Community scheme	£176	£176	£0
Space heating	£116	£116	£0
Space cooling	£5	£5	£0
Water heating	£78	£78	£0
Lighting	£38	£38	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£191	£191	£0
Total cost of uses	£190	£190	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	32 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	282.80 (P1)
Transmission heat loss coefficient	23.46 (37)
Summer heat loss coefficient	306.27 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South West	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	8.0000	119.9223	0.6800	0.8000	0.9000	422.7407
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						493.8808

	Jun	Jul	Aug	
Solar gains	521	494	453	(P3)
Internal gains	375	362	368	
Total summer gains	895	856	821	(P5)
Summer gain/loss ratio	2.92	2.79	2.68	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.22	21.99	21.78	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007035	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0102
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	87 B	**DER**	7.52	**TER**	17.00
Environmental	95 A	**% DER<TER**	55.76		
CO_2 Emissions (t/year)	0.31	**DFEE**	30.62	**TFEE**	34.59
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.47		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South West
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               8.4, 50.4, 2.7
Living Area:                   30 m2, fraction: 59.5%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                11.68, 22.68, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South West, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.413
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System  None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 50 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.52 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing South West:		8.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	12.1949	12.0518	11.9086	11.1929	11.0498	10.3341	10.3341	10.1909	10.6204	11.0498	11.3361	11.6223	(38)
Heat transfer coeff	35.9023	35.7592	35.6160	34.9003	34.7572	34.0415	34.0415	33.8984	34.3278	34.7572	35.0435	35.3298	(39)
Average = Sum(39)m / 12 =												34.8646	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7123	0.7095	0.7067	0.6925	0.6896	0.6754	0.6754	0.6726	0.6811	0.6896	0.6953	0.7010	(40)
HLP (average)												0.6918	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	323.8652	322.2012	312.5507	297.1092	281.7042	266.6207	256.6651	261.4500	269.2424	284.8543	302.7872	315.9741	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	447.5938	537.1954	617.9735	694.4139	743.9430	733.0934	703.2415	658.4243	606.3026	525.5042	451.7574	421.3605	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.9947	39.1508	39.3081	40.1142	40.2794	41.1263	41.1263	41.2999	40.7833	40.2794	39.9504	39.6267	
alpha	3.5996	3.6101	3.6205	3.6743	3.6853	3.7418	3.7418	3.7533	3.7189	3.6853	3.6634	3.6418	
util living area													
	0.8803	0.8093	0.7085	0.5657	0.4229	0.2950	0.2125	0.2360	0.3834	0.6225	0.8141	0.8954	(86)
MIT	20.1411	20.4104	20.6708	20.8757	20.9635	20.9930	20.9985	20.9977	20.9812	20.8550	20.4979	20.0921	(87)
Th 2	20.3299	20.3324	20.3349	20.3475	20.3500	20.3626	20.3626	20.3651	20.3576	20.3500	20.3450	20.3400	(88)
util rest of house													
	0.8688	0.7935	0.6877	0.5407	0.3955	0.2662	0.1819	0.2037	0.3494	0.5927	0.7961	0.8850	(89)
MIT 2	19.1877	19.5630	19.9191	20.1990	20.3102	20.3561	20.3615	20.3634	20.3393	20.1807	19.7008	19.1268	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.7552	20.0674	20.3666	20.6018	20.6991	20.7353	20.7406	20.7410	20.7214	20.5821	20.1753	19.7014	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7552	20.0674	20.3666	20.6018	20.6991	20.7353	20.7406	20.7410	20.7214	20.5821	20.1753	19.7014	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8579	0.7868	0.6887	0.5505	0.4103	0.2830	0.2000	0.2229	0.3687	0.6035	0.7911	0.8739	(94)
Useful gains	383.9852	422.6776	425.5833	382.2911	305.2124	207.4890	140.6779	146.7391	223.5637	317.1674	357.3817	368.2214	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	554.8772	542.3731	493.8717	408.3968	312.7831	208.8532	140.9535	147.1520	227.2981	346.9501	458.2037	547.6615	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	127.1437	80.4354	50.8065	18.7961	5.6326	0.0000	0.0000	0.0000	0.0000	22.1583	72.5919	133.5034	(98)
Space heating												511.0679	(98)
Space heating per m2											(98) / (4) =	10.1402	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	319.9901	251.9071	257.6276	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9869	0.9932	0.9911	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	315.7906	250.1903	255.3402	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	908.9754	873.0935	821.3624	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	427.0931	463.4400	421.1205	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1311.6535	(104)
Cooled fraction											fC = cooled area / (4) =	1.1905	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	127.1110	137.9286	125.3335	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												390.3731	(107)
Space cooling per m2												7.7455	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	511.0679	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	187.8175	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	348.8039	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1824.8985	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932	(310b)
Electricity used for heat distribution	24.5276	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	90.3641	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	114.1371	(330a)
Total electricity for the above, kWh/year	114.1371	(331)
Electricity for lighting (calculated in Appendix L)	233.5912	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2890.8572	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	903.6502	0.2160	195.1884	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	634.1889	0.2160	136.9848	(363)
less credit emissions for electricity	-221.9661	0.5190	-115.2004	(364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391	(365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524	(366)
Electrical energy for heat distribution	24.5276	0.5190	12.7298	(372)
Total CO2 associated with community systems			307.4894	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			307.4894	(376)
Space cooling	90.3641	0.5190	46.8990	(377)
Pumps and fans	114.1371	0.5190	59.2372	(378)
Energy for lighting	233.5912	0.5190	121.2339	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			379.1594	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5200	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5200	ZC1
Total Floor Area	TFA	50.4000	
Assumed number of occupants	N	1.7019	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4332	ZC2
CO2 emissions from cooking, equation (L16)		3.1715	ZC3
Total CO2 emissions		28.1247	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.1247	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3374	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4302	0.4218	0.4133	0.3712	0.3627	0.3206	0.3206	0.3121	0.3374	0.3627	0.3796	0.3965	(22b)
Effective ac	0.5925	0.5890	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1800	2.1024			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6857			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	22.0857	(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	26.6090	26.4476	26.2895	25.5465	25.4075	24.7604	24.7604	24.6406	25.0096	25.4075	25.6887	25.9827	(38)
Heat transfer coeff	48.6948	48.5334	48.3752	47.6322	47.4932	46.8461	46.8461	46.7263	47.0954	47.4932	47.7744	48.0684	(39)
Average = Sum(39)m / 12 =												47.6316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9662	0.9630	0.9598	0.9451	0.9423	0.9295	0.9295	0.9271	0.9344	0.9423	0.9479	0.9537	(40)
HLP (average)												0.9451	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(64)
								Total per year (kWh/year) = Sum(64)m =				1722.6761	(64)
Heat gains from water heating, kWh/month													
	77.7494	69.0669	73.8039	67.9194	67.8329	62.4418	61.7100	65.3144	64.4469	70.3424	72.1681	76.4723	(65)

---

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	104.5019	102.7782	99.1987	94.3325	91.1732	86.7247	82.9436	87.7882	89.5095	94.5462	100.2334	102.7854	(72)
Total internal gains													
	317.5298	315.8658	306.2153	290.7738	275.3688	260.2854	250.3297	255.1146	262.9070	278.5189	296.4519	309.6388	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	417.8319	490.1534	553.8099	612.8535	650.0882	638.4369	612.3521	576.9265	536.1488	473.6046	417.2163	395.0715	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.8763	72.1153	72.3511	73.4797	73.6947	74.7127	74.7127	74.9043	74.3173	73.6947	73.2609	72.8129	
alpha	5.7918	5.8077	5.8234	5.8986	5.9130	5.9808	5.9808	5.9936	5.9545	5.9130	5.8841	5.8542	
util living area													
	0.9896	0.9741	0.9336	0.8275	0.6556	0.4669	0.3363	0.3719	0.5936	0.8727	0.9748	0.9922	(86)
MIT	20.2294	20.4137	20.6441	20.8661	20.9700	20.9966	20.9996	20.9993	20.9870	20.8439	20.5021	20.1969	(87)
Th 2	20.1116	20.1143	20.1169	20.1293	20.1317	20.1425	20.1425	20.1445	20.1383	20.1317	20.1270	20.1221	(88)
util rest of house													
	0.9865	0.9668	0.9164	0.7910	0.6020	0.4056	0.2709	0.3031	0.5246	0.8353	0.9665	0.9898	(89)
MIT 2	19.1014	19.3670	19.6895	19.9874	20.1059	20.1405	20.1424	20.1442	20.1295	19.9698	19.5061	19.0626	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.7728	19.9900	20.2577	20.5104	20.6203	20.6501	20.6526	20.6532	20.6399	20.4901	20.0990	19.7378	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7728	19.9900	20.2577	20.5104	20.6203	20.6501	20.6526	20.6532	20.6399	20.4901	20.0990	19.7378	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9657	0.9194	0.8077	0.6327	0.4420	0.3098	0.3441	0.5653	0.8518	0.9662	0.9885	(94)
Useful gains	411.5973	473.3215	509.1921	495.0112	411.2788	282.1939	189.7310	198.5172	303.0652	403.4119	403.1210	390.5407	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.4453	732.3686	665.5306	553.0290	423.6524	283.4234	189.8500	198.7364	308.0007	469.7113	621.0195	746.8774	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	254.3349	174.0797	116.3158	41.7728	9.2059	0.0000	0.0000	0.0000	0.0000	49.3267	156.8869	265.1145	(98)
Space heating												1067.0373	(98)
Space heating per m2											(98) / (4) =	21.1714	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1141.2163	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	254.3349	174.0797	116.3158	41.7728	9.2059	0.0000	0.0000	0.0000	0.0000	49.3267	156.8869	265.1145	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	272.0159	186.1815	124.4020	44.6768	9.8459	0.0000	0.0000	0.0000	0.0000	52.7558	167.7934	283.5449	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9124	85.2377	84.0369	82.0179	80.3924	79.8000	79.8000	79.8000	79.8000	82.2554	84.8695	86.0808	(217)
Fuel for water heating, kWh/month													
	195.9201	174.2738	186.1722	171.7542	172.2743	155.8835	150.4774	164.0617	163.4403	177.5480	181.0392	191.0749	(219)
Water heating fuel used												2083.9197	(219)
Annual totals kWh/year													
Space heating fuel - main system												1141.2163	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.5912	(232)
Total delivered energy for all uses												3533.7273	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1141.2163	0.2160	246.5027	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2083.9197	0.2160	450.1267	(264)
Space and water heating			696.6294	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	233.5912	0.5190	121.2339	(268)
Total CO2, kg/m2/year			856.7882	(272)
Emissions per m2 for space and water heating			13.8220	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4054	(272b)
Emissions per m2 for pumps and fans			0.7723	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8220 * 1.00) + 2.4054 + 0.7723, rounded to 2 d.p.			17.0000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3218	0.3155	0.3092	0.2777	0.2714	0.2398	0.2398	0.2335	0.2524	0.2714	0.2840	0.2966	(22b)
Effective ac	0.5518	0.5498	0.5478	0.5386	0.5368	0.5288	0.5288	0.5273	0.5319	0.5368	0.5403	0.5440	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		23.7074	(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	24.7790	24.6887	24.6001	24.1843	24.1066	23.7444	23.7444	23.6773	23.8839	24.1066	24.2639	24.4285	(38)
Heat transfer coeff	48.4864	48.3961	48.3076	47.8918	47.8140	47.4518	47.4518	47.3848	47.5913	47.8140	47.9713	48.1359	(39)
Average = Sum(39)m / 12 =												47.8914	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9620	0.9602	0.9585	0.9502	0.9487	0.9415	0.9415	0.9402	0.9443	0.9487	0.9518	0.9551	(40)
HLP (average)												0.9502	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7019 (42)
Average daily hot water use (litres/day)		74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	25.8665	22.6230	23.3449	20.3527	19.5289	16.8519	15.6158	17.9194	18.1334	21.1327	23.0680	25.0503 (65)

---

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	34.7668	33.6652	31.3776	28.2676	26.2485	23.4055	20.9890	24.0852	25.1852	28.4042	32.0389	33.6698	(72)
Total internal gains													
	244.7948	243.7529	235.3941	221.7089	207.4441	193.9661	185.3750	188.4115	195.5827	209.3769	225.2573	237.5232	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	368.5233	458.7470	540.8170	619.0136	669.6829	660.4388	631.9515	585.3858	532.6429	450.0268	374.2275	342.9096	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.8741	28.9280	28.9810	29.2326	29.2801	29.5036	29.5036	29.5454	29.4171	29.2801	29.1841	29.0843	
alpha	2.9249	2.9285	2.9321	2.9488	2.9520	2.9669	2.9669	2.9697	2.9611	2.9520	2.9456	2.9390	
util living area													
	0.9429	0.9004	0.8328	0.7216	0.5809	0.4339	0.3220	0.3597	0.5503	0.7829	0.9108	0.9521	(86)
MIT	19.2473	19.6108	20.0505	20.4943	20.7880	20.9345	20.9798	20.9716	20.8654	20.4478	19.7594	19.1669	(87)
Th 2	20.1151	20.1166	20.1181	20.1250	20.1263	20.1324	20.1324	20.1335	20.1300	20.1263	20.1237	20.1209	(88)
util rest of house													
	0.9354	0.8883	0.8135	0.6920	0.5399	0.3816	0.2614	0.2961	0.4952	0.7515	0.8979	0.9457	(89)
MIT 2	18.5147	18.8686	19.2908	19.7089	19.9687	20.0922	20.1231	20.1199	20.0415	19.6793	19.0246	18.4404	(90)
Living area fraction										fLA = Living area / (4) =		0.5952	(91)
MIT	18.9508	19.3104	19.7430	20.1764	20.4564	20.5935	20.6330	20.6269	20.5319	20.1367	19.4620	18.8728	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9508	19.3104	19.7430	20.1764	20.4564	20.5935	20.6330	20.6269	20.5319	20.1367	19.4620	18.8728	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9236	0.8757	0.8045	0.6938	0.5558	0.4098	0.2967	0.3327	0.5213	0.7519	0.8865	0.9347	(94)
Useful gains	340.3703	401.7038	435.1044	429.4685	372.1929	270.6204	187.4862	194.7586	277.6888	338.3562	331.7419	320.5077	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	710.3627	697.4083	639.7360	540.0465	418.6764	284.4048	191.3750	200.2888	306.1031	455.9882	593.0216	706.2897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	275.2744	198.7134	152.2459	79.6162	34.5837	0.0000	0.0000	0.0000	0.0000	87.5182	188.1214	287.0218	(98)
Space heating												1303.0950	(98)
Space heating per m2											(98) / (4) =	25.8551	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	446.0472	351.1435	360.1242	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9212	0.9496	0.9375	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	410.9005	333.4376	337.6012	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	836.3207	801.8035	748.3240	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	306.3026	348.4642	305.5778	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												960.3446	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    76.5756    87.1161    76.3944     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          240.0861 (107)
Space cooling per m2                                                                                                                     4.7636 (108)
Energy for space heating                                                                                                                25.8551 (99)
Energy for space cooling                                                                                                                 4.7636 (108)
Total                                                                                                                                   30.6187 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   30.6 (109)


------------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3374	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4302	0.4218	0.4133	0.3712	0.3627	0.3206	0.3206	0.3121	0.3374	0.3627	0.3796	0.3965	(22b)
Effective ac	0.5925	0.5890	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1800	2.1024			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6857			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	22.0857	(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	26.6090	26.4476	26.2895	25.5465	25.4075	24.7604	24.7604	24.6406	25.0096	25.4075	25.6887	25.9827	(38)
Heat transfer coeff	48.6948	48.5334	48.3752	47.6322	47.4932	46.8461	46.8461	46.7263	47.0954	47.4932	47.7744	48.0684	(39)
Average = Sum(39)m / 12 =												47.6316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9662	0.9630	0.9598	0.9451	0.9423	0.9295	0.9295	0.9271	0.9344	0.9423	0.9479	0.9537	(40)
HLP (average)												0.9451	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	25.8665	22.6230	23.3449	20.3527	19.5289	16.8519	15.6158	17.9194	18.1334	21.1327	23.0680	25.0503	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	34.7668	33.6652	31.3776	28.2676	26.2485	23.4055	20.9890	24.0852	25.1852	28.4042	32.0389	33.6698	(72)
Total internal gains													
	244.7948	243.7529	235.3941	221.7089	207.4441	193.9661	185.3750	188.4115	195.5827	209.3769	225.2573	237.5232	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	345.0968	418.0404	482.9887	543.7886	582.1634	572.1177	547.3975	510.2234	468.8245	404.4625	346.0217	322.9559	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.8763	72.1153	72.3511	73.4797	73.6947	74.7127	74.7127	74.9043	74.3173	73.6947	73.2609	72.8129	
alpha	5.7918	5.8077	5.8234	5.8986	5.9130	5.9808	5.9808	5.9936	5.9545	5.9130	5.8841	5.8542	
util living area													
	0.9960	0.9875	0.9615	0.8787	0.7167	0.5188	0.3759	0.4199	0.6671	0.9258	0.9895	0.9972	(86)
MIT	20.0948	20.2890	20.5425	20.8093	20.9527	20.9941	20.9993	20.9986	20.9763	20.7686	20.3777	20.0618	(87)
Th 2	20.1116	20.1143	20.1169	20.1293	20.1317	20.1425	20.1425	20.1445	20.1383	20.1317	20.1270	20.1221	(88)
util rest of house													
	0.9947	0.9837	0.9502	0.8479	0.6625	0.4516	0.3030	0.3426	0.5940	0.8988	0.9857	0.9963	(89)
MIT 2	19.2890	19.4832	19.7313	19.9865	20.1030	20.1401	20.1423	20.1442	20.1269	19.9590	19.5828	19.2648	(90)
Living area fraction										fLA = Living area / (4) =		0.5952	(91)
MIT	19.7687	19.9628	20.2141	20.4762	20.6088	20.6484	20.6524	20.6528	20.6325	20.4409	20.0560	19.7392	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7687	19.9628	20.2141	20.4762	20.6088	20.6484	20.6524	20.6528	20.6325	20.4409	20.0560	19.7392	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9830	0.9516	0.8609	0.6930	0.4915	0.3464	0.3886	0.6368	0.9094	0.9853	0.9958	(94)
Useful gains	343.0521	410.9133	459.6236	468.1586	403.4216	281.1906	189.6197	198.2899	298.5569	367.8164	340.9469	321.5981	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	753.2425	731.0499	663.4245	551.4023	423.1057	283.3456	189.8400	198.7164	307.6519	467.3770	618.9636	746.9448	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	305.1817	215.1318	151.6279	59.9355	14.6449	0.0000	0.0000	0.0000	0.0000	74.0731	200.1720	316.4579	(98)
Space heating												1337.2247	(98)
Space heating per m2											(98) / (4) =	26.5322	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	440.3536	346.6613	355.1198	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9805	0.9926	0.9886	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	431.7677	344.0814	351.0846	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	733.0883	702.9742	660.4718	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	216.9508	267.0162	230.1840	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												714.1511	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	54.2377	66.7541	57.5460	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	178.5378 (107)
Space cooling per m2	3.5424 (108)
Energy for space heating	26.5322 (99)
Energy for space cooling	3.5424 (108)
Total	30.0747 (109)
Target Fabric Energy Efficiency (TFEE)	34.6 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	10.4772	10.3341	10.1909	9.9047	9.9047	9.3321	9.6184	9.3321	9.1890	9.4753	9.4753	10.0478	(38)
Heat transfer coeff	34.1846	34.0415	33.8984	33.6121	33.6121	33.0395	33.3258	33.0395	32.8964	33.1827	33.1827	33.7552	(39)
Average = Sum(39)m / 12 =												33.4809	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6783	0.6754	0.6726	0.6669	0.6669	0.6555	0.6612	0.6555	0.6527	0.6584	0.6584	0.6697	(40)
HLP (average)												0.6643	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
RHI water heating demand 1825 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

---

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	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.0673	29.3700	23.8853	18.0827	13.5171	11.4117	12.3307	16.0279	21.5126	27.3152	31.8809	33.9863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3027	223.5991	217.8122	205.4925	189.9411	175.3250	165.5605	163.2641	169.0510	181.3707	196.9221	211.5382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	449.1580	446.0335	431.1825	408.1940	384.9176	363.7476	351.1211	357.3665	370.3594	393.5183	419.3227	438.5961	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	131.8135	202.0460	294.5937	397.9076	452.6293	488.5552	466.1742	425.9578	357.7418	251.9288	163.9249	115.0032	(83)
Total gains	580.9715	648.0795	725.7762	806.1015	837.5468	852.3028	817.2952	783.3242	728.1012	645.4472	583.2476	553.5993	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.9541	41.1263	41.2999	41.6517	41.6517	42.3735	42.0095	42.3735	42.5579	42.1907	42.1907	41.4751	
alpha	3.7303	3.7418	3.7533	3.7768	3.7768	3.8249	3.8006	3.8249	3.8372	3.8127	3.8127	3.7650	
util living area													
	0.7453	0.6806	0.5597	0.4192	0.2871	0.1627	0.0938	0.1012	0.2298	0.4309	0.6341	0.7619	(86)
MIT	20.6186	20.7339	20.8823	20.9648	20.9932	20.9995	21.0000	21.0000	20.9980	20.9691	20.8364	20.5973	(87)
Th 2	20.3601	20.3626	20.3651	20.3702	20.3702	20.3803	20.3752	20.3803	20.3828	20.3777	20.3777	20.3676	(88)
util rest of house													
	0.7268	0.6604	0.5366	0.3953	0.2624	0.1387	0.0683	0.0751	0.2022	0.4019	0.6099	0.7439	(89)
MIT 2	19.8705	20.0263	20.2227	20.3305	20.3635	20.3799	20.3752	20.3802	20.3812	20.3446	20.1787	19.8490	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	20.3158	20.4475	20.6153	20.7081	20.7384	20.7487	20.7471	20.7491	20.7483	20.7163	20.5702	20.2945	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3158	20.4475	20.6153	20.7081	20.7384	20.7487	20.7471	20.7491	20.7483	20.7163	20.5702	20.2945	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7255	0.6632	0.5458	0.4082	0.2768	0.1530	0.0835	0.0906	0.2185	0.4178	0.6175	0.7418	(94)
Useful gains	421.5025	429.7782	396.1367	329.0543	231.8643	130.3800	68.2157	70.9993	159.1257	269.6637	360.1572	410.6505	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	499.6367	485.0064	420.8590	336.3921	233.2130	130.4643	68.2206	71.0059	159.4932	275.9582	393.8857	492.6394	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	58.1319	37.1134	18.3933	5.2832	1.0034	0.0000	0.0000	0.0000	0.0000	4.6831	24.2845	60.9997	(98)
Space heating												209.8924	(98)
RHI space heating demand												210	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	12.1949	12.0518	11.9086	11.1929	11.0498	10.3341	10.3341	10.1909	10.6204	11.0498	11.3361	11.6223	(38)
Heat transfer coeff	35.9023	35.7592	35.6160	34.9003	34.7572	34.0415	34.0415	33.8984	34.3278	34.7572	35.0435	35.3298	(39)
Average = Sum(39)m / 12 =												34.8646	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7123	0.7095	0.7067	0.6925	0.6896	0.6754	0.6754	0.6726	0.6811	0.6896	0.6953	0.7010	(40)
HLP (average)												0.6918	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

---

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	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.0673	29.3700	23.8853	18.0827	13.5171	11.4117	12.3307	16.0279	21.5126	27.3152	31.8809	33.9863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3027	223.5991	217.8122	205.4925	189.9411	175.3250	165.5605	163.2641	169.0510	181.3707	196.9221	211.5382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	449.1580	446.0335	431.1825	408.1940	384.9176	363.7476	351.1211	357.3665	370.3594	393.5183	419.3227	438.5961	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	572.8866	661.0277	736.6053	805.4986	847.1564	830.2202	797.6975	754.3408	707.4196	634.1683	568.2929	543.9825	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.9947	39.1508	39.3081	40.1142	40.2794	41.1263	41.1263	41.2999	40.7833	40.2794	39.9504	39.6267	
alpha	3.5996	3.6101	3.6205	3.6743	3.6853	3.7418	3.7418	3.7533	3.7189	3.6853	3.6634	3.6418	
util living area													
	0.8000	0.7261	0.6292	0.4998	0.3747	0.2611	0.1875	0.2063	0.3310	0.5367	0.7214	0.8174	(86)
MIT	20.4099	20.5994	20.7783	20.9170	20.9755	20.9954	20.9990	20.9986	20.9885	20.9110	20.6753	20.3749	(87)
Th 2	20.3299	20.3324	20.3349	20.3475	20.3500	20.3626	20.3626	20.3651	20.3576	20.3500	20.3450	20.3400	(88)
util rest of house													
	0.7844	0.7076	0.6077	0.4762	0.3498	0.2355	0.1604	0.1780	0.3011	0.5083	0.7000	0.8026	(89)
MIT 2	19.5579	19.8172	20.0584	20.2493	20.3235	20.3584	20.3619	20.3641	20.3465	20.2478	19.9362	19.5186	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	20.0650	20.2828	20.4869	20.6468	20.7116	20.7376	20.7411	20.7417	20.7287	20.6426	20.3762	20.0283	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0650	20.2828	20.4869	20.6468	20.7116	20.7376	20.7411	20.7417	20.7287	20.6426	20.3762	20.0283	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7778	0.7062	0.6127	0.4871	0.3637	0.2506	0.1765	0.1948	0.3184	0.5212	0.7011	0.7953	(94)
Useful gains	445.6117	466.8258	451.3461	392.3861	308.1245	208.0353	140.7929	146.9212	225.2635	330.5429	398.4232	432.6084	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	566.0007	550.0760	498.1584	409.9663	313.2180	208.9322	140.9701	147.1782	227.5472	349.0514	465.2433	559.2105	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	89.5695	55.9441	34.8284	12.6577	3.7896	0.0000	0.0000	0.0000	0.0000	13.7703	48.1104	94.1920	(98)
Space heating												352.8620	(98)
Space heating per m2											(98) / (4) =	7.0012	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	319.9901	251.9071	257.6276	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9869	0.9932	0.9911	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	315.7906	250.1903	255.3402	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	908.9754	873.0935	821.3624	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	427.0931	463.4400	421.1205	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling		1311.6535 (104)
Cooled fraction	fC = cooled area / (4) =	1.1905 (105)
Intermittency factor (Table 10b)		0.0000 (106)
Space cooling kWh		0.0000 (107)
Space cooling		390.3731 (107)
Space cooling per m2		7.7455 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.3500 (303a)
Fraction of heat from community Combined Heat and Power	0.6500 (303b)
Fraction of total space heat from community Boilers	0.3500 (304a)
Fraction of total space heat from community Combined Heat and Power	0.6500 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	352.8620 (98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	129.6768 (307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	240.8283 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	1824.8985 (64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502 (310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932 (310b)
Electricity used for heat distribution	22.8665 (313)
Cooling System Energy Efficiency Ratio	4.3200 (314)
Space cooling (if there is a fixed cooling system, if not enter 0)	90.3641 (315)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)	
mechanical ventilation fans (SFP = 0.6875)	114.1371 (330a)
Total electricity for the above, kWh/year	114.1371 (331)
Electricity for lighting (calculated in Appendix L)	233.5912 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
Total delivered energy for all uses	2724.7409 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	129.6768	4.2400	5.4983	(340a)
Space heating from Combined Heat and Power	240.8283	2.9700	7.1526	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	670.6502	4.2400	28.4356	(342a)
Water heating from Combined Heat and Power	1245.4932	2.9700	36.9911	(342b)
Space cooling	90.3641	13.1900	11.9190	(348)
Mechanical ventilation fans	114.1371	13.1900	15.0547	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	233.5912	13.1900	30.8107	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			216.2920	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9522 (357)
SAP value		86.7164
SAP rating (Section 12)		87 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	842.4494	0.2160	181.9691 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	437.8696	0.2160	94.5798 (363)
less credit emissions for electricity	-153.2544	0.5190	-79.5390 (364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391 (365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524 (366)
Electrical energy for heat distribution	22.8665	0.5190	11.8677 (372)
Total CO2 associated with community systems			286.6643 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			286.6643 (376)
Space cooling	90.3641	0.5190	46.8990 (377)
Pumps and fans	114.1371	0.5190	59.2372 (378)
Energy for lighting	233.5912	0.5190	121.2339 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			358.3343 (383)
CO2 emissions per m2			7.1100 (384)
EI value			94.9668 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	10.4772	10.3341	10.1909	9.9047	9.9047	9.3321	9.6184	9.3321	9.1890	9.4753	9.4753	10.0478	(38)
Heat transfer coeff	34.1846	34.0415	33.8984	33.6121	33.6121	33.0395	33.3258	33.0395	32.8964	33.1827	33.1827	33.7552	(39)
Average = Sum(39)m / 12 =												33.4809	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6783	0.6754	0.6726	0.6669	0.6669	0.6555	0.6612	0.6555	0.6527	0.6584	0.6584	0.6697	(40)
HLP (average)												0.6643	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

---

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	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.0673	29.3700	23.8853	18.0827	13.5171	11.4117	12.3307	16.0279	21.5126	27.3152	31.8809	33.9863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3027	223.5991	217.8122	205.4925	189.9411	175.3250	165.5605	163.2641	169.0510	181.3707	196.9221	211.5382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	449.1580	446.0335	431.1825	408.1940	384.9176	363.7476	351.1211	357.3665	370.3594	393.5183	419.3227	438.5961	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	131.8135	202.0460	294.5937	397.9076	452.6293	488.5552	466.1742	425.9578	357.7418	251.9288	163.9249	115.0032	(83)
Total gains	580.9715	648.0795	725.7762	806.1015	837.5468	852.3028	817.2952	783.3242	728.1012	645.4472	583.2476	553.5993	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.9541	41.1263	41.2999	41.6517	41.6517	42.3735	42.0095	42.3735	42.5579	42.1907	42.1907	41.4751	
alpha	3.7303	3.7418	3.7533	3.7768	3.7768	3.8249	3.8006	3.8249	3.8372	3.8127	3.8127	3.7650	
util living area													
	0.7453	0.6806	0.5597	0.4192	0.2871	0.1627	0.0938	0.1012	0.2298	0.4309	0.6341	0.7619	(86)
MIT	20.6186	20.7339	20.8823	20.9648	20.9932	20.9995	21.0000	21.0000	20.9980	20.9691	20.8364	20.5973	(87)
Th 2	20.3601	20.3626	20.3651	20.3702	20.3702	20.3803	20.3752	20.3803	20.3828	20.3777	20.3777	20.3676	(88)
util rest of house													
	0.7268	0.6604	0.5366	0.3953	0.2624	0.1387	0.0683	0.0751	0.2022	0.4019	0.6099	0.7439	(89)
MIT 2	19.8705	20.0263	20.2227	20.3305	20.3635	20.3799	20.3752	20.3802	20.3812	20.3446	20.1787	19.8490	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	20.3158	20.4475	20.6153	20.7081	20.7384	20.7487	20.7471	20.7491	20.7483	20.7163	20.5702	20.2945	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3158	20.4475	20.6153	20.7081	20.7384	20.7487	20.7471	20.7491	20.7483	20.7163	20.5702	20.2945	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7255	0.6632	0.5458	0.4082	0.2768	0.1530	0.0835	0.0906	0.2185	0.4178	0.6175	0.7418	(94)
Useful gains	421.5025	429.7782	396.1367	329.0543	231.8643	130.3800	68.2157	70.9993	159.1257	269.6637	360.1572	410.6505	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	499.6367	485.0064	420.8590	336.3921	233.2130	130.4643	68.2206	71.0059	159.4932	275.9582	393.8857	492.6394	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	58.1319	37.1134	18.3933	5.2832	1.0034	0.0000	0.0000	0.0000	0.0000	4.6831	24.2845	60.9997	(98)
Space heating												209.8924	(98)
Space heating per m2										(98) / (4) =		4.1645	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	237.8846	176.6268	178.4135	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9960	0.9983	0.9980	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	236.9382	176.3307	178.0614	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	934.7862	896.0000	855.2392	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	502.4506	535.4340	503.8203	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1541.7048	(104)
Cooled fraction										fC = cooled area / (4) =		1.1905	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	149.5389	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												149.5389	(107)
Space cooling per m2												2.9670	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	209.8924	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	77.1355	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	143.2516	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1824.8985	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932	(310b)
Electricity used for heat distribution	21.3653	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	34.6155	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	114.1371	(330a)
Total electricity for the above, kWh/year	114.1371	(331)
Electricity for lighting (calculated in Appendix L)	233.5912	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2518.8743	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	77.1355	5.0000	3.8568	(340a)
Space heating from Combined Heat and Power	143.2516	3.5000	5.0138	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	670.6502	5.0000	33.5325	(342a)
Water heating from Combined Heat and Power	1245.4932	3.5000	43.5923	(342b)
Space cooling	34.6155	15.7000	5.4346	(348)
Mechanical ventilation fans	114.1371	15.7000	17.9195	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	233.5912	15.7000	36.6738	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			187.9233	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	787.1428	0.2160	170.0228	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	260.4574	0.2160	56.2588	(363)
less credit emissions for electricity	-91.1601	0.5190	-47.3121	(364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391	(365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524	(366)
Electrical energy for heat distribution	21.3653	0.5190	11.0886	(372)
Total CO2 associated with community systems			267.8449	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			267.8449	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	34.6155	0.5190	17.9654 (377)
Pumps and fans	114.1371	0.5190	59.2372 (378)
Energy for lighting	233.5912	0.5190	121.2339 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			310.5813 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	787.1428	1.2200	960.3142	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	260.4574	1.2200	317.7581	(363)
less credit emissions for electricity	-91.1601	3.0700	-279.8615	(364)
Water heating from Combined Heat and Power	2264.5331	1.2200	2762.7304	(365)
less credit emissions for electricity	-792.5866	3.0700	-2433.2408	(366)
Electrical energy for heat distribution	21.3653	3.0700	65.5915	(372)
Total CO2 associated with community systems			1393.2918	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1393.2918	(376)
Space cooling	34.6155	3.0700	106.2695	(377)
Pumps and fans	114.1371	3.0700	350.4009	(378)
Energy for lighting	233.5912	3.0700	717.1251	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			1646.0873	(383)
Primary energy kWh/m2/year			32.6605	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£60	£60	£0
Community scheme	£175	£175	£0
Space heating	£116	£116	£0
Space cooling	£5	£5	£0
Water heating	£77	£77	£0
Lighting	£37	£37	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£188	£188	£0
Total cost of uses	£188	£188	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	33 kWh/m²	33 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	269.44 (P1)
Transmission heat loss coefficient	23.71 (37)
Summer heat loss coefficient	293.15 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South West	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	8.0000	119.9223	0.6800	0.8000	0.9000	422.7407
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						493.8808

	Jun	Jul	Aug	
Solar gains	521	494	453	(P3)
Internal gains	364	351	357	
Total summer gains	884	845	810	(P5)
Summer gain/loss ratio	3.02	2.88	2.76	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.32	22.08	21.86	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007036	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0103
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	6.90	**TER**	14.16
Environmental	94 A	**% DER<TER**	51.26		
CO_2 Emissions (t/year)	0.46	**DFEE**	29.07	**TFEE**	33.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.15		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               18.8, 80.3, 2.7
Living Area:                   30 m2, fraction: 37.4%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                27.76, 50.76, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     under Balcony             Window, External Wall 1, South East, , Light-coloured curtain or roller blind, 1, True, 0, 0, 0, 12.00, 20
     Window                    Window, External Wall 1, South West, , Light-coloured curtain or roller blind, 0, , 0, 0, 0, 8.00, 20
     Window                    Window, External Wall 1, South East, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.184
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.90 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)29.1 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls:	Charging system linked to use of community heating, TRVsOK	
Hot water controls:	No cylinder	

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.55	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Oversharing:	Average	
Windows facing South East:	15.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South West:	8.00 m², No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	Light-coloured curtain or roller blind, closed 20% of daylight hours	

10 Key features
Air permeability 3.0 m³/m²h
Community CHP, Mains gas
Photovoltaic array

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	50.7600	23.0000	27.7600	0.1500	4.1640			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4999			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	39.8599	(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	19.4296	19.2015	18.9734	17.8332	17.6051	16.4648	16.4648	16.2368	16.9209	17.6051	18.0612	18.5173	(38)
Heat transfer coeff	59.2894	59.0614	58.8333	57.6930	57.4650	56.3247	56.3247	56.0966	56.7808	57.4650	57.9211	58.3772	(39)
Average = Sum(39)m / 12 =												57.6360	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7383	0.7355	0.7327	0.7185	0.7156	0.7014	0.7014	0.6986	0.7071	0.7156	0.7213	0.7270	(40)
HLP (average)												0.7178	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4685 (42)
Average daily hot water use (litres/day)	92.8276 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7140	19.8658	20.4997	17.8722	17.1488	14.7981	13.7126	15.7354	15.9233	18.5571	20.2565	21.9973	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
206.7034 182.3661 191.9417 172.6414 169.6019 152.1476 146.6941 160.1795 159.6493 178.9909 188.5373 201.9254 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
206.7034 182.3661 191.9417 172.6414 169.6019 152.1476 146.6941 160.1795 159.6493 178.9909 188.5373 201.9254 (64)
Total per year (kWh/year) = Sum(64)m = 2111.3787 (64)
Heat gains from water heating, kWh/month
94.5708 83.9778 89.6625 82.4116 82.2345 75.5974 74.6177 79.1016 78.0917 85.3564 87.6969 92.9821 (65)

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	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.6191	17.4255	14.1714	10.7286	8.0198	6.7706	7.3159	9.5095	12.7636	16.2064	18.9152	20.1644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.0664	222.3500	216.5954	204.3445	188.8800	174.3456	164.6357	162.3520	168.1067	180.3575	195.8220	210.3565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	(71)
Water heating gains (Table 5)													
	127.1113	124.9670	120.5141	114.4605	110.5303	104.9963	100.2926	106.3193	108.4607	114.7263	121.8013	124.9760	(72)
Total internal gains													
	426.8247	424.7704	411.3088	389.5616	367.4580	346.1405	332.2721	338.2088	349.3589	371.3181	396.5665	415.5247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	36.7938	0.6800	0.8000	0.7700	208.0647	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	319.0326	543.4305	743.5453	921.2886	1031.9200	1024.4577	987.6866	905.1506	805.1023	600.6064	382.1275	273.0254	(83)
Total gains	745.8572	968.2009	1154.8541	1310.8502	1399.3781	1370.5982	1319.9587	1243.3594	1154.4611	971.9245	778.6939	688.5501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.6215	37.7667	37.9131	38.6625	38.8159	39.6017	39.6017	39.7627	39.2836	38.8159	38.5102	38.2094	
alpha	3.5081	3.5178	3.5275	3.5775	3.5877	3.6401	3.6401	3.6508	3.6189	3.5877	3.5673	3.5473	
util living area													
	0.8734	0.7716	0.6498	0.5049	0.3743	0.2615	0.1874	0.2070	0.3348	0.5686	0.7939	0.8938	(86)
MIT	20.1210	20.4704	20.7331	20.9051	20.9723	20.9946	20.9988	20.9983	20.9863	20.8820	20.5116	20.0476	(87)
Th 2	20.3071	20.3096	20.3121	20.3245	20.3270	20.3396	20.3396	20.3421	20.3346	20.3270	20.3220	20.3171	(88)
util rest of house													
	0.8612	0.7540	0.6279	0.4805	0.3487	0.2349	0.1594	0.1776	0.3037	0.5386	0.7745	0.8831	(89)
MIT 2	19.1413	19.6242	19.9786	20.2124	20.2971	20.3346	20.3387	20.3408	20.3214	20.1911	19.6993	19.0464	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	19.5073	19.9403	20.2605	20.4712	20.5494	20.5812	20.5853	20.5864	20.5698	20.4492	20.0028	19.4205	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5073	19.9403	20.2605	20.4712	20.5494	20.5812	20.5853	20.5864	20.5698	20.4492	20.0028	19.4205	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8455	0.7440	0.6262	0.4858	0.3572	0.2447	0.1698	0.1885	0.3148	0.5442	0.7647	0.8673	(94)
Useful gains	630.5988	720.3284	723.1297	636.8731	499.8761	335.3485	224.1771	234.4104	363.3673	528.9097	595.4919	597.1613	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	901.6345	888.3031	809.5755	667.5777	508.5287	336.8875	224.4720	234.8445	367.3604	565.9861	747.3415	888.5281	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	201.6506	112.8790	64.3156	22.1073	6.4375	0.0000	0.0000	0.0000	0.0000	27.5848	109.3317	216.7769	(98)
Space heating												761.0835	(98)
Space heating per m2										(98) / (4) =		9.4780	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	529.4522	416.8028	426.3345	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9897	0.9947	0.9932	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	524.0194	414.5895	423.4428	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1681.2086	1620.3964	1532.0281	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	833.1762	897.1203	824.7874	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2555.0840	(104)
Cooled fraction										fC = cooled area / (4) =		0.7472	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	155.6369	167.5816	154.0699	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												477.2884	(107)
Space cooling per m2												5.9438	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	761.0835	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	279.6982	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	519.4395	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2111.3787	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	775.9317	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1441.0160	(310b)
Electricity used for heat distribution	30.1609	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	110.4834	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	181.8494	(330a)
Total electricity for the above, kWh/year	181.8494	(331)
Electricity for lighting (calculated in Appendix L)	346.4791	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3654.8971	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1111.1893	0.2160	240.0169	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	944.4354	0.2160	203.9980	(363)
less credit emissions for electricity	-330.5524	0.5190	-171.5567	(364)
Water heating from Combined Heat and Power	2620.0290	0.2160	565.9263	(365)
less credit emissions for electricity	-917.0102	0.5190	-475.9283	(366)
Electrical energy for heat distribution	30.1609	0.5190	15.6535	(372)
Total CO2 associated with community systems			378.1097	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			378.1097	(376)
Space cooling	110.4834	0.5190	57.3409	(377)
Pumps and fans	181.8494	0.5190	94.3798	(378)
Energy for lighting	346.4791	0.5190	179.8226	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			553.9531	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.9000	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.9000	ZC1
Total Floor Area	TFA	80.3000	
Assumed number of occupants	N	2.4685	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2399	ZC2
CO2 emissions from cooking, equation (L16)		2.2197	ZC3
Total CO2 emissions		25.3597	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.3597	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1384	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3884	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3054	0.3301	0.3549	0.3714	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			20.0700	1.3258	26.6080			(27)
External Wall 1	50.7600	20.0700	30.6900	0.1800	5.5242			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1322			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		37.5322	(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	42.1111	41.8650	41.6238	40.4908	40.2788	39.2920	39.2920	39.1093	39.6721	40.2788	40.7076	41.1560	(38)
Heat transfer coeff	79.6432	79.3971	79.1559	78.0229	77.8110	76.8242	76.8242	76.6414	77.2043	77.8110	78.2398	78.6881	(39)
Average = Sum(39)m / 12 =												78.0219	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9918	0.9888	0.9858	0.9716	0.9690	0.9567	0.9567	0.9544	0.9614	0.9690	0.9743	0.9799	(40)
HLP (average)												0.9716	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4685 (42)
Average daily hot water use (litres/day)		92.8276 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7140	19.8658	20.4997	17.8722	17.1488	14.7981	13.7126	15.7354	15.9233	18.5571	20.2565	21.9973	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	198.0215	174.5244	183.2598	164.2396	160.9200	143.7457	138.0122	151.4976	151.2474	170.3090	180.1355	193.2435	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	198.0215	174.5244	183.2598	164.2396	160.9200	143.7457	138.0122	151.4976	151.2474	170.3090	180.1355	193.2435	(64)
								Total per year (kWh/year) = Sum(64)m =				2009.1563	(64)
Heat gains from water heating, kWh/month													
	87.6253	77.7044	82.7170	75.6901	75.2890	68.8759	67.6722	72.1561	71.3702	78.4109	80.9755	86.0366	(65)

---

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	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.6191	17.4255	14.1714	10.7286	8.0198	6.7706	7.3159	9.5095	12.7636	16.2064	18.9152	20.1644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.0664	222.3500	216.5954	204.3445	188.8800	174.3456	164.6357	162.3520	168.1067	180.3575	195.8220	210.3565	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	(71)
Water heating gains (Table 5)													
	117.7759	115.6316	111.1788	105.1251	101.1949	95.6610	90.9572	96.9840	99.1253	105.3909	112.4659	115.6406	(72)
Total internal gains													
	420.4893	418.4350	404.9734	383.2262	361.1227	339.8051	325.9367	331.8734	343.0235	364.9827	390.2311	409.1893	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	13.0900	36.7938	0.6300	0.7000	0.7700	147.1928	(77)
Southwest	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(79)

Solar gains	225.6806	384.4176	525.9769	651.7108	729.9704	724.6917	698.6801	640.2949	569.5217	424.8633	270.3133	193.1356	(83)
Total gains	646.1699	802.8526	930.9503	1034.9371	1091.0931	1064.4968	1024.6168	972.1684	912.5452	789.8460	660.5444	602.3249	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.0171	70.2341	70.4482	71.4712	71.6659	72.5864	72.5864	72.7595	72.2290	71.6659	71.2731	70.8670	
alpha	5.6678	5.6823	5.6965	5.7647	5.7777	5.8391	5.8391	5.8506	5.8153	5.7777	5.7515	5.7245	
util living area													
	0.9913	0.9723	0.9240	0.8103	0.6410	0.4591	0.3296	0.3620	0.5729	0.8626	0.9769	0.9939	(86)
MIT	20.1697	20.4003	20.6533	20.8726	20.9707	20.9965	20.9996	20.9993	20.9880	20.8453	20.4657	20.1270	(87)
Th 2	20.0902	20.0927	20.0952	20.1070	20.1092	20.1196	20.1196	20.1215	20.1156	20.1092	20.1048	20.1001	(88)
util rest of house													
	0.9887	0.9646	0.9049	0.7720	0.5868	0.3972	0.2638	0.2932	0.5040	0.8232	0.9691	0.9920	(89)
MIT 2	18.9989	19.3306	19.6824	19.9734	20.0843	20.1175	20.1194	20.1212	20.1075	19.9504	19.4370	18.9447	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	19.4363	19.7302	20.0451	20.3093	20.4154	20.4459	20.4482	20.4492	20.4365	20.2847	19.8213	19.3864	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4363	19.7302	20.0451	20.3093	20.4154	20.4459	20.4482	20.4492	20.4365	20.2847	19.8213	19.3864	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9862	0.9609	0.9037	0.7812	0.6058	0.4203	0.2884	0.3190	0.5294	0.8317	0.9660	0.9901	(94)
Useful gains	637.2834	771.4332	841.2792	808.4554	661.0289	447.4158	295.4896	310.0749	483.0699	656.9111	638.1188	596.3488	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1205.5030	1177.4784	1072.1788	890.1908	678.1575	449.1026	295.6379	310.3402	489.2018	753.5768	995.3114	1194.9881	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	422.7554	272.8623	171.7893	58.8495	12.7437	0.0000	0.0000	0.0000	0.0000	71.9193	257.1787	445.3876	(98)
Space heating												1713.4857	(98)
Space heating per m2											(98) / (4) =	21.3386	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1832.6051	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	422.7554	272.8623	171.7893	58.8495	12.7437	0.0000	0.0000	0.0000	0.0000	71.9193	257.1787	445.3876	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	452.1448	291.8314	183.7318	62.9406	13.6296	0.0000	0.0000	0.0000	0.0000	76.9190	275.0574	476.3504	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	198.0215	174.5244	183.2598	164.2396	160.9200	143.7457	138.0122	151.4976	151.2474	170.3090	180.1355	193.2435	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7879	86.0016	84.6420	82.3690	80.4984	79.8000	79.8000	79.8000	79.8000	82.7032	85.7632	86.9713	(217)
Fuel for water heating, kWh/month													
	228.1672	202.9317	216.5115	199.3949	199.9046	180.1325	172.9476	189.8466	189.5331	205.9279	210.0382	222.1922	(219)
Water heating fuel used												2417.5281	(219)
Annual totals kWh/year													
Space heating fuel - main system												1832.6051	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												346.4791	(232)
Total delivered energy for all uses												4671.6123	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1832.6051	0.2160	395.8427	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2417.5281	0.2160	522.1861	(264)
Space and water heating			918.0288	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	346.4791	0.5190	179.8226	(268)
Total CO2, kg/m2/year			1136.7764	(272)
Emissions per m2 for space and water heating			11.4325	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2394	(272b)
Emissions per m2 for pumps and fans			0.4847	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.4325 * 1.00) + 2.2394 + 0.4847, rounded to 2 d.p.			14.1600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1384	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2884	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2451	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3125	0.3064	0.3003	0.2696	0.2635	0.2329	0.2329	0.2267	0.2451	0.2635	0.2758	0.2880	(22b)
Effective ac	0.5488	0.5469	0.5451	0.5363	0.5347	0.5271	0.5271	0.5257	0.5300	0.5347	0.5380	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	50.7600	23.0000	27.7600	0.1500	4.1640			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4999			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	39.8599	(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	39.2676	39.1320	38.9990	38.3743	38.2575	37.7134	37.7134	37.6127	37.9230	38.2575	38.4939	38.7411	(38)
Heat transfer coeff	79.1275	78.9918	78.8589	78.2342	78.1173	77.5733	77.5733	77.4725	77.7828	78.1173	78.3538	78.6009	(39)
Average = Sum(39)m / 12 =												78.2336	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9854	0.9837	0.9821	0.9743	0.9728	0.9660	0.9660	0.9648	0.9687	0.9728	0.9758	0.9788	(40)
HLP (average)												0.9743	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4685	(42)
Average daily hot water use (litres/day)	92.8276	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	32.1782	28.1432	29.0413	25.3189	24.2941	20.9639	19.4262	22.2918	22.5581	26.2892	28.6968	31.1628 (65)

---

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	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	(66)

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

	19.6191	17.4255	14.1714	10.7286	8.0198	6.7706	7.3159	9.5095	12.7636	16.2064	18.9152	20.1644	(67)

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

	220.0664	222.3500	216.5954	204.3445	188.8800	174.3456	164.6357	162.3520	168.1067	180.3575	195.8220	210.3565	(68)

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

	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	(71)

Water heating gains (Table 5)

	43.2502	41.8798	39.0340	35.1651	32.6533	29.1166	26.1105	29.9621	31.3306	35.3350	39.8566	41.8855	(72)

Total internal gains

	342.9636	341.6832	329.8287	310.2662	289.5811	270.2607	258.0899	261.8516	272.2288	291.9268	314.6218	332.4343	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	36.7938	0.6800	0.8000	0.7700	208.0647	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	319.0326	543.4305	743.5453	921.2886	1031.9200	1024.4577	987.6866	905.1506	805.1023	600.6064	382.1275	273.0254	(83)
Total gains	661.9962	885.1137	1073.3739	1231.5549	1321.5011	1294.7185	1245.7765	1167.0022	1077.3311	892.5332	696.7493	605.4597	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.1894	28.2378	28.2854	28.5113	28.5539	28.7542	28.7542	28.7916	28.6767	28.5539	28.4678	28.3782	
alpha	2.8793	2.8825	2.8857	2.9008	2.9036	2.9169	2.9169	2.9194	2.9118	2.9036	2.8979	2.8919	
util living area	0.9268	0.8584	0.7656	0.6395	0.5015	0.3687	0.2694	0.2987	0.4630	0.7079	0.8803	0.9403	(86)
MIT	19.3298	19.7912	20.2402	20.6231	20.8489	20.9545	20.9864	20.9814	20.9100	20.5719	19.8734	19.2234	(87)
Th 2	20.0955	20.0969	20.0983	20.1048	20.1060	20.1117	20.1117	20.1128	20.1095	20.1060	20.1036	20.1010	(88)
util rest of house	0.9175	0.8427	0.7423	0.6076	0.4618	0.3214	0.2166	0.2434	0.4114	0.6720	0.8640	0.9326	(89)
MIT 2	18.5797	19.0237	19.4473	19.8009	19.9961	20.0845	20.1057	20.1041	20.0521	19.7676	19.1164	18.4804	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	18.8599	19.3105	19.7435	20.1081	20.3147	20.4095	20.4347	20.4319	20.3726	20.0681	19.3992	18.7580	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8599	19.3105	19.7435	20.1081	20.3147	20.4095	20.4347	20.4319	20.3726	20.0681	19.3992	18.7580	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9023	0.8272	0.7324	0.6077	0.4713	0.3375	0.2360	0.2635	0.4270	0.6704	0.8492	0.9184	(94)
Useful gains	597.3383	732.2069	786.1257	748.4499	622.8139	436.9195	293.9886	307.4523	460.0570	598.3678	591.6720	556.0699	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1152.0893	1138.3089	1044.3677	876.8530	672.9578	450.6652	297.4739	312.3581	487.9032	739.6221	963.6913	1144.2740	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	412.7347	272.9006	192.1321	92.4503	37.3071	0.0000	0.0000	0.0000	0.0000	105.0932	267.8539	437.6239	(98)
Space heating												1818.0958	(98)
Space heating per m2											(98) / (4) =	22.6413	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	729.1889	574.0423	588.7913	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9428	0.9643	0.9564	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	687.4688	553.5669	563.0928	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1605.3289	1546.2142	1455.6709	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	660.8593	738.5296	664.0781	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2063.4669	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   165.2148   184.6324   166.0195     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          515.8667 (107)
Space cooling per m2                                                                                                                     6.4242 (108)
Energy for space heating                                                                                                                22.6413 (99)
Energy for space cooling                                                                                                                 6.4242 (108)
Total                                                                                                                                   29.0655 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   29.1 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1384	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3884	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3054	0.3301	0.3549	0.3714	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			20.0700	1.3258	26.6080			(27)
External Wall 1	50.7600	20.0700	30.6900	0.1800	5.5242			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1322			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		37.5322	(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	42.1111	41.8650	41.6238	40.4908	40.2788	39.2920	39.2920	39.1093	39.6721	40.2788	40.7076	41.1560	(38)
Heat transfer coeff	79.6432	79.3971	79.1559	78.0229	77.8110	76.8242	76.8242	76.6414	77.2043	77.8110	78.2398	78.6881	(39)
Average = Sum(39)m / 12 =												78.0219	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9918	0.9888	0.9858	0.9716	0.9690	0.9567	0.9567	0.9544	0.9614	0.9690	0.9743	0.9799	(40)
HLP (average)												0.9716	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4685 (42)
Average daily hot water use (litres/day)		92.8276 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.1782	28.1432	29.0413	25.3189	24.2941	20.9639	19.4262	22.2918	22.5581	26.2892	28.6968	31.1628	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	123.4264	(66)

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

	19.6191	17.4255	14.1714	10.7286	8.0198	6.7706	7.3159	9.5095	12.7636	16.2064	18.9152	20.1644	(67)

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

	220.0664	222.3500	216.5954	204.3445	188.8800	174.3456	164.6357	162.3520	168.1067	180.3575	195.8220	210.3565	(68)

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

	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	35.3426	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	(71)

Water heating gains (Table 5)

	43.2502	41.8798	39.0340	35.1651	32.6533	29.1166	26.1105	29.9621	31.3306	35.3350	39.8566	41.8855	(72)

Total internal gains

	342.9636	341.6832	329.8287	310.2662	289.5811	270.2607	258.0899	261.8516	272.2288	291.9268	314.6218	332.4343	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	13.0900	36.7938	0.6300	0.7000	0.7700	147.1928	(77)
Southwest	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(79)

Solar gains	225.6806	384.4176	525.9769	651.7108	729.9704	724.6917	698.6801	640.2949	569.5217	424.8633	270.3133	193.1356	(83)
Total gains	568.6442	726.1008	855.8055	961.9771	1019.5515	994.9524	956.7701	902.1465	841.7505	716.7901	584.9351	525.5699	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.0171	70.2341	70.4482	71.4712	71.6659	72.5864	72.5864	72.7595	72.2290	71.6659	71.2731	70.8670	
alpha	5.6678	5.6823	5.6965	5.7647	5.7777	5.8391	5.8391	5.8506	5.8153	5.7777	5.7515	5.7245	
util living area	0.9953	0.9822	0.9444	0.8441	0.6783	0.4901	0.3528	0.3898	0.6159	0.8989	0.9867	0.9969	(86)
MIT	20.0799	20.3191	20.5907	20.8403	20.9611	20.9950	20.9994	20.9989	20.9827	20.8005	20.3834	20.0368	(87)
Th 2	20.0902	20.0927	20.0952	20.1070	20.1092	20.1196	20.1196	20.1215	20.1156	20.1092	20.1048	20.1001	(88)
util rest of house	0.9939	0.9770	0.9292	0.8086	0.6231	0.4245	0.2825	0.3159	0.5438	0.8656	0.9820	0.9959	(89)
MIT 2	19.2563	19.4940	19.7565	19.9904	20.0862	20.1175	20.1194	20.1212	20.1075	19.9648	19.5694	19.2218	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	19.5640	19.8023	20.0682	20.3079	20.4131	20.4454	20.4482	20.4491	20.4345	20.2770	19.8735	19.5263	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5640	19.8023	20.0682	20.3079	20.4131	20.4454	20.4482	20.4491	20.4345	20.2770	19.8735	19.5263	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9749	0.9287	0.8171	0.6425	0.4490	0.3088	0.3436	0.5704	0.8726	0.9804	0.9951	(94)
Useful gains	564.5379	707.9073	794.7874	786.0714	655.0273	446.6878	295.4178	309.9341	480.1145	625.4750	573.4877	523.0066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1215.6739	1183.1962	1074.0014	890.0769	677.9753	449.0653	295.6326	310.3299	489.0478	752.9787	999.3961	1205.9967	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	484.4452	319.3941	207.7352	74.8840	17.0733	0.0000	0.0000	0.0000	0.0000	94.8627	306.6540	508.1446	(98)
Space heating												2013.1933	(98)
Space heating per m2											(98) / (4) =	25.0709	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	722.1471	568.4988	582.4748	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9828	0.9935	0.9905	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	709.6960	564.7926	576.9603	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1254.9529	1208.4145	1146.0993	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	392.5850	478.8546	423.4395	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1294.8791	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	98.1462	119.7137	105.8599	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	323.7198 (107)
Space cooling per m2	4.0314 (108)
Energy for space heating	25.0709 (99)
Energy for space cooling	4.0314 (108)
Total	29.1023 (109)
Target Fabric Energy Efficiency (TFEE)	33.5 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	50.7600	23.0000	27.7600	0.1500	4.1640			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4999			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	39.8599	(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	16.6929	16.4648	16.2368	15.7807	15.7807	14.8684	15.3245	14.8684	14.6404	15.0965	15.0965	16.0087	(38)
Heat transfer coeff	56.5528	56.3247	56.0966	55.6405	55.6405	54.7283	55.1844	54.7283	54.5002	54.9564	54.9564	55.8686	(39)
Average = Sum(39)m / 12 =												55.4315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7043	0.7014	0.6986	0.6929	0.6929	0.6815	0.6872	0.6815	0.6787	0.6844	0.6844	0.6957	(40)
HLP (average)												0.6903	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4685	(42)
Average daily hot water use (litres/day)	92.8276	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7140	19.8658	20.4997	17.8722	17.1488	14.7981	13.7126	15.7354	15.9233	18.5571	20.2565	21.9973	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
206.7034 182.3661 191.9417 172.6414 169.6019 152.1476 146.6941 160.1795 159.6493 178.9909 188.5373 201.9254 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
206.7034 182.3661 191.9417 172.6414 169.6019 152.1476 146.6941 160.1795 159.6493 178.9909 188.5373 201.9254 (64)
Total per year (kWh/year) = Sum(64)m = 2111.3787 (64)
RHI water heating demand 2111 (64)
Heat gains from water heating, kWh/month
94.5708 83.9778 89.6625 82.4116 82.2345 75.5974 74.6177 79.1016 78.0917 85.3564 87.6969 92.9821 (65)

---

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	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.0477	43.5637	35.4284	26.8216	20.0494	16.9266	18.2898	23.7737	31.9091	40.5159	47.2880	50.4109	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.4573	331.8657	323.2767	304.9918	281.9105	260.2173	245.7249	242.3165	250.9054	269.1903	292.2717	313.9649	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	(71)
Water heating gains (Table 5)													
	127.1113	124.9670	120.5141	114.4605	110.5303	104.9963	100.2926	106.3193	108.4607	114.7263	121.8013	124.9760	(72)
Total internal gains													
	606.2666	602.0467	580.8695	547.9242	514.1405	483.7905	465.9575	474.0599	492.9254	526.0828	563.0113	591.0020	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	39.0225	0.6800	0.8000	0.7700	220.6674	(77)
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)

Solar gains	338.3567	507.6524	711.5210	914.7181	1002.5997	1065.4495	1023.4330	963.0582	847.3067	624.5112	418.4274	296.7249	(83)
Total gains	944.6232	1109.6990	1292.3905	1462.6423	1516.7402	1549.2399	1489.3905	1437.1181	1340.2321	1150.5940	981.4387	887.7269	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.4420	39.6017	39.7627	40.0887	40.0887	40.7569	40.4200	40.7569	40.9274	40.5878	40.5878	39.9250	
alpha	3.6295	3.6401	3.6508	3.6726	3.6726	3.7171	3.6947	3.7171	3.7285	3.7059	3.7059	3.6617	
util living area													
	0.7484	0.6614	0.5247	0.3841	0.2627	0.1483	0.0852	0.0914	0.2069	0.4017	0.6237	0.7704	(86)
MIT	20.5834	20.7376	20.8947	20.9701	20.9941	20.9996	21.0000	21.0000	20.9983	20.9723	20.8305	20.5488	(87)
Th 2	20.3371	20.3396	20.3421	20.3471	20.3471	20.3572	20.3521	20.3572	20.3597	20.3546	20.3546	20.3446	(88)
util rest of house													
	0.7295	0.6406	0.5017	0.3611	0.2392	0.1256	0.0612	0.0669	0.1811	0.3733	0.5988	0.7523	(89)
MIT 2	19.8028	20.0094	20.2156	20.3137	20.3414	20.3569	20.3521	20.3571	20.3583	20.3252	20.1493	19.7634	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	20.0944	20.2815	20.4693	20.5589	20.5853	20.5970	20.5942	20.5973	20.5974	20.5669	20.4038	20.0568	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0944	20.2815	20.4693	20.5589	20.5853	20.5970	20.5942	20.5973	20.5974	20.5669	20.4038	20.0568	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7223	0.6387	0.5062	0.3686	0.2478	0.1341	0.0702	0.0761	0.1907	0.3827	0.6007	0.7440	(94)
Useful gains	682.3043	708.7428	654.2017	539.1074	375.8166	207.6993	104.5224	109.3018	255.5796	440.3626	589.5504	660.4572	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	814.0434	793.1336	688.2664	548.5549	377.5355	207.8021	104.5277	109.3088	256.0120	448.8238	643.1983	802.0935	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	98.0139	56.7106	25.3441	6.8022	1.2788	0.0000	0.0000	0.0000	0.0000	6.2951	38.6265	105.3774	(98)
Space heating												338.4486	(98)
RHI space heating demand												338	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	50.7600	23.0000	27.7600	0.1500	4.1640			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4999			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	39.8599	(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	19.4296	19.2015	18.9734	17.8332	17.6051	16.4648	16.4648	16.2368	16.9209	17.6051	18.0612	18.5173	(38)
Heat transfer coeff	59.2894	59.0614	58.8333	57.6930	57.4650	56.3247	56.3247	56.0966	56.7808	57.4650	57.9211	58.3772	(39)
Average = Sum(39)m / 12 =												57.6360	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7383	0.7355	0.7327	0.7185	0.7156	0.7014	0.7014	0.6986	0.7071	0.7156	0.7213	0.7270	(40)
HLP (average)												0.7178	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4685 (42)
Average daily hot water use (litres/day)	92.8276 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7140	19.8658	20.4997	17.8722	17.1488	14.7981	13.7126	15.7354	15.9233	18.5571	20.2565	21.9973	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (56)
If cylinder contains dedicated solar storage
    32.0144   28.9162   32.0144   30.9817   32.0144   30.9817   32.0144   32.0144   30.9817   32.0144   30.9817   32.0144 (57)
Primary loss    23.2624   21.0112   23.2624   22.5120   23.2624   22.5120   23.2624   23.2624   22.5120   23.2624   22.5120   23.2624 (59)
Total heat required for water heating calculated for each month
   206.7034  182.3661  191.9417  172.6414  169.6019  152.1476  146.6941  160.1795  159.6493  178.9909  188.5373  201.9254 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   206.7034  182.3661  191.9417  172.6414  169.6019  152.1476  146.6941  160.1795  159.6493  178.9909  188.5373  201.9254 (64)
                                                                    Total per year (kWh/year) = Sum(64)m =   2111.3787 (64)
Heat gains from water heating, kWh/month
    94.5708   83.9778   89.6625   82.4116   82.2345   75.5974   74.6177   79.1016   78.0917   85.3564   87.6969   92.9821 (65)
```

---

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  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117  148.1117 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    49.0477   43.5637   35.4284   26.8216   20.0494   16.9266   18.2898   23.7737   31.9091   40.5159   47.2880   50.4109 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   328.4573  331.8657  323.2767  304.9918  281.9105  260.2173  245.7249  242.3165  250.9054  269.1903  292.2717  313.9649 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797   52.2797 (69)
Pumps, fans     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
   -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411  -98.7411 (71)
Water heating gains (Table 5)
   127.1113  124.9670  120.5141  114.4605  110.5303  104.9963  100.2926  106.3193  108.4607  114.7263  121.8013  124.9760 (72)
Total internal gains
   606.2666  602.0467  580.8695  547.9242  514.1405  483.7905  465.9575  474.0599  492.9254  526.0828  563.0113  591.0020 (73)
```

---

6. Solar gains

```
[Jan]                                  Area        Solar flux          g              FF          Access          Gains
                                       m2          Table 6a      Specific data  Specific data   factor           W
                                                     W/m2        or Table 6b    or Table 6c    Table 6d
-------------------------------------------------------------------------------------------------------------------
Southeast                           15.0000          36.7938          0.6800         0.8000       0.7700      208.0647 (77)
Southwest                            8.0000          36.7938          0.6800         0.8000       0.7700      110.9678 (79)
-------------------------------------------------------------------------------------------------------------------

Solar gains   319.0326  543.4305  743.5453  921.2886 1031.9200 1024.4577  987.6866  905.1506  805.1023  600.6064  382.1275  273.0254 (83)
Total gains   925.2991 1145.4771 1324.4148 1469.2128 1546.0605 1508.2482 1453.6441 1379.2104 1298.0277 1126.6892  945.1388  864.0274 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                   21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
          Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau     37.6215   37.7667   37.9131   38.6625   38.8159   39.6017   39.6017   39.7627   39.2836   38.8159   38.5102   38.2094
alpha    3.5081    3.5178    3.5275    3.5775    3.5877    3.6401    3.6401    3.6508    3.6189    3.5877    3.5673    3.5473
util living area
    0.8037    0.7013    0.5879    0.4571    0.3406    0.2380    0.1703    0.1868    0.2991    0.5033    0.7147    0.8266 (86)

MIT     20.3605   20.6167   20.8062   20.9308   20.9796   20.9960   20.9991   20.9988   20.9905   20.9201   20.6612   20.3052 (87)
Th 2    20.3071   20.3096   20.3121   20.3245   20.3270   20.3396   20.3396   20.3421   20.3346   20.3270   20.3220   20.3171 (88)
util rest of house
    0.7879    0.6820    0.5660    0.4342    0.3170    0.2137    0.1448    0.1602    0.2709    0.4750    0.6927    0.8121 (89)
MIT 2   19.4710   19.8193   20.0723   20.2433   20.3051   20.3360   20.3390   20.3412   20.3255   20.2360   19.8968   19.4036 (90)
Living area fraction                                                                 fLA = Living area / (4) =     0.3736 (91)
MIT     19.8033   20.1172   20.3465   20.5002   20.5571   20.5826   20.5856   20.5869   20.5740   20.4916   20.1824   19.7404 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT    19.8033   20.1172   20.3465   20.5002   20.5571   20.5826   20.5856   20.5869   20.5740   20.4916   20.1824   19.7404 (93)
```

---

8. Space heating requirement

```
          Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.7756    0.6765    0.5671    0.4402    0.3251    0.2227    0.1543    0.1701    0.2811    0.4821    0.6880    0.7987 (94)
Useful gains  717.6524  774.8806  751.1331  646.7636  502.5933  335.8475  224.2762  234.5647  364.8489  543.1318  650.2787  690.1017 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
   919.1833  898.7500  814.6337  669.2494  508.9723  336.9667  224.4877  234.8688  367.5981  568.4194  757.7476  907.2080 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   149.9390   83.2403   47.2444   16.1898    4.7460    0.0000    0.0000    0.0000    0.0000   18.8140   77.3776  161.5271 (98)
Space heating                                                                                                559.0782 (98)
Space heating per m2                                                                                 (98) / (4) =     6.9624 (99)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	529.4522	416.8028	426.3345	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9897	0.9947	0.9932	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	524.0194	414.5895	423.4428	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1681.2086	1620.3964	1532.0281	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	833.1762	897.1203	824.7874	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling		2555.0840 (104)
Cooled fraction	fC = cooled area / (4) =	0.7472 (105)
Intermittency factor (Table 10b)		0.0000 (106)
Space cooling kWh		0.0000 (107)
Space cooling		477.2884 (107)
Space cooling per m2		5.9438 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Boilers	0.3500 (303a)
Fraction of heat from community Combined Heat and Power	0.6500 (303b)
Fraction of total space heat from community Boilers	0.3500 (304a)
Fraction of total space heat from community Combined Heat and Power	0.6500 (304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	559.0782 (98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	205.4612 (307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	381.5709 (307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2111.3787 (64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	775.9317 (310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1441.0160 (310b)
Electricity used for heat distribution	28.0398 (313)
Cooling System Energy Efficiency Ratio	4.3200 (314)
Space cooling (if there is a fixed cooling system, if not enter 0)	110.4834 (315)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)	
mechanical ventilation fans (SFP = 0.6875)	181.8494 (330a)
Total electricity for the above, kWh/year	181.8494 (331)
Electricity for lighting (calculated in Appendix L)	346.4791 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
Total delivered energy for all uses	3442.7916 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	205.4612	4.2400	8.7116	(340a)
Space heating from Combined Heat and Power	381.5709	2.9700	11.3327	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	775.9317	4.2400	32.8995	(342a)
Water heating from Combined Heat and Power	1441.0160	2.9700	42.7982	(342b)
Space cooling	110.4834	13.1900	14.5728	(348)
Mechanical ventilation fans	181.8494	13.1900	23.9859	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	346.4791	13.1900	45.7006	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			260.4312	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8730 (357)
SAP value		87.8223
SAP rating (Section 12)		88 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1033.0452	0.2160	223.1378 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	693.7652	0.2160	149.8533 (363)
less credit emissions for electricity	-242.8178	0.5190	-126.0225 (364)
Water heating from Combined Heat and Power	2620.0290	0.2160	565.9263 (365)
less credit emissions for electricity	-917.0102	0.5190	-475.9283 (366)
Electrical energy for heat distribution	28.0398	0.5190	14.5527 (372)
Total CO2 associated with community systems			351.5192 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			351.5192 (376)
Space cooling	110.4834	0.5190	57.3409 (377)
Pumps and fans	181.8494	0.5190	94.3798 (378)
Energy for lighting	346.4791	0.5190	179.8226 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			527.3626 (383)
CO2 emissions per m2			6.5700 (384)
EI value			94.3602 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	80.3000 (1b)	x	2.7000 (2b)	=	216.8100	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.8100	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	50.7600	23.0000	27.7600	0.1500	4.1640			(29a)
Total net area of external elements Aum(A, m2)			50.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4999			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	39.8599	(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	16.6929	16.4648	16.2368	15.7807	15.7807	14.8684	15.3245	14.8684	14.6404	15.0965	15.0965	16.0087	(38)
Heat transfer coeff	56.5528	56.3247	56.0966	55.6405	55.6405	54.7283	55.1844	54.7283	54.5002	54.9564	54.9564	55.8686	(39)
Average = Sum(39)m / 12 =												55.4315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7043	0.7014	0.6986	0.6929	0.6929	0.6815	0.6872	0.6815	0.6787	0.6844	0.6844	0.6957	(40)
HLP (average)												0.6903	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4685 (42)
Average daily hot water use (litres/day)	92.8276 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1103	98.3972	94.6841	90.9710	87.2579	83.5448	83.5448	87.2579	90.9710	94.6841	98.3972	102.1103	(44)
Energy conte	151.4266	132.4387	136.6649	119.1478	114.3251	98.6539	91.4173	104.9027	106.1556	123.7141	135.0436	146.6486	(45)
Energy content (annual)										Total = Sum(45)m =		1460.5389	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7140	19.8658	20.4997	17.8722	17.1488	14.7981	13.7126	15.7354	15.9233	18.5571	20.2565	21.9973	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	206.7034	182.3661	191.9417	172.6414	169.6019	152.1476	146.6941	160.1795	159.6493	178.9909	188.5373	201.9254 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	206.7034	182.3661	191.9417	172.6414	169.6019	152.1476	146.6941	160.1795	159.6493	178.9909	188.5373	201.9254 (64)

Total per year (kWh/year) = Sum(64)m = 2111.3787 (64)

Heat gains from water heating, kWh/month

	94.5708	83.9778	89.6625	82.4116	82.2345	75.5974	74.6177	79.1016	78.0917	85.3564	87.6969	92.9821 (65)

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	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	148.1117	(66)

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

	49.0477	43.5637	35.4284	26.8216	20.0494	16.9266	18.2898	23.7737	31.9091	40.5159	47.2880	50.4109 (67)

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

	328.4573	331.8657	323.2767	304.9918	281.9105	260.2173	245.7249	242.3165	250.9054	269.1903	292.2717	313.9649 (68)

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

	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797	52.2797 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411	-98.7411 (71)

Water heating gains (Table 5)

	127.1113	124.9670	120.5141	114.4605	110.5303	104.9963	100.2926	106.3193	108.4607	114.7263	121.8013	124.9760 (72)

Total internal gains

	606.2666	602.0467	580.8695	547.9242	514.1405	483.7905	465.9575	474.0599	492.9254	526.0828	563.0113	591.0020 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	39.0225	0.6800	0.8000	0.7700	220.6674	(77)
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)

Solar gains	338.3567	507.6524	711.5210	914.7181	1002.5997	1065.4495	1023.4330	963.0582	847.3067	624.5112	418.4274	296.7249 (83)
Total gains	944.6232	1109.6990	1292.3905	1462.6423	1516.7402	1549.2399	1489.3905	1437.1181	1340.2321	1150.5940	981.4387	887.7269 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.4420	39.6017	39.7627	40.0887	40.0887	40.7569	40.4200	40.7569	40.9274	40.5878	40.5878	39.9250	
alpha	3.6295	3.6401	3.6508	3.6726	3.6726	3.7171	3.6947	3.7171	3.7285	3.7059	3.7059	3.6617	
util living area													
	0.7484	0.6614	0.5247	0.3841	0.2627	0.1483	0.0852	0.0914	0.2069	0.4017	0.6237	0.7704	(86)
MIT	20.5834	20.7376	20.8947	20.9701	20.9941	20.9996	21.0000	21.0000	20.9983	20.9723	20.8305	20.5488	(87)
Th 2	20.3371	20.3396	20.3421	20.3471	20.3471	20.3572	20.3521	20.3572	20.3597	20.3546	20.3546	20.3446	(88)
util rest of house													
	0.7295	0.6406	0.5017	0.3611	0.2392	0.1256	0.0612	0.0669	0.1811	0.3733	0.5988	0.7523	(89)
MIT 2	19.8028	20.0094	20.2156	20.3137	20.3414	20.3569	20.3521	20.3571	20.3583	20.3252	20.1493	19.7634	(90)
Living area fraction									fLA = Living area / (4) =			0.3736	(91)
MIT	20.0944	20.2815	20.4693	20.5589	20.5853	20.5970	20.5942	20.5973	20.5974	20.5669	20.4038	20.0568	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0944	20.2815	20.4693	20.5589	20.5853	20.5970	20.5942	20.5973	20.5974	20.5669	20.4038	20.0568	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7223	0.6387	0.5062	0.3686	0.2478	0.1341	0.0702	0.0761	0.1907	0.3827	0.6007	0.7440	(94)
Useful gains	682.3043	708.7428	654.2017	539.1074	375.8166	207.6993	104.5224	109.3018	255.5796	440.3626	589.5504	660.4572	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	814.0434	793.1336	688.2664	548.5549	377.5355	207.8021	104.5277	109.3088	256.0120	448.8238	643.1983	802.0935	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	98.0139	56.7106	25.3441	6.8022	1.2788	0.0000	0.0000	0.0000	0.0000	6.2951	38.6265	105.3774	(98)
Space heating												338.4486	(98)
Space heating per m2											(98) / (4) =	4.2148	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	394.0438	292.4774	295.5328	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9968	0.9987	0.9985	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	392.7958	292.0846	295.0802	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1729.1210	1662.1779	1599.7123	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	962.1541	1019.3495	970.6463	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2952.1499	(104)
Cooled fraction										fC = cooled area / (4) =		0.7472	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	179.7299	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												179.7299	(107)
Space cooling per m2												2.2382	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	338.4486	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	124.3799	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	230.9912	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2111.3787	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	775.9317	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1441.0160	(310b)
Electricity used for heat distribution	25.7232	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	41.6041	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	181.8494	(330a)
Total electricity for the above, kWh/year	181.8494	(331)
Electricity for lighting (calculated in Appendix L)	346.4791	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3142.2513	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	124.3799	5.0000	6.2190	(340a)
Space heating from Combined Heat and Power	230.9912	3.5000	8.0847	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	775.9317	5.0000	38.7966	(342a)
Water heating from Combined Heat and Power	1441.0160	3.5000	50.4356	(342b)
Space cooling	41.6041	15.7000	6.5319	(348)
Mechanical ventilation fans	181.8494	15.7000	28.5504	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	346.4791	15.7000	54.3972	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			234.9152	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	947.6964	0.2160	204.7024	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	419.9840	0.2160	90.7165	(363)
less credit emissions for electricity	-146.9944	0.5190	-76.2901	(364)
Water heating from Combined Heat and Power	2620.0290	0.2160	565.9263	(365)
less credit emissions for electricity	-917.0102	0.5190	-475.9283	(366)
Electrical energy for heat distribution	25.7232	0.5190	13.3503	(372)
Total CO2 associated with community systems			322.4772	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			322.4772	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	41.6041	0.5190	21.5926 (377)
Pumps and fans	181.8494	0.5190	94.3798 (378)
Energy for lighting	346.4791	0.5190	179.8226 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			462.5722 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	947.6964	1.2200	1156.1896	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	419.9840	1.2200	512.3805	(363)
less credit emissions for electricity	-146.9944	3.0700	-451.2728	(364)
Water heating from Combined Heat and Power	2620.0290	1.2200	3196.4354	(365)
less credit emissions for electricity	-917.0102	3.0700	-2815.2212	(366)
Electrical energy for heat distribution	25.7232	3.0700	78.9702	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1677.4816	(373)
Space and water heating			1677.4816	(376)
Space cooling	41.6041	3.0700	127.7247	(377)
Pumps and fans	181.8494	3.0700	558.2776	(378)
Energy for lighting	346.4791	3.0700	1063.6908	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2506.1747	(383)
Primary energy kWh/m2/year			31.2101	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£89	£89	£0
Community scheme	£193	£193	£0
Space heating	£132	£132	£0
Space cooling	£7	£7	£0
Water heating	£89	£89	£0
Lighting	£54	£54	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£235	£235	£0
Total cost of uses	£235	£235	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	31 kWh/m²	31 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	429.28 (P1)
Transmission heat loss coefficient	39.86 (37)
Summer heat loss coefficient	469.14 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	1.000	0.360	Wide overhang
South West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	0.920	0.90	0.360	0.239 (P8)
South East	1.000	0.90	0.360	0.260 (P8)
South West	0.920	0.90	1.000	0.828 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	15.0000	119.9223	0.6800	0.8000	0.2392	210.6658
South West	8.0000	119.9223	0.6800	0.8000	0.8280	388.9214
total:						599.5872

	Jun	Jul	Aug	
Solar gains	629	600	559	(P3)
Internal gains	484	466	474	
Total summer gains	1113	1066	1033	(P5)
Summer gain/loss ratio	2.37	2.27	2.20	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.67	21.47	21.30	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007037	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0104
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	87 B	**DER**	7.34	**TER**	16.46
Environmental	95 A	**% DER<TER**	55.41		
CO_2 Emissions (t/year)	0.32	**DFEE**	29.37	**TFEE**	33.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.35		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, Mid-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               8, 52.7, 2.7
Living Area:                   25 m2, fraction: 47.4%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                10.6, 21.6, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North East, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.433
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.34 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)29.4 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South East:		8.00 m², No overhang	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1500	1.5900			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1854			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.5454	(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	12.7514	12.6017	12.4521	11.7037	11.5540	10.8057	10.8057	10.6560	11.1050	11.5540	11.8534	12.1527	(38)
Heat transfer coeff	36.2968	36.1472	35.9975	35.2491	35.0995	34.3511	34.3511	34.2014	34.6504	35.0995	35.3988	35.6981	(39)
Average = Sum(39)m / 12 =												35.2117	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6887	0.6859	0.6831	0.6689	0.6660	0.6518	0.6518	0.6490	0.6575	0.6660	0.6717	0.6774	(40)
HLP (average)												0.6682	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697	(42)
Average daily hot water use (litres/day)	76.2308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6529	16.3140	16.8346	14.6768	14.0827	12.1523	11.2609	12.9221	13.0764	15.2393	16.6348	18.0644	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	179.6297	158.6872	167.5072	151.3388	149.1616	134.5091	130.3495	141.4238	140.6696	156.8719	164.3927	175.7059 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	179.6297	158.6872	167.5072	151.3388	149.1616	134.5091	130.3495	141.4238	140.6696	156.8719	164.3927	175.7059 (64)

Total per year (kWh/year) = Sum(64)m = 1850.2469 (64)

Heat gains from water heating, kWh/month

	85.5688	76.1046	81.5380	75.3285	75.4381	69.7326	69.1831	72.8653	71.7809	78.0018	79.6689	84.2641 (65)

---

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	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	(66)

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

	13.7945	12.2521	9.9641	7.5435	5.6388	4.7605	5.1439	6.6863	8.9743	11.3949	13.2996	14.1778	(67)

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

	154.2407	155.8412	151.8079	143.2215	132.3827	122.1957	115.3902	113.7897	117.8230	126.4094	137.2482	147.4352	(68)

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

	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	(71)

Water heating gains (Table 5)

	115.0118	113.2509	109.5941	104.6229	101.3953	96.8508	92.9881	97.9373	99.6957	104.8411	110.6512	113.2582	(72)

Total internal gains

	332.5927	330.8899	320.9119	304.9336	288.9626	273.3528	263.0680	267.9590	276.0388	292.1912	310.7447	324.4170	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(77)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	456.3213	545.8841	626.3348	702.2382	751.2014	739.8255	709.6444	664.9333	613.0989	532.8411	459.7149	429.8034	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3310	40.4980	40.6664	41.5298	41.7069	42.6155	42.6155	42.8020	42.2473	41.7069	41.3542	41.0074	
alpha	3.6887	3.6999	3.7111	3.7687	3.7805	3.8410	3.8410	3.8535	3.8165	3.7805	3.7569	3.7338	
util living area	0.8821	0.8117	0.7109	0.5672	0.4238	0.2952	0.2125	0.2359	0.3834	0.6233	0.8157	0.8971	(86)
MIT	20.1784	20.4389	20.6897	20.8853	20.9672	20.9940	20.9987	20.9981	20.9834	20.8660	20.5244	20.1318	(87)
Th 2	20.3508	20.3533	20.3558	20.3684	20.3709	20.3836	20.3836	20.3861	20.3785	20.3709	20.3659	20.3609	(88)
util rest of house	0.8709	0.7962	0.6905	0.5428	0.3971	0.2673	0.1829	0.2047	0.3504	0.5943	0.7981	0.8870	(89)
MIT 2	19.2565	19.6198	19.9630	20.2310	20.3350	20.3780	20.3826	20.3847	20.3623	20.2140	19.7547	19.1990	(90)

Living area fraction fLA = Living area / (4) = 0.4744 (91)

MIT	19.6938	20.0084	20.3077	20.5414	20.6349	20.6702	20.6749	20.6757	20.6570	20.5233	20.1198	19.6415	(92)

Temperature adjustment 0.0000
adjusted MIT 19.6938 20.0084 20.3077 20.5414 20.6349 20.6702 20.6749 20.6757 20.6570 20.5233 20.1198 19.6415 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8583	0.7874	0.6889	0.5496	0.4084	0.2803	0.1969	0.2194	0.3653	0.6015	0.7908	0.8743	(94)
Useful gains	391.6721	429.8303	431.4807	385.9479	306.7827	207.3601	139.7570	145.9004	223.9382	320.4788	363.5356	375.7770	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	558.7468	546.1256	497.0438	410.3491	313.6100	208.5184	139.9772	146.2338	227.2014	348.3018	460.8864	551.2324	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	124.3036	78.1504	48.7790	17.5689	5.0795	0.0000	0.0000	0.0000	0.0000	20.7003	70.0925	130.5389	(98)

Space heating 495.2131 (98)
Space heating per m2 (98) / (4) = 9.3968 (99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	322.9003	254.1981	259.9309	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9883	0.9940	0.9922	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	319.1087	252.6780	257.8985	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	919.1440	882.8269	831.2666	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	432.0254	468.8308	426.5859	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1327.4420	(104)
Cooled fraction										fC = cooled area / (4) =		1.1385	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	122.9674	133.4433	121.4191	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												377.8298	(107)
Space cooling per m2												7.1694	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	495.2131	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	181.9908	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	337.9829	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1850.2469	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	679.9657	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1262.7935	(310b)
Electricity used for heat distribution	24.6273	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	87.4606	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.3457	(330a)
Total electricity for the above, kWh/year	119.3457	(331)
Electricity for lighting (calculated in Appendix L)	243.6143	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2913.1536	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	907.3227	0.2160	195.9817	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	614.5144	0.2160	132.7351	(363)
less credit emissions for electricity	-215.0800	0.5190	-111.6265	(364)
Water heating from Combined Heat and Power	2295.9882	0.2160	495.9335	(365)
less credit emissions for electricity	-803.5959	0.5190	-417.0663	(366)
Electrical energy for heat distribution	24.6273	0.5190	12.7816	(372)
Total CO2 associated with community systems			308.7390	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			308.7390	(376)
Space cooling	87.4606	0.5190	45.3921	(377)
Pumps and fans	119.3457	0.5190	61.9404	(378)
Energy for lighting	243.6143	0.5190	126.4358	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			386.8074	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.3400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.3400	ZC1
Total Floor Area	TFA	52.7000	
Assumed number of occupants	N	1.7697	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3434	ZC2
CO2 emissions from cooking, equation (L16)		3.0640	ZC3
Total CO2 emissions		27.7474	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7474	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3906	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3320	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4233	0.4150	0.4067	0.3652	0.3569	0.3154	0.3154	0.3071	0.3320	0.3569	0.3735	0.3901	(22b)
Effective ac	0.5896	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5471	0.5551	0.5637	0.5697	0.5761	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1800	1.9080			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4913			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		21.8913	(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	27.6840	27.5207	27.3606	26.6086	26.4679	25.8130	25.8130	25.6917	26.0653	26.4679	26.7526	27.0501	(38)
Heat transfer coeff	49.5754	49.4120	49.2519	48.5000	48.3593	47.7043	47.7043	47.5830	47.9566	48.3593	48.6439	48.9414	(39)
Average = Sum(39)m / 12 =												48.4993	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9407	0.9376	0.9346	0.9203	0.9176	0.9052	0.9052	0.9029	0.9100	0.9176	0.9230	0.9287	(40)
HLP (average)												0.9203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697	(42)
Average daily hot water use (litres/day)	76.2308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6529	16.3140	16.8346	14.6768	14.0827	12.1523	11.2609	12.9221	13.0764	15.2393	16.6348	18.0644	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	170.9478	150.8455	158.8253	142.9370	140.4797	126.1073	121.6676	132.7419	132.2677	148.1900	155.9908	167.0240	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9478	150.8455	158.8253	142.9370	140.4797	126.1073	121.6676	132.7419	132.2677	148.1900	155.9908	167.0240	(64)
									Total per year (kWh/year) = Sum(64)m =			1748.0245	(64)
Heat gains from water heating, kWh/month													
	78.6232	69.8312	74.5925	68.6070	68.4926	63.0111	62.2376	65.9198	65.0595	71.0563	72.9474	77.3186	(65)

---

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	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7945	12.2521	9.9641	7.5435	5.6388	4.7605	5.1439	6.6863	8.9743	11.3949	13.2996	14.1778	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.2407	155.8412	151.8079	143.2215	132.3827	122.1957	115.3902	113.7897	117.8230	126.4094	137.2482	147.4352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	(71)
Water heating gains (Table 5)													
	105.6764	103.9155	100.2588	95.2875	92.0600	87.5154	83.6527	88.6019	90.3604	95.5058	101.3158	103.9229	(72)
Total internal gains													
	326.2573	324.5546	314.5765	298.5982	282.6272	267.0174	256.7326	261.6236	269.7034	285.8559	304.4093	318.0816	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(75)
Southeast	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(77)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	426.5593	498.8421	562.1712	620.6779	657.3466	645.1690	618.7550	583.4355	542.9452	480.9415	425.1738	403.5144	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.8214	74.0654	74.3062	75.4582	75.6778	76.7168	76.7168	76.9123	76.3132	75.6778	75.2350	74.7776	
alpha	5.9214	5.9377	5.9537	6.0305	6.0452	6.1145	6.1145	6.1275	6.0875	6.0452	6.0157	5.9852	
util living area	0.9903	0.9757	0.9368	0.8326	0.6608	0.4706	0.3389	0.3746	0.5974	0.8765	0.9763	0.9928	(86)
MIT	20.2488	20.4275	20.6522	20.8697	20.9714	20.9969	20.9997	20.9994	20.9878	20.8485	20.5147	20.2171	(87)
Th 2	20.1330	20.1356	20.1382	20.1503	20.1525	20.1631	20.1631	20.1650	20.1590	20.1525	20.1480	20.1432	(88)
util rest of house	0.9875	0.9689	0.9204	0.7971	0.6080	0.4103	0.2746	0.3069	0.5296	0.8402	0.9685	0.9906	(89)
MIT 2	19.1461	19.4039	19.7191	20.0116	20.1278	20.1612	20.1630	20.1648	20.1507	19.9948	19.5410	19.1081	(90)
Living area fraction									fLA = Living area / (4) =			0.4744	(91)
MIT	19.6692	19.8895	20.1618	20.4187	20.5280	20.5576	20.5599	20.5607	20.5478	20.3998	20.0029	19.6342	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6692	19.8895	20.1618	20.4187	20.5280	20.5576	20.5599	20.5607	20.5478	20.3998	20.0029	19.6342	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9856	0.9666	0.9209	0.8089	0.6319	0.4389	0.3051	0.3390	0.5614	0.8517	0.9669	0.9889	(94)
Useful gains	420.3981	482.1883	517.7135	502.0811	415.3497	283.1444	188.8101	197.8047	304.8106	409.6009	411.0845	399.0499	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	761.9330	740.6622	672.8678	558.6558	426.9153	284.2053	188.9029	197.9788	309.2157	473.9122	627.6474	755.3716	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	254.1020	173.6944	115.4348	40.7338	8.6049	0.0000	0.0000	0.0000	0.0000	47.8476	155.9253	265.1034	(98)
Space heating												1061.4462	(98)
Space heating per m2											(98) / (4) =	20.1413	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1135.2365	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	254.1020	173.6944	115.4348	40.7338	8.6049	0.0000	0.0000	0.0000	0.0000	47.8476	155.9253	265.1034	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	271.7669	185.7695	123.4597	43.5656	9.2031	0.0000	0.0000	0.0000	0.0000	51.1739	166.7650	283.5330	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9478	150.8455	158.8253	142.9370	140.4797	126.1073	121.6676	132.7419	132.2677	148.1900	155.9908	167.0240	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8693	85.1907	83.9791	81.9488	80.3483	79.8000	79.8000	79.8000	79.8000	82.1712	84.8127	86.0408	(217)
Fuel for water heating, kWh/month													
	199.0789	177.0681	189.1248	174.4224	174.8384	158.0291	152.4657	166.3432	165.7490	180.3429	183.9238	194.1218	(219)
Water heating fuel used												2115.5081	(219)
Annual totals kWh/year													
Space heating fuel - main system												1135.2365	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												243.6143	(232)
Total delivered energy for all uses												3569.3589	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1135.2365	0.2160	245.2111	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2115.5081	0.2160	456.9497	(264)
Space and water heating			702.1608	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	243.6143	0.5190	126.4358	(268)
Total CO2, kg/m2/year			867.5217	(272)
Emissions per m2 for space and water heating			13.3237	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3992	(272b)
Emissions per m2 for pumps and fans			0.7386	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3237 * 1.00) + 2.3992 + 0.7386, rounded to 2 d.p.			16.4600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2906	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2470	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3149	0.3087	0.3025	0.2717	0.2655	0.2346	0.2346	0.2285	0.2470	0.2655	0.2778	0.2902	(22b)
Effective ac	0.5496	0.5477	0.5458	0.5369	0.5352	0.5275	0.5275	0.5261	0.5305	0.5352	0.5386	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1500	1.5900			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1854			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		23.5454	(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	25.8058	25.7154	25.6268	25.2106	25.1328	24.7703	24.7703	24.7032	24.9099	25.1328	25.2903	25.4550	(38)
Heat transfer coeff	49.3513	49.2609	49.1723	48.7561	48.6782	48.3157	48.3157	48.2486	48.4553	48.6782	48.8357	49.0004	(39)
Average = Sum(39)m / 12 =												48.7557	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9365	0.9347	0.9331	0.9252	0.9237	0.9168	0.9168	0.9155	0.9195	0.9237	0.9267	0.9298	(40)
HLP (average)												0.9252	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697	(42)
Average daily hot water use (litres/day)	76.2308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.4250	23.1115	23.8490	20.7921	19.9505	17.2158	15.9529	18.3062	18.5249	21.5890	23.5660	25.5912 (65)

---

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	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	(66)

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

	13.7945	12.2521	9.9641	7.5435	5.6388	4.7605	5.1439	6.6863	8.9743	11.3949	13.2996	14.1778	(67)

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

	154.2407	155.8412	151.8079	143.2215	132.3827	122.1957	115.3902	113.7897	117.8230	126.4094	137.2482	147.4352	(68)

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

	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	(71)

Water heating gains (Table 5)

	35.5175	34.3921	32.0550	28.8779	26.8152	23.9108	21.4421	24.6052	25.7290	29.0174	32.7306	34.3968	(72)

Total internal gains

	253.0983	252.0311	243.3728	229.1886	214.3825	200.4128	191.5220	194.6269	202.0720	216.3675	232.8241	245.5555	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(77)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	376.8269	467.0253	548.7957	626.4933	676.6213	666.8855	638.0985	591.6012	539.1322	457.0174	381.7943	350.9419	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.6626	29.7171	29.7706	30.0248	30.0728	30.2984	30.2984	30.3406	30.2111	30.0728	29.9758	29.8750	
alpha	2.9775	2.9811	2.9847	3.0017	3.0049	3.0199	3.0199	3.0227	3.0141	3.0049	2.9984	2.9917	
util living area	0.9447	0.9035	0.8372	0.7271	0.5863	0.4381	0.3250	0.3628	0.5547	0.7873	0.9134	0.9537	(86)
MIT	19.2861	19.6404	20.0706	20.5059	20.7941	20.9371	20.9809	20.9731	20.8701	20.4613	19.7871	19.2071	(87)
Th 2	20.1366	20.1381	20.1395	20.1462	20.1474	20.1532	20.1532	20.1543	20.1510	20.1474	20.1449	20.1422	(88)
util rest of house	0.9376	0.8918	0.8185	0.6981	0.5459	0.3865	0.2653	0.3002	0.5005	0.7566	0.9009	0.9476	(89)
MIT 2	18.5688	18.9140	19.3276	19.7383	19.9936	20.1144	20.1444	20.1412	20.0649	19.7097	19.0679	18.4957	(90)
Living area fraction									fLA = Living area / (4) =			0.4744	(91)
MIT	18.9091	19.2586	19.6801	20.1024	20.3733	20.5047	20.5412	20.5358	20.4469	20.0662	19.4091	18.8332	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9091	19.2586	19.6801	20.1024	20.3733	20.5047	20.5412	20.5358	20.4469	20.0662	19.4091	18.8332	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9252	0.8781	0.8075	0.6966	0.5570	0.4083	0.2929	0.3288	0.5200	0.7534	0.8883	0.9361	(94)
Useful gains	348.6323	410.0880	443.1605	436.3888	376.8630	272.2946	186.9290	194.5340	280.3557	344.3105	339.1292	328.5143	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	720.9756	707.3169	648.0932	546.1851	422.2028	285.2886	190.4221	199.5485	307.5401	460.7993	601.1234	717.0323	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	277.0234	199.7378	152.4700	79.0534	33.7328	0.0000	0.0000	0.0000	0.0000	86.6677	188.6358	289.0573	(98)
Space heating												1306.3782	(98)
Space heating per m2											(98) / (4) =	24.7890	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	454.1676	357.5362	366.6892	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9229	0.9511	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	419.1690	340.0478	344.4041	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.2040	811.2810	757.9345	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	307.4652	350.5975	307.6666	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												965.7293	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    76.8663    87.6494    76.9166     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          241.4323 (107)
Space cooling per m2                                                                                                                     4.5813 (108)
Energy for space heating                                                                                                                24.7890 (99)
Energy for space cooling                                                                                                                 4.5813 (108)
Total                                                                                                                                   29.3702 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   29.4 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1406	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3906	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3320	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4233	0.4150	0.4067	0.3652	0.3569	0.3154	0.3154	0.3071	0.3320	0.3569	0.3735	0.3901	(22b)
Effective ac	0.5896	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5471	0.5551	0.5637	0.5697	0.5761	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1800	1.9080			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4913			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		21.8913	(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	27.6840	27.5207	27.3606	26.6086	26.4679	25.8130	25.8130	25.6917	26.0653	26.4679	26.7526	27.0501	(38)
Heat transfer coeff	49.5754	49.4120	49.2519	48.5000	48.3593	47.7043	47.7043	47.5830	47.9566	48.3593	48.6439	48.9414	(39)
Average = Sum(39)m / 12 =												48.4993	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9407	0.9376	0.9346	0.9203	0.9176	0.9052	0.9052	0.9029	0.9100	0.9176	0.9230	0.9287	(40)
HLP (average)												0.9203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697	(42)
Average daily hot water use (litres/day)	76.2308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	26.4250	23.1115	23.8490	20.7921	19.9505	17.2158	15.9529	18.3062	18.5249	21.5890	23.5660	25.5912	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	88.4859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7945	12.2521	9.9641	7.5435	5.6388	4.7605	5.1439	6.6863	8.9743	11.3949	13.2996	14.1778	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.2407	155.8412	151.8079	143.2215	132.3827	122.1957	115.3902	113.7897	117.8230	126.4094	137.2482	147.4352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	31.8486	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	(71)
Water heating gains (Table 5)													
	35.5175	34.3921	32.0550	28.8779	26.8152	23.9108	21.4421	24.6052	25.7290	29.0174	32.7306	34.3968	(72)
Total internal gains													
	253.0983	252.0311	243.3728	229.1886	214.3825	200.4128	191.5220	194.6269	202.0720	216.3675	232.8241	245.5555	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(75)
Southeast	8.0000	36.7938	0.6300	0.7000	0.7700	89.9574	(77)

Solar gains	100.3020	174.2875	247.5946	322.0797	374.7194	378.1516	362.0224	321.8119	273.2418	195.0857	120.7645	85.4327	(83)
Total gains	353.4004	426.3187	490.9674	551.2683	589.1018	578.5644	553.5445	516.4388	475.3138	411.4532	353.5886	330.9883	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.8214	74.0654	74.3062	75.4582	75.6778	76.7168	76.7168	76.9123	76.3132	75.6778	75.2350	74.7776	
alpha	5.9214	5.9377	5.9537	6.0305	6.0452	6.1145	6.1145	6.1275	6.0875	6.0452	6.0157	5.9852	
util living area													
	0.9963	0.9884	0.9638	0.8831	0.7219	0.5226	0.3786	0.4226	0.6709	0.9286	0.9902	0.9974	(86)
MIT	20.1184	20.3064	20.5530	20.8140	20.9545	20.9945	20.9994	20.9988	20.9776	20.7751	20.3940	20.0862	(87)
Th 2	20.1330	20.1356	20.1382	20.1503	20.1525	20.1631	20.1631	20.1650	20.1590	20.1525	20.1480	20.1432	(88)
util rest of house													
	0.9951	0.9849	0.9531	0.8533	0.6686	0.4566	0.3069	0.3466	0.5991	0.9026	0.9867	0.9966	(89)
MIT 2	19.3303	19.5184	19.7602	20.0104	20.1249	20.1608	20.1629	20.1647	20.1482	19.9840	19.6166	19.3068	(90)
Living area fraction										fLA = Living area / (4) =		0.4744	(91)
MIT	19.7042	19.8922	20.1363	20.3916	20.5184	20.5563	20.5597	20.5604	20.5416	20.3593	19.9854	19.6765	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7042	19.8922	20.1363	20.3916	20.5184	20.5563	20.5597	20.5604	20.5416	20.3593	19.9854	19.6765	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9837	0.9530	0.8624	0.6923	0.4879	0.3409	0.3827	0.6326	0.9097	0.9858	0.9960	(94)
Useful gains	351.4097	419.3638	467.9093	475.4246	407.8437	282.2594	188.7214	197.6200	300.6818	374.3068	348.5755	329.6707	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	763.6686	740.7964	671.6144	557.3419	426.4525	284.1416	188.8952	197.9631	308.9193	471.9523	626.7950	757.4442	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	306.7206	216.0027	151.5566	58.9805	13.8450	0.0000	0.0000	0.0000	0.0000	72.6482	200.3180	318.2635	(98)
Space heating												1338.3352	(98)
Space heating per m2											(98) / (4) =	25.3954	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	448.4207	353.0121	361.6312	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9814	0.9931	0.9894	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	440.0804	350.5635	357.7818	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	742.9715	712.4516	670.0823	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	218.0816	269.2448	232.3516	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												719.6780	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	54.5204	67.3112	58.0879	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	179.9195 (107)
Space cooling per m2	3.4140 (108)
Energy for space heating	25.3954 (99)
Energy for space cooling	3.4140 (108)
Total	28.8094 (109)
Target Fabric Energy Efficiency (TFEE)	33.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1500	1.5900			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1854			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.5454	(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	10.9554	10.8057	10.6560	10.3567	10.3567	9.7580	10.0573	9.7580	9.6083	9.9077	9.9077	10.5063	(38)
Heat transfer coeff	34.5008	34.3511	34.2014	33.9021	33.9021	33.3034	33.6027	33.3034	33.1537	33.4531	33.4531	34.0518	(39)
Average = Sum(39)m / 12 =												33.7649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6547	0.6518	0.6490	0.6433	0.6433	0.6319	0.6376	0.6319	0.6291	0.6348	0.6348	0.6461	(40)
HLP (average)												0.6407	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697 (42)
Average daily hot water use (litres/day)	76.2308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6529	16.3140	16.8346	14.6768	14.0827	12.1523	11.2609	12.9221	13.0764	15.2393	16.6348	18.0644	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              179.6297   158.6872   167.5072   151.3388   149.1616   134.5091   130.3495   141.4238   140.6696   156.8719   164.3927   175.7059 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              179.6297   158.6872   167.5072   151.3388   149.1616   134.5091   130.3495   141.4238   140.6696   156.8719   164.3927   175.7059 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1850.2469 (64)
RHI water heating demand                                                                                    1850 (64)
Heat gains from water heating, kWh/month
               85.5688    76.1046    81.5380    75.3285    75.4381    69.7326    69.1831    72.8653    71.7809    78.0018    79.6689    84.2641 (65)


-------------------------------------------------------------------------------------------------------------
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         106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830   106.1830 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               34.4861    30.6303    24.9102    18.8586    14.0970    11.9013    12.8598    16.7157    22.4357    28.4873    33.2489    35.4446 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              230.2100   232.5988   226.5790   213.7634   197.5861   182.3817   172.2242   169.8354   175.8552   188.6708   204.8481   220.0525 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880    47.3880 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887   -70.7887 (71)
Water heating gains (Table 5)
              115.0118   113.2509   109.5941   104.6229   101.3953    96.8508    92.9881    97.9373    99.6957   104.8411   110.6512   113.2582 (72)
Total internal gains
              462.4902   459.2623   443.8657   420.0273   395.8609   373.9162   360.8545   367.2707   380.7690   404.7816   431.5305   451.5377 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data      Specific data      factor             W
                                                         W/m2          or Table 6b        or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------
Northeast                              3.0000           12.4885           0.6800             0.8000           0.7700          14.1242 (75)
Southeast                              8.0000           39.0225           0.6800             0.8000           0.7700         117.6893 (77)
-------------------------------------------------------------------------------------------------------------

Solar gains   131.8135   202.0460   294.5937   397.9076   452.6293   488.5552   466.1742   425.9578   357.7418   251.9288   163.9249   115.0032 (83)
Total gains   594.3037   661.3083   738.4594   817.9348   848.4901   862.4714   827.0286   793.2285   738.5109   656.7104   595.4554   566.5409 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           42.4306    42.6155    42.8020    43.1799    43.1799    43.9561    43.5646    43.9561    44.1546    43.7595    43.7595    42.9901
alpha          3.8287     3.8410     3.8535     3.8787     3.8787     3.9304     3.9043     3.9304     3.9436     3.9173     3.9173     3.8660
util living area
                0.7435     0.6789     0.5579     0.4178     0.2860     0.1621     0.0934     0.1008     0.2284     0.4282     0.6311     0.7599 (86)

MIT            20.6481    20.7564    20.8941    20.9692    20.9943    20.9996    21.0000    21.0000    20.9984    20.9732    20.8527    20.6285 (87)
Th 2           20.3811    20.3836    20.3861    20.3912    20.3912    20.4013    20.3963    20.4013    20.4039    20.3988    20.3988    20.3886 (88)
util rest of house
                0.7253     0.6591     0.5355     0.3946     0.2623     0.1390     0.0689     0.0756     0.2019     0.4002     0.6074     0.7423 (89)
MIT 2          19.9289    20.0753    20.2578    20.3563    20.3856    20.4011    20.3962    20.4013    20.4026    20.3700    20.2194    19.9097 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.4744 (91)
MIT            20.2701    20.3984    20.5596    20.6471    20.6743    20.6850    20.6826    20.6853    20.6852    20.6562    20.5198    20.2507 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   20.2701    20.3984    20.5596    20.6471    20.6743    20.6850    20.6826    20.6853    20.6852    20.6562    20.5198    20.2507 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.7220     0.6595     0.5419     0.4044     0.2733     0.1499     0.0806     0.0875     0.2144     0.4123     0.6123     0.7382 (94)
Useful gains  429.0587   436.1643   400.1526   330.7644   231.9268   129.3205    66.6190    69.4435   158.3581   270.7380   364.5715   418.2106 (95)
Ext temp.       5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              502.6781   487.7292   422.7174   337.2267   233.0543   129.3841    66.6223    69.4479   158.6476   276.1939   395.4096   495.4769 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               54.7728    34.6516    16.7881     4.6529     0.8389     0.0000     0.0000     0.0000     0.0000     4.0592    22.2035    57.4861 (98)
Space heating                                                                                                                195.4530 (98)
RHI space heating demand                                                                                                     195 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1500	1.5900			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1854			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.5454	(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	12.7514	12.6017	12.4521	11.7037	11.5540	10.8057	10.8057	10.6560	11.1050	11.5540	11.8534	12.1527	(38)
Heat transfer coeff	36.2968	36.1472	35.9975	35.2491	35.0995	34.3511	34.3511	34.2014	34.6504	35.0995	35.3988	35.6981	(39)
Average = Sum(39)m / 12 =												35.2117	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6887	0.6859	0.6831	0.6689	0.6660	0.6518	0.6518	0.6490	0.6575	0.6660	0.6717	0.6774	(40)
HLP (average)												0.6682	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697	(42)
Average daily hot water use (litres/day)	76.2308	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6529	16.3140	16.8346	14.6768	14.0827	12.1523	11.2609	12.9221	13.0764	15.2393	16.6348	18.0644	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.6297 158.6872 167.5072 151.3388 149.1616 134.5091 130.3495 141.4238 140.6696 156.8719 164.3927 175.7059 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6297 158.6872 167.5072 151.3388 149.1616 134.5091 130.3495 141.4238 140.6696 156.8719 164.3927 175.7059 (64)
Total per year (kWh/year) = Sum(64)m = 1850.2469 (64)
Heat gains from water heating, kWh/month
85.5688 76.1046 81.5380 75.3285 75.4381 69.7326 69.1831 72.8653 71.7809 78.0018 79.6689 84.2641 (65)

---

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	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
34.4861 30.6303 24.9102 18.8586 14.0970 11.9013 12.8598 16.7157 22.4357 28.4873 33.2489 35.4446 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
230.2100 232.5988 226.5790 213.7634 197.5861 182.3817 172.2242 169.8354 175.8552 188.6708 204.8481 220.0525 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 47.3880 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 -70.7887 (71)
Water heating gains (Table 5)
115.0118 113.2509 109.5941 104.6229 101.3953 96.8508 92.9881 97.9373 99.6957 104.8411 110.6512 113.2582 (72)
Total internal gains
462.4902 459.2623 443.8657 420.0273 395.8609 373.9162 360.8545 367.2707 380.7690 404.7816 431.5305 451.5377 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(75)
Southeast	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(77)

Solar gains	123.7286	214.9941	305.4229	397.3047	462.2388	466.4727	446.5764	396.9743	337.0602	240.6499	148.9702	105.3864	(83)
Total gains	586.2188	674.2565	749.2885	817.3319	858.0997	840.3889	807.4309	764.2450	717.8292	645.4315	580.5007	556.9241	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3310	40.4980	40.6664	41.5298	41.7069	42.6155	42.6155	42.8020	42.2473	41.7069	41.3542	41.0074	
alpha	3.6887	3.6999	3.7111	3.7687	3.7805	3.8410	3.8410	3.8535	3.8165	3.7805	3.7569	3.7338	
util living area	0.7997	0.7259	0.6291	0.4993	0.3742	0.2605	0.1869	0.2055	0.3297	0.5351	0.7202	0.8169	(86)
MIT	20.4457	20.6262	20.7953	20.9251	20.9785	20.9961	20.9992	20.9988	20.9901	20.9198	20.6993	20.4131	(87)
Th 2	20.3508	20.3533	20.3558	20.3684	20.3709	20.3836	20.3836	20.3861	20.3785	20.3709	20.3659	20.3609	(88)
util rest of house	0.7843	0.7078	0.6080	0.4764	0.3501	0.2357	0.1608	0.1782	0.3008	0.5074	0.6993	0.8024	(89)
MIT 2	19.6249	19.8719	20.1001	20.2796	20.3475	20.3800	20.3830	20.3852	20.3690	20.2786	19.9869	19.5889	(90)
Living area fraction									fLA = Living area / (4) =			0.4744	(91)
MIT	20.0143	20.2297	20.4299	20.5858	20.6468	20.6723	20.6753	20.6763	20.6636	20.5828	20.3249	19.9799	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0143	20.2297	20.4299	20.5858	20.6468	20.6723	20.6753	20.6763	20.6636	20.5828	20.3249	19.9799	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7758	0.7042	0.6105	0.4843	0.3607	0.2473	0.1732	0.1911	0.3141	0.5168	0.6979	0.7932	(94)
Useful gains	454.7987	474.8227	457.4465	395.8578	309.5386	207.8461	139.8532	146.0541	225.4918	333.5757	405.1054	441.7684	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	570.3777	554.1264	501.4404	411.9147	314.0284	208.5898	139.9914	146.2562	227.4328	350.3914	468.1448	563.3125	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	85.9908	53.2921	32.7315	11.5610	3.3404	0.0000	0.0000	0.0000	0.0000	12.5108	45.3883	90.4288	(98)
Space heating												335.2437	(98)
Space heating per m2											(98) / (4) =	6.3614	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	322.9003	254.1981	259.9309	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9883	0.9940	0.9922	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	319.1087	252.6780	257.8985	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	919.1440	882.8269	831.2666	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	432.0254	468.8308	426.5859	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1327.4420	(104)
Cooled fraction										fC = cooled area / (4) =		1.1385	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	122.9674	133.4433	121.4191	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												377.8298	(107)
Space cooling per m2												7.1694	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	335.2437	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	123.2021	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	228.8038	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1850.2469	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	679.9657	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1262.7935	(310b)
Electricity used for heat distribution	22.9477	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	87.4606	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.3457	(330a)
Total electricity for the above, kWh/year	119.3457	(331)
Electricity for lighting (calculated in Appendix L)	243.6143	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2745.1858	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	123.2021	4.2400	5.2238	(340a)
Space heating from Combined Heat and Power	228.8038	2.9700	6.7955	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	679.9657	4.2400	28.8305	(342a)
Water heating from Combined Heat and Power	1262.7935	2.9700	37.5050	(342b)
Space cooling	87.4606	13.1900	11.5361	(348)
Mechanical ventilation fans	119.3457	13.1900	15.7417	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	243.6143	13.1900	32.1327	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			218.1952	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.9380	(357)
SAP value	86.9150	
SAP rating (Section 12)	87	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	845.4398	0.2160	182.6150 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	416.0070	0.2160	89.8575 (363)
less credit emissions for electricity	-145.6024	0.5190	-75.5677 (364)
Water heating from Combined Heat and Power	2295.9882	0.2160	495.9335 (365)
less credit emissions for electricity	-803.5959	0.5190	-417.0663 (366)
Electrical energy for heat distribution	22.9477	0.5190	11.9098 (372)
Total CO2 associated with community systems			287.6819 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			287.6819 (376)
Space cooling	87.4606	0.5190	45.3921 (377)
Pumps and fans	119.3457	0.5190	61.9404 (378)
Energy for lighting	243.6143	0.5190	126.4358 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			365.7502 (383)
CO2 emissions per m2			6.9400 (384)
EI value			94.9836 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7000 (1b)	x	2.7000 (2b)	=	142.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)
								Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =							0.0000 / (5) =	0.0000	(8)
Pressure test								Yes	
Measured/design q50								3.0000	
Infiltration rate								0.1500	(18)
Number of sides sheltered								2	(19)
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	21.6000	11.0000	10.6000	0.1500	1.5900			(29a)
Total net area of external elements Aum(A, m2)			21.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.1854			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.5454	(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	10.9554	10.8057	10.6560	10.3567	10.3567	9.7580	10.0573	9.7580	9.6083	9.9077	9.9077	10.5063	(38)
Heat transfer coeff	34.5008	34.3511	34.2014	33.9021	33.9021	33.3034	33.6027	33.3034	33.1537	33.4531	33.4531	34.0518	(39)
Average = Sum(39)m / 12 =												33.7649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6547	0.6518	0.6490	0.6433	0.6433	0.6319	0.6376	0.6319	0.6291	0.6348	0.6348	0.6461	(40)
HLP (average)												0.6407	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7697 (42)
Average daily hot water use (litres/day)	76.2308 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.8539	80.8046	77.7554	74.7062	71.6569	68.6077	68.6077	71.6569	74.7062	77.7554	80.8046	83.8539	(44)
Energy conte	124.3529	108.7598	112.2304	97.8452	93.8848	81.0154	75.0727	86.1470	87.1759	101.5951	110.8990	120.4291	(45)
Energy content (annual)										Total = Sum(45)m =		1199.4071	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6529	16.3140	16.8346	14.6768	14.0827	12.1523	11.2609	12.9221	13.0764	15.2393	16.6348	18.0644	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
179.6297 158.6872 167.5072 151.3388 149.1616 134.5091 130.3495 141.4238 140.6696 156.8719 164.3927 175.7059 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6297 158.6872 167.5072 151.3388 149.1616 134.5091 130.3495 141.4238 140.6696 156.8719 164.3927 175.7059 (64)
Total per year (kWh/year) = Sum(64)m = 1850.2469 (64)
Heat gains from water heating, kWh/month
85.5688 76.1046 81.5380 75.3285 75.4381 69.7326 69.1831 72.8653 71.7809 78.0018 79.6689 84.2641 (65)

---

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	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	106.1830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.4861	30.6303	24.9102	18.8586	14.0970	11.9013	12.8598	16.7157	22.4357	28.4873	33.2489	35.4446	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	230.2100	232.5988	226.5790	213.7634	197.5861	182.3817	172.2242	169.8354	175.8552	188.6708	204.8481	220.0525	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	47.3880	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	-70.7887	(71)
Water heating gains (Table 5)													
	115.0118	113.2509	109.5941	104.6229	101.3953	96.8508	92.9881	97.9373	99.6957	104.8411	110.6512	113.2582	(72)
Total internal gains													
	462.4902	459.2623	443.8657	420.0273	395.8609	373.9162	360.8545	367.2707	380.7690	404.7816	431.5305	451.5377	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(75)
Southeast	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(77)

Solar gains	131.8135	202.0460	294.5937	397.9076	452.6293	488.5552	466.1742	425.9578	357.7418	251.9288	163.9249	115.0032	(83)
Total gains	594.3037	661.3083	738.4594	817.9348	848.4901	862.4714	827.0286	793.2285	738.5109	656.7104	595.4554	566.5409	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.4306	42.6155	42.8020	43.1799	43.1799	43.9561	43.5646	43.9561	44.1546	43.7595	43.7595	42.9901	
alpha	3.8287	3.8410	3.8535	3.8787	3.8787	3.9304	3.9043	3.9304	3.9436	3.9173	3.9173	3.8660	
util living area													
	0.7435	0.6789	0.5579	0.4178	0.2860	0.1621	0.0934	0.1008	0.2284	0.4282	0.6311	0.7599	(86)
MIT	20.6481	20.7564	20.8941	20.9692	20.9943	20.9996	21.0000	21.0000	20.9984	20.9732	20.8527	20.6285	(87)
Th 2	20.3811	20.3836	20.3861	20.3912	20.3912	20.4013	20.3963	20.4013	20.4039	20.3988	20.3988	20.3886	(88)
util rest of house													
	0.7253	0.6591	0.5355	0.3946	0.2623	0.1390	0.0689	0.0756	0.2019	0.4002	0.6074	0.7423	(89)
MIT 2	19.9289	20.0753	20.2578	20.3563	20.3856	20.4011	20.3962	20.4013	20.4026	20.3700	20.2194	19.9097	(90)
Living area fraction									fLA = Living area / (4) =			0.4744	(91)
MIT	20.2701	20.3984	20.5596	20.6471	20.6743	20.6850	20.6826	20.6853	20.6852	20.6562	20.5198	20.2507	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2701	20.3984	20.5596	20.6471	20.6743	20.6850	20.6826	20.6853	20.6852	20.6562	20.5198	20.2507	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7220	0.6595	0.5419	0.4044	0.2733	0.1499	0.0806	0.0875	0.2144	0.4123	0.6123	0.7382	(94)
Useful gains	429.0587	436.1643	400.1526	330.7644	231.9268	129.3205	66.6190	69.4435	158.3581	270.7380	364.5715	418.2106	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	502.6781	487.7292	422.7174	337.2267	233.0543	129.3841	66.6223	69.4479	158.6476	276.1939	395.4096	495.4769	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	54.7728	34.6516	16.7881	4.6529	0.8389	0.0000	0.0000	0.0000	0.0000	4.0592	22.2035	57.4861	(98)
Space heating												195.4530	(98)
Space heating per m2											(98) / (4) =	3.7088	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	239.7845	178.0945	179.8384	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9966	0.9986	0.9983	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	238.9674	177.8446	179.5415	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	944.9548	905.7334	865.1434	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	508.3109	541.5493	510.0878	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1559.9480	(104)
Cooled fraction										fC = cooled area / (4) =		1.1385	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	144.6805	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												144.6805	(107)
Space cooling per m2												2.7454	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	195.4530	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	71.8290	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	133.3967	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1850.2469	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	679.9657	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1262.7935	(310b)
Electricity used for heat distribution	21.4798	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	33.4909	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	119.3457	(330a)
Total electricity for the above, kWh/year	119.3457	(331)
Electricity for lighting (calculated in Appendix L)	243.6143	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2544.4358	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	71.8290	5.0000	3.5914	(340a)
Space heating from Combined Heat and Power	133.3967	3.5000	4.6689	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	679.9657	5.0000	33.9983	(342a)
Water heating from Combined Heat and Power	1262.7935	3.5000	44.1978	(342b)
Space cooling	33.4909	15.7000	5.2581	(348)
Mechanical ventilation fans	119.3457	15.7000	18.7373	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	243.6143	15.7000	38.2474	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			190.5992	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	791.3629	0.2160	170.9344	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	242.5394	0.2160	52.3885	(363)
less credit emissions for electricity	-84.8888	0.5190	-44.0573	(364)
Water heating from Combined Heat and Power	2295.9882	0.2160	495.9335	(365)
less credit emissions for electricity	-803.5959	0.5190	-417.0663	(366)
Electrical energy for heat distribution	21.4798	0.5190	11.1480	(372)
Total CO2 associated with community systems			269.2808	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			269.2808	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	33.4909	0.5190	17.3818 (377)
Pumps and fans	119.3457	0.5190	61.9404 (378)
Energy for lighting	243.6143	0.5190	126.4358 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			319.3389 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	791.3629	1.2200	965.4627	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	242.5394	1.2200	295.8981	(363)
less credit emissions for electricity	-84.8888	3.0700	-260.6086	(364)
Water heating from Combined Heat and Power	2295.9882	1.2200	2801.1056	(365)
less credit emissions for electricity	-803.5959	3.0700	-2467.0393	(366)
Electrical energy for heat distribution	21.4798	3.0700	65.9431	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1400.7616	(373)
Space and water heating			1400.7616	(376)
Space cooling	33.4909	3.0700	102.8170	(377)
Pumps and fans	119.3457	3.0700	366.3914	(378)
Energy for lighting	243.6143	3.0700	747.8959	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			1696.8659	(383)
Primary energy kWh/m2/year			32.1986	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£62	£62	£0
Community scheme	£175	£175	£0
Space heating	£116	£116	£0
Space cooling	£5	£5	£0
Water heating	£78	£78	£0
Lighting	£38	£38	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£190	£190	£0
Total cost of uses	£190	£190	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	32 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	281.73 (P1)
Transmission heat loss coefficient	23.55 (37)
Summer heat loss coefficient	305.28 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	1.000	0.590	Wide overhang
South East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	0.590	0.490 (P8)
South East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
South East	8.0000	119.9223	0.6800	0.8000	0.9000	422.7407
total:						493.8808

	Jun	Jul	Aug	
Solar gains	521	494	453	(P3)
Internal gains	374	361	367	
Total summer gains	894	855	820	(P5)
Summer gain/loss ratio	2.93	2.80	2.69	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.23	22.00	21.79	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007038	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0105
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	6.56	**TER**	13.93
Environmental	95 A	**% DER<TER**	52.90		
CO_2 Emissions (t/year)	0.42	**DFEE**	25.62	**TFEE**	29.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.91		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, Mid-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               10.6, 75.1, 2.7
Living Area:                   25 m2, fraction: 33.3%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                13.62, 28.62, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.00,
     Window                    Window, External Wall 1, South West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.327
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 75 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.56 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)29.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)25.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls:	Charging system linked to use of community heating, TRVsOK	
Hot water controls:	No cylinder	

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.55	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing South East:	12.00 m², No overhang	
Windows facing South West:	3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

10 Key features
Air permeability 3.0 m³/m²h
Community CHP, Mains gas
Photovoltaic array

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	18.1714	17.9581	17.7448	16.6783	16.4651	15.3986	15.3986	15.1853	15.8252	16.4651	16.8916	17.3182	(38)
Heat transfer coeff	46.7499	46.5366	46.3234	45.2569	45.0436	43.9772	43.9772	43.7639	44.4038	45.0436	45.4702	45.8968	(39)
Average = Sum(39)m / 12 =												45.2036	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6225	0.6197	0.6168	0.6026	0.5998	0.5856	0.5856	0.5827	0.5913	0.5998	0.6055	0.6111	(40)
HLP (average)												0.6019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3633 (42)
Average daily hot water use (litres/day)	90.3290 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1026	19.3311	19.9480	17.3911	16.6872	14.3998	13.3435	15.3119	15.4947	18.0576	19.7113	21.4052	(46)

Water storage loss:		
Store volume	110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (64)
Total per year (kWh/year) = Sum(64)m = 2072.0663 (64)
Heat gains from water heating, kWh/month
93.2156 82.7925 88.4394 81.3452 81.2114 74.7144 73.7995 78.1627 77.1416 84.2492 86.4883 91.6696 (65)

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	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7571	16.6599	13.5487	10.2572	7.6674	6.4732	6.9945	9.0917	12.2028	15.4943	18.0841	19.2784	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	208.8965	211.0642	205.6017	193.9726	179.2930	165.4963	156.2792	154.1115	159.5741	171.2031	185.8827	199.6794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)
Water heating gains (Table 5)													
	125.2898	123.2032	118.8702	112.9795	109.1551	103.7701	99.1929	105.0575	107.1411	113.2381	120.1227	123.2119	(72)
Total internal gains													
	411.3932	409.3771	396.4704	375.6592	354.5654	334.1894	320.9165	326.7106	337.3679	358.3854	382.5394	400.6196	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	3.0000	36.7938	0.6800	0.8000	0.7700	41.6129	(79)

Solar gains	208.0647	354.4112	484.9208	600.8404	672.9913	668.1246	644.1434	590.3156	525.0667	391.6998	249.2136	178.0600	(83)
Total gains	619.4579	763.7883	881.3913	976.4997	1027.5567	1002.3140	965.0600	917.0262	862.4346	750.0853	631.7530	578.6796	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6228	44.8273	45.0337	46.0949	46.3131	47.4362	47.4362	47.6674	46.9805	46.3131	45.8786	45.4522	
alpha	3.9749	3.9885	4.0022	4.0730	4.0875	4.1624	4.1624	4.1778	4.1320	4.0875	4.0586	4.0301	
util living area													
	0.8796	0.7918	0.6798	0.5361	0.4014	0.2798	0.2003	0.2192	0.3521	0.5869	0.8025	0.8973	(86)
MIT	20.3134	20.5789	20.7885	20.9293	20.9812	20.9970	20.9994	20.9992	20.9919	20.9170	20.6333	20.2634	(87)
Th 2	20.4098	20.4123	20.4149	20.4276	20.4302	20.4430	20.4430	20.4456	20.4379	20.4302	20.4251	20.4200	(88)
util rest of house													
	0.8687	0.7764	0.6603	0.5141	0.3780	0.2557	0.1750	0.1929	0.3242	0.5602	0.7852	0.8877	(89)
MIT 2	19.4931	19.8621	20.1474	20.3428	20.4094	20.4401	20.4426	20.4449	20.4298	20.3330	19.9534	19.4314	(90)
Living area fraction									fLA = Living area / (4) =			0.3329	(91)
MIT	19.7661	20.1007	20.3608	20.5380	20.5998	20.6255	20.6279	20.6294	20.6169	20.5274	20.1797	19.7083	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7661	20.1007	20.3608	20.5380	20.5998	20.6255	20.6279	20.6294	20.6169	20.5274	20.1797	19.7083	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8556	0.7678	0.6585	0.5184	0.3850	0.2636	0.1834	0.2016	0.3331	0.5648	0.7774	0.8745	(94)
Useful gains	530.0139	586.4097	580.3630	506.1764	395.6183	264.2162	177.0128	184.9114	287.2584	423.6752	491.1125	506.0674	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	723.0412	707.3896	642.0788	526.7017	400.8775	264.9842	177.1374	185.0960	289.3761	447.1653	594.7374	711.7825	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	143.6123	81.2985	45.9166	14.7782	3.9128	0.0000	0.0000	0.0000	0.0000	17.4766	74.6099	153.0521	(98)
Space heating												534.6571	(98)
Space heating per m2										(98) / (4) =		7.1193	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	413.3855	325.4311	332.6056	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9932	0.9968	0.9960	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	410.5841	324.3974	331.2617	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1246.6970	1201.6364	1146.5929	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	602.0013	652.6658	606.6064	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1861.2736	(104)
Cooled fraction										fC = cooled area / (4) =		0.7989	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	120.2399	130.3594	121.1597	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												371.7590	(107)
Space cooling per m2												4.9502	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	534.6571	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	196.4865	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	364.9034	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2072.0663	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	761.4844	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1414.1853	(310b)
Electricity used for heat distribution	27.3706	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	86.0553	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	170.0733	(330a)
Total electricity for the above, kWh/year	170.0733	(331)
Electricity for lighting (calculated in Appendix L)	331.2558	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3324.4441	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1008.3904	0.2160	217.8123	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	663.4608	0.2160	143.3075	(363)
less credit emissions for electricity	-232.2113	0.5190	-120.5177	(364)
Water heating from Combined Heat and Power	2571.2460	0.2160	555.3891	(365)
less credit emissions for electricity	-899.9361	0.5190	-467.0668	(366)
Electrical energy for heat distribution	27.3706	0.5190	14.2053	(372)
Total CO2 associated with community systems			343.1298	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			343.1298	(376)
Space cooling	86.0553	0.5190	44.6627	(377)
Pumps and fans	170.0733	0.5190	88.2681	(378)
Energy for lighting	331.2558	0.5190	171.9218	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			492.2824	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.5600	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.5600	ZC1
Total Floor Area	TFA	75.1000	
Assumed number of occupants	N	2.3633	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4830	ZC2
CO2 emissions from cooking, equation (L16)		2.3398	ZC3
Total CO2 emissions		25.3829	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.3829	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1480	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3980	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3383	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975	(22b)
Effective ac	0.5930	0.5894	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5790	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			15.0000	1.3258	19.8864			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1800	2.4516			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3380			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		27.7380	(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	39.6801	39.4385	39.2016	38.0891	37.8809	36.9119	36.9119	36.7325	37.2852	37.8809	38.3020	38.7422	(38)
Heat transfer coeff	67.4181	67.1764	66.9396	65.8270	65.6189	64.6499	64.6499	64.4704	65.0231	65.6189	66.0400	66.4802	(39)
Average = Sum(39)m / 12 =												65.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8977	0.8945	0.8913	0.8765	0.8738	0.8609	0.8609	0.8585	0.8658	0.8738	0.8794	0.8852	(40)
HLP (average)												0.8765	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3633	(42)
Average daily hot water use (litres/day)	90.3290	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1026	19.3311	19.9480	17.3911	16.6872	14.3998	13.3435	15.3119	15.4947	18.0576	19.7113	21.4052	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.9457	170.9597	179.5813	161.0326	157.8428	141.0903	135.5516	148.6740	148.3901	166.9791	176.5006	189.2963	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	193.9457	170.9597	179.5813	161.0326	157.8428	141.0903	135.5516	148.6740	148.3901	166.9791	176.5006	189.2963	(64)
								Total per year (kWh/year) = Sum(64)m =				1969.8440	(64)
Heat gains from water heating, kWh/month													
	86.2701	76.5192	81.4939	74.6238	74.2658	67.9930	66.8540	71.2172	70.4201	77.3037	79.7669	84.7241	(65)

---

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	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7571	16.6599	13.5487	10.2572	7.6674	6.4732	6.9945	9.0917	12.2028	15.4943	18.0841	19.2784	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	208.8965	211.0642	205.6017	193.9726	179.2930	165.4963	156.2792	154.1115	159.5741	171.2031	185.8827	199.6794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)
Water heating gains (Table 5)													
	115.9544	113.8678	109.5348	103.6441	99.8197	94.4347	89.8576	95.7221	97.8058	103.9028	110.7873	113.8765	(72)
Total internal gains													
	405.0578	403.0417	390.1351	369.3239	348.2300	327.8540	314.5811	320.3752	331.0325	352.0500	376.2040	394.2842	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6300	0.7000	0.7700	134.9361	(77)
Southwest	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(79)

Solar gains	168.6701	287.3076	393.1068	487.0783	545.5683	541.6231	522.1824	478.5463	425.6515	317.5361	202.0279	144.3465	(83)
Total gains	573.7279	690.3493	783.2418	856.4022	893.7984	869.4771	836.7636	798.9215	756.6840	669.5861	578.2319	538.6307	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.3573	77.6355	77.9102	79.2270	79.4783	80.6696	80.6696	80.8941	80.2065	79.4783	78.9715	78.4486	
alpha	6.1572	6.1757	6.1940	6.2818	6.2986	6.3780	6.3780	6.3929	6.3471	6.2986	6.2648	6.2299	
util living area													
	0.9922	0.9765	0.9350	0.8295	0.6619	0.4737	0.3397	0.3708	0.5840	0.8710	0.9788	0.9945	(86)
MIT	20.2704	20.4656	20.6872	20.8867	20.9754	20.9975	20.9997	20.9996	20.9911	20.8694	20.5370	20.2363	(87)
Th 2	20.1694	20.1722	20.1749	20.1875	20.1899	20.2009	20.2009	20.2030	20.1966	20.1899	20.1851	20.1801	(88)
util rest of house													
	0.9899	0.9699	0.9185	0.7946	0.6109	0.4155	0.2782	0.3068	0.5197	0.8348	0.9718	0.9928	(89)
MIT 2	19.2058	19.4876	19.7981	20.0669	20.1686	20.1994	20.2008	20.2028	20.1906	20.0543	19.6028	19.1647	(90)
Living area fraction									fLA = Living area / (4) =			0.3329	(91)
MIT	19.5602	19.8132	20.0941	20.3398	20.4372	20.4651	20.4668	20.4680	20.4571	20.3256	19.9138	19.5215	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5602	19.8132	20.0941	20.3398	20.4372	20.4651	20.4668	20.4680	20.4571	20.3256	19.9138	19.5215	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9665	0.9167	0.8015	0.6268	0.4349	0.2987	0.3281	0.5409	0.8414	0.9689	0.9910	(94)
Useful gains	566.6563	667.2251	717.9690	686.4150	560.2717	378.0979	249.9072	262.1247	409.2670	563.3953	560.2490	533.7887	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1028.8112	1001.8152	909.9839	753.0484	573.3238	379.1750	249.9861	262.2670	413.3555	638.1831	846.2228	1018.5732	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	343.8433	224.8446	142.8590	47.9761	9.7108	0.0000	0.0000	0.0000	0.0000	55.6421	205.9011	360.6797	(98)
Space heating												1391.4566	(98)
Space heating per m2											(98) / (4) =	18.5281	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1488.1889	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	343.8433	224.8446	142.8590	47.9761	9.7108	0.0000	0.0000	0.0000	0.0000	55.6421	205.9011	360.6797	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	367.7468	240.4755	152.7904	51.3113	10.3858	0.0000	0.0000	0.0000	0.0000	59.5103	220.2151	385.7537	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9457	170.9597	179.5813	161.0326	157.8428	141.0903	135.5516	148.6740	148.3901	166.9791	176.5006	189.2963	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3256	85.5456	84.2113	82.0261	80.3506	79.8000	79.8000	79.8000	79.8000	82.2300	85.2256	86.5076	(217)
Fuel for water heating, kWh/month													
	224.6675	199.8463	213.2509	196.3187	196.4426	176.8049	169.8642	186.3083	185.9525	203.0635	207.0982	218.8204	(219)
Water heating fuel used												2378.4379	(219)
Annual totals kWh/year													
Space heating fuel - main system												1488.1889	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.2558	(232)
Total delivered energy for all uses												4272.8826	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1488.1889	0.2160	321.4488	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.4379	0.2160	513.7426	(264)
Space and water heating			835.1914	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.2558	0.5190	171.9218	(268)
Total CO2, kg/m2/year			1046.0382	(272)
Emissions per m2 for space and water heating			11.1211	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.5183	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.1211 * 1.00) + 2.2892 + 0.5183, rounded to 2 d.p.			13.9300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1480	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2980	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2533	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3229	0.3166	0.3102	0.2786	0.2723	0.2406	0.2406	0.2343	0.2533	0.2723	0.2849	0.2976	(22b)
Effective ac	0.5521	0.5501	0.5481	0.5388	0.5371	0.5289	0.5289	0.5274	0.5321	0.5371	0.5406	0.5443	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		28.5786	(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	36.9455	36.8101	36.6773	36.0536	35.9369	35.3937	35.3937	35.2932	35.6030	35.9369	36.1730	36.4198	(38)
Heat transfer coeff	65.5241	65.3886	65.2559	64.6322	64.5155	63.9723	63.9723	63.8717	64.1815	64.5155	64.7516	64.9983	(39)
Average = Sum(39)m / 12 =												64.6316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8725	0.8707	0.8689	0.8606	0.8591	0.8518	0.8518	0.8505	0.8546	0.8591	0.8622	0.8655	(40)
HLP (average)												0.8606	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3633 (42)
Average daily hot water use (litres/day)		90.3290 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	31.3120	27.3857	28.2596	24.6374	23.6402	20.3997	18.9033	21.6918	21.9509	25.5816	27.9244	30.3240 (65)

---

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	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	(66)

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

	18.7571	16.6599	13.5487	10.2572	7.6674	6.4732	6.9945	9.0917	12.2028	15.4943	18.0841	19.2784	(67)

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

	208.8965	211.0642	205.6017	193.9726	179.2930	165.4963	156.2792	154.1115	159.5741	171.2031	185.8827	199.6794	(68)

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

	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)

Water heating gains (Table 5)

	42.0861	40.7525	37.9833	34.2186	31.7744	28.3329	25.4077	29.1557	30.4873	34.3839	38.7838	40.7581	(72)

Total internal gains

	328.1895	326.9265	315.5836	296.8984	277.1848	258.7522	247.1312	250.8088	260.7141	279.5312	301.2005	318.1658	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	3.0000	36.7938	0.6800	0.8000	0.7700	41.6129	(79)

Solar gains	208.0647	354.4112	484.9208	600.8404	672.9913	668.1246	644.1434	590.3156	525.0667	391.6998	249.2136	178.0600	(83)
Total gains	536.2542	681.3377	800.5044	897.7388	950.1761	926.8768	891.2747	841.1244	785.7808	671.2310	550.4141	496.2258	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.8373	31.9033	31.9682	32.2767	32.3350	32.6096	32.6096	32.6609	32.5033	32.3350	32.2172	32.0948	
alpha	3.1225	3.1269	3.1312	3.1518	3.1557	3.1740	3.1740	3.1774	3.1669	3.1557	3.1478	3.1397	
util living area	0.9419	0.8915	0.8171	0.7045	0.5674	0.4227	0.3102	0.3412	0.5195	0.7592	0.9050	0.9523	(86)
MIT	19.4494	19.8270	20.2302	20.6044	20.8391	20.9531	20.9867	20.9818	20.9083	20.5731	19.9380	19.3653	(87)
Th 2	20.1909	20.1925	20.1940	20.2011	20.2024	20.2086	20.2086	20.2098	20.2062	20.2024	20.1997	20.1969	(88)
util rest of house	0.9347	0.8792	0.7979	0.6760	0.5293	0.3752	0.2564	0.2853	0.4695	0.7281	0.8921	0.9462	(89)
MIT 2	18.7696	19.1365	19.5222	19.8745	20.0818	20.1794	20.2024	20.2008	20.1454	19.8564	19.2558	18.6921	(90)
Living area fraction									fLA = Living area / (4) =			0.3329	(91)
MIT	18.9959	19.3664	19.7579	20.1175	20.3339	20.4370	20.4635	20.4608	20.3993	20.0950	19.4829	18.9162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9959	19.3664	19.7579	20.1175	20.3339	20.4370	20.4635	20.4608	20.3993	20.0950	19.4829	18.9162	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9218	0.8648	0.7865	0.6729	0.5358	0.3891	0.2739	0.3032	0.4820	0.7236	0.8786	0.9344	(94)
Useful gains	494.2986	589.2483	629.6101	604.0805	509.0793	360.6712	244.0942	255.0701	378.7711	485.6932	483.5675	463.6527	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	962.9368	945.9364	865.1530	725.0101	557.0186	373.4035	247.1558	259.3709	404.3016	612.5751	801.8118	956.5277	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	348.6668	239.6944	175.2439	87.0694	35.6668	0.0000	0.0000	0.0000	0.0000	94.4001	229.1359	366.6990	(98)
Space heating												1576.5763	(98)
Space heating per m2										(98) / (4) =		20.9930	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	601.3398	473.3952	485.4252	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9375	0.9621	0.9540	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	563.7519	455.4510	463.1157	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1171.2598	1127.8511	1070.6912	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	437.4057	500.2657	452.0362	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1389.7075	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   109.3514   125.0664   113.0090     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          347.4269 (107)
Space cooling per m2                                                                                                                     4.6262 (108)
Energy for space heating                                                                                                                20.9930 (99)
Energy for space cooling                                                                                                                 4.6262 (108)
Total                                                                                                                                   25.6192 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   25.6 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1480	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3980	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3383	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975	(22b)
Effective ac	0.5930	0.5894	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5790	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			15.0000	1.3258	19.8864			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1800	2.4516			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3380			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		27.7380	(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	39.6801	39.4385	39.2016	38.0891	37.8809	36.9119	36.9119	36.7325	37.2852	37.8809	38.3020	38.7422	(38)
Heat transfer coeff	67.4181	67.1764	66.9396	65.8270	65.6189	64.6499	64.6499	64.4704	65.0231	65.6189	66.0400	66.4802	(39)
Average = Sum(39)m / 12 =												65.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8977	0.8945	0.8913	0.8765	0.8738	0.8609	0.8609	0.8585	0.8658	0.8738	0.8794	0.8852	(40)
HLP (average)												0.8765	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3633	(42)
Average daily hot water use (litres/day)												90.3290	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.3120	27.3857	28.2596	24.6374	23.6402	20.3997	18.9033	21.6918	21.9509	25.5816	27.9244	30.3240	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	118.1663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7571	16.6599	13.5487	10.2572	7.6674	6.4732	6.9945	9.0917	12.2028	15.4943	18.0841	19.2784	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	208.8965	211.0642	205.6017	193.9726	179.2930	165.4963	156.2792	154.1115	159.5741	171.2031	185.8827	199.6794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	34.8166	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)
Water heating gains (Table 5)													
	42.0861	40.7525	37.9833	34.2186	31.7744	28.3329	25.4077	29.1557	30.4873	34.3839	38.7838	40.7581	(72)
Total internal gains													
	328.1895	326.9265	315.5836	296.8984	277.1848	258.7522	247.1312	250.8088	260.7141	279.5312	301.2005	318.1658	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6300	0.7000	0.7700	134.9361	(77)
Southwest	3.0000	36.7938	0.6300	0.7000	0.7700	33.7340	(79)

Solar gains	168.6701	287.3076	393.1068	487.0783	545.5683	541.6231	522.1824	478.5463	425.6515	317.5361	202.0279	144.3465	(83)
Total gains	496.8596	614.2341	708.6904	783.9767	822.7531	800.3753	769.3137	729.3551	686.3656	597.0673	503.2284	462.5123	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	77.3573	77.6355	77.9102	79.2270	79.4783	80.6696	80.6696	80.8941	80.2065	79.4783	78.9715	78.4486	
alpha	6.1572	6.1757	6.1940	6.2818	6.2986	6.3780	6.3780	6.3929	6.3471	6.2986	6.2648	6.2299	
util living area	0.9964	0.9866	0.9571	0.8694	0.7088	0.5132	0.3693	0.4058	0.6377	0.9135	0.9894	0.9976	(86)
MIT	20.1731	20.3763	20.6163	20.8488	20.9644	20.9960	20.9996	20.9993	20.9856	20.8195	20.4475	20.1388	(87)
Th 2	20.1694	20.1722	20.1749	20.1875	20.1899	20.2009	20.2009	20.2030	20.1966	20.1899	20.1851	20.1801	(88)
util rest of house	0.9952	0.9827	0.9450	0.8385	0.6572	0.4508	0.3025	0.3359	0.5699	0.8846	0.9856	0.9968	(89)
MIT 2	19.4152	19.6183	19.8525	20.0747	20.1683	20.1992	20.2008	20.2027	20.1898	20.0567	19.7008	19.3900	(90)
Living area fraction										fLA = Living area / (4) =		0.3329	(91)
MIT	19.6675	19.8706	20.1067	20.3324	20.4333	20.4645	20.4667	20.4679	20.4547	20.3106	19.9494	19.6393	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6675	19.8706	20.1067	20.3324	20.4333	20.4645	20.4667	20.4679	20.4547	20.3106	19.9494	19.6393	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9809	0.9439	0.8444	0.6732	0.4716	0.3248	0.3592	0.5922	0.8894	0.9842	0.9962	(94)
Useful gains	494.0424	602.5122	668.9106	661.9999	553.8723	377.4316	249.8522	262.0163	406.4751	531.0265	495.2930	460.7356	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1036.0485	1005.6720	910.8291	752.5613	573.0692	379.1383	249.9821	262.2593	413.2006	637.2017	848.5715	1026.4048	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	403.2526	270.9234	179.9874	65.2042	14.2825	0.0000	0.0000	0.0000	0.0000	78.9944	254.3605	420.8579	(98)
Space heating												1687.8628	(98)
Space heating per m2											(98) / (4) =	22.4749	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	607.7089	478.4091	489.9753	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9851	0.9948	0.9925	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	598.6275	475.9428	486.3044	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1023.4009	985.2993	940.0517	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	305.8368	378.9612	337.5880	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1022.3861	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	76.4592	94.7403	84.3970	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	255.5965 (107)
Space cooling per m2	3.4034 (108)
Energy for space heating	22.4749 (99)
Energy for space cooling	3.4034 (108)
Total	25.8783 (109)
Target Fabric Energy Efficiency (TFEE)	29.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	15.6119	15.3986	15.1853	14.7587	14.7587	13.9056	14.3322	13.9056	13.6923	14.1189	14.1189	14.9720	(38)
Heat transfer coeff	44.1905	43.9772	43.7639	43.3373	43.3373	42.4842	42.9107	42.4842	42.2709	42.6974	42.6974	43.5506	(39)
Average = Sum(39)m / 12 =												43.1418	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5884	0.5856	0.5827	0.5771	0.5771	0.5657	0.5714	0.5657	0.5629	0.5685	0.5685	0.5799	(40)
HLP (average)												0.5745	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3633 (42)
Average daily hot water use (litres/day)	90.3290 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1026	19.3311	19.9480	17.3911	16.6872	14.3998	13.3435	15.3119	15.4947	18.0576	19.7113	21.4052	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              202.6276   178.8014   188.2632   169.4344   166.5247   149.4922   144.2335   157.3559   156.7919   175.6610   184.9024   197.9782 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              202.6276   178.8014   188.2632   169.4344   166.5247   149.4922   144.2335   157.3559   156.7919   175.6610   184.9024   197.9782 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   2072.0663 (64)
RHI water heating demand                                                                                    2072 (64)
Heat gains from water heating, kWh/month
               93.2156    82.7925    88.4394    81.3452    81.2114    74.7144    73.7995    78.1627    77.1416    84.2492    86.4883    91.6696 (65)


-------------------------------------------------------------------------------------------------------------
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         141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995   141.7995 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               46.8927    41.6497    33.8718    25.6431    19.1685    16.1829    17.4862    22.7292    30.5071    38.7357    45.2103    48.1960 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              311.7858   315.0212   306.8682   289.5114   267.6015   247.0094   233.2526   230.0172   238.1702   255.5270   277.4368   298.0290 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433    51.5433 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330   -94.5330 (71)
Water heating gains (Table 5)
              125.2898   123.2032   118.8702   112.9795   109.1551   103.7701    99.1929   105.0575   107.1411   113.2381   120.1227   123.2119 (72)
Total internal gains
              582.7780   578.6838   558.4199   526.9438   494.7349   465.7721   448.7415   456.6137   474.6282   506.3107   541.5797   568.2466 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g              FF           Access          Gains
                                           m2           Table 6a      Specific data  Specific data      factor              W
                                                           W/m2        or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------
Southeast                                12.0000          39.0225          0.6800         0.8000         0.7700       176.5339 (77)
Southwest                                 3.0000          39.0225          0.6800         0.8000         0.7700        44.1335 (79)
-------------------------------------------------------------------------------------------------------------

Solar gains    220.6674   331.0776   464.0354   596.5553   653.8694   694.8584   667.4563   628.0815   552.5913   407.2899   272.8874   193.5162 (83)
Total gains    803.4454   909.7614  1022.4553  1123.4990  1148.6043  1160.6305  1116.1978  1084.6951  1027.2195   913.6006   814.4671   761.7629 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            47.2073    47.4362    47.6674    48.1366    48.1366    49.1033    48.6151    49.1033    49.3510    48.8580    48.8580    47.9009
alpha           4.1472     4.1624     4.1778     4.2091     4.2091     4.2736     4.2410     4.2736     4.2901     4.2572     4.2572     4.1934
util living area
                0.7307     0.6540     0.5269     0.3923     0.2708     0.1537     0.0884     0.0940     0.2097     0.3969     0.6055     0.7499 (86)

MIT            20.7371    20.8348    20.9365    20.9835    20.9972    20.9998    21.0000    21.0000    20.9994    20.9864    20.9047    20.7182 (87)
Th 2           20.4404    20.4430    20.4456    20.4507    20.4507    20.4610    20.4558    20.4610    20.4635    20.4584    20.4584    20.4481 (88)
util rest of house
                0.7134     0.6354     0.5067     0.3723     0.2504     0.1340     0.0675     0.0729     0.1877     0.3729     0.5837     0.7331 (89)
MIT 2          20.1021    20.2338    20.3684    20.4319    20.4479    20.4609    20.4558    20.4610    20.4630    20.4437    20.3421    20.0842 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.3329 (91)
MIT            20.3135    20.4339    20.5575    20.6155    20.6308    20.6403    20.6370    20.6404    20.6416    20.6243    20.5294    20.2952 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT   20.3135    20.4339    20.5575    20.6155    20.6308    20.6403    20.6370    20.6404    20.6416    20.6243    20.5294    20.2952 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.7093     0.6351     0.5109     0.3783     0.2571     0.1405     0.0745     0.0799     0.1950     0.3803     0.5866     0.7283 (94)
Useful gains  569.9180   577.7877   522.3243   425.0348   295.2958   163.1191    83.1155    86.6830   200.2844   347.4436   477.7756   554.7889 (95)
Ext temp.       5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              645.7774   625.9652   540.8133   429.7109   296.0266   163.1512    83.1168    86.6846   200.4300   351.1578   505.0854   635.6316 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               56.4394    32.3753    13.7558     3.3668     0.5437     0.0000     0.0000     0.0000     0.0000     2.7634    19.6630    60.1470 (98)
Space heating                                                                                                               189.0543 (98)
RHI space heating demand                                                                                                    189 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	18.1714	17.9581	17.7448	16.6783	16.4651	15.3986	15.3986	15.1853	15.8252	16.4651	16.8916	17.3182	(38)
Heat transfer coeff	46.7499	46.5366	46.3234	45.2569	45.0436	43.9772	43.9772	43.7639	44.4038	45.0436	45.4702	45.8968	(39)
Average = Sum(39)m / 12 =												45.2036	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6225	0.6197	0.6168	0.6026	0.5998	0.5856	0.5856	0.5827	0.5913	0.5998	0.6055	0.6111	(40)
HLP (average)												0.6019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3633 (42)
Average daily hot water use (litres/day)	90.3290 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1026	19.3311	19.9480	17.3911	16.6872	14.3998	13.3435	15.3119	15.4947	18.0576	19.7113	21.4052	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (64)
Total per year (kWh/year) = Sum(64)m = 2072.0663 (64)
Heat gains from water heating, kWh/month
93.2156 82.7925 88.4394 81.3452 81.2114 74.7144 73.7995 78.1627 77.1416 84.2492 86.4883 91.6696 (65)

---

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	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.8927	41.6497	33.8718	25.6431	19.1685	16.1829	17.4862	22.7292	30.5071	38.7357	45.2103	48.1960	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	311.7858	315.0212	306.8682	289.5114	267.6015	247.0094	233.2526	230.0172	238.1702	255.5270	277.4368	298.0290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)
Water heating gains (Table 5)													
	125.2898	123.2032	118.8702	112.9795	109.1551	103.7701	99.1929	105.0575	107.1411	113.2381	120.1227	123.2119	(72)
Total internal gains													
	582.7780	578.6838	558.4199	526.9438	494.7349	465.7721	448.7415	456.6137	474.6282	506.3107	541.5797	568.2466	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	3.0000	36.7938	0.6800	0.8000	0.7700	41.6129	(79)

Solar gains	208.0647	354.4112	484.9208	600.8404	672.9913	668.1246	644.1434	590.3156	525.0667	391.6998	249.2136	178.0600	(83)
Total gains	790.8427	933.0950	1043.3407	1127.7842	1167.7263	1133.8967	1092.8849	1046.9293	999.6949	898.0105	790.7932	746.3067	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6228	44.8273	45.0337	46.0949	46.3131	47.4362	47.4362	47.6674	46.9805	46.3131	45.8786	45.4522	
alpha	3.9749	3.9885	4.0022	4.0730	4.0875	4.1624	4.1624	4.1778	4.1320	4.0875	4.0586	4.0301	
util living area													
	0.7938	0.7039	0.5995	0.4720	0.3552	0.2477	0.1769	0.1921	0.3049	0.5035	0.7040	0.8141	(86)
MIT	20.5548	20.7305	20.8653	20.9552	20.9880	20.9981	20.9997	20.9995	20.9953	20.9522	20.7790	20.5217	(87)
Th 2	20.4098	20.4123	20.4149	20.4276	20.4302	20.4430	20.4430	20.4456	20.4379	20.4302	20.4251	20.4200	(88)
util rest of house													
	0.7790	0.6865	0.5801	0.4516	0.3341	0.2263	0.1546	0.1690	0.2804	0.4788	0.6841	0.8002	(89)
MIT 2	19.8255	20.0652	20.2465	20.3744	20.4170	20.4412	20.4427	20.4452	20.4332	20.3750	20.1462	19.7891	(90)
Living area fraction									fLA = Living area / (4) =			0.3329	(91)
MIT	20.0682	20.2867	20.4525	20.5678	20.6071	20.6266	20.6281	20.6297	20.6203	20.5671	20.3568	20.0330	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0682	20.2867	20.4525	20.5678	20.6071	20.6266	20.6281	20.6297	20.6203	20.5671	20.3568	20.0330	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7700	0.6827	0.5813	0.4566	0.3407	0.2333	0.1620	0.1767	0.2884	0.4848	0.6816	0.7904	(94)
Useful gains	608.9325	637.0117	606.5193	515.0002	397.8504	264.5536	177.0693	184.9990	288.2959	435.3567	539.0202	589.8681	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	737.1642	716.0451	646.3271	528.0464	401.2074	265.0326	177.1456	185.1085	289.5266	448.9558	602.7912	726.6827	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	95.4043	53.1104	29.6170	9.3932	2.4976	0.0000	0.0000	0.0000	0.0000	10.1177	45.9151	101.7900	(98)
Space heating												347.8455	(98)
Space heating per m2											(98) / (4) =	4.6318	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	413.3855	325.4311	332.6056	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9932	0.9968	0.9960	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	410.5841	324.3974	331.2617	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1246.6970	1201.6364	1146.5929	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	602.0013	652.6658	606.6064	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1861.2736	(104)
Cooled fraction										fC = cooled area / (4) =		0.7989	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	120.2399	130.3594	121.1597	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												371.7590	(107)
Space cooling per m2												4.9502	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	347.8455	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	127.8332	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	237.4045	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2072.0663	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	761.4844	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1414.1853	(310b)
Electricity used for heat distribution	25.4091	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	86.0553	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	170.0733	(330a)
Total electricity for the above, kWh/year	170.0733	(331)
Electricity for lighting (calculated in Appendix L)	331.2558	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3128.2919	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	127.8332	4.2400	5.4201	(340a)
Space heating from Combined Heat and Power	237.4045	2.9700	7.0509	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	761.4844	4.2400	32.2869	(342a)
Water heating from Combined Heat and Power	1414.1853	2.9700	42.0013	(342b)
Space cooling	86.0553	13.1900	11.3507	(348)
Mechanical ventilation fans	170.0733	13.1900	22.4327	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	331.2558	13.1900	43.6926	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			244.6653	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8556	(357)
SAP value	88.0642	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	936.1238	0.2160	202.2027 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	431.6446	0.2160	93.2352 (363)
less credit emissions for electricity	-151.0756	0.5190	-78.4082 (364)
Water heating from Combined Heat and Power	2571.2460	0.2160	555.3891 (365)
less credit emissions for electricity	-899.9361	0.5190	-467.0668 (366)
Electrical energy for heat distribution	25.4091	0.5190	13.1873 (372)
Total CO2 associated with community systems			318.5393 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			318.5393 (376)
Space cooling	86.0553	0.5190	44.6627 (377)
Pumps and fans	170.0733	0.5190	88.2681 (378)
Energy for lighting	331.2558	0.5190	171.9218 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			467.6919 (383)
CO2 emissions per m2			6.2300 (384)
EI value			94.7818 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.1000 (1b)	x	2.7000 (2b)	=	202.7700	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	202.7700	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	15.6119	15.3986	15.1853	14.7587	14.7587	13.9056	14.3322	13.9056	13.6923	14.1189	14.1189	14.9720	(38)
Heat transfer coeff	44.1905	43.9772	43.7639	43.3373	43.3373	42.4842	42.9107	42.4842	42.2709	42.6974	42.6974	43.5506	(39)
Average = Sum(39)m / 12 =												43.1418	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5884	0.5856	0.5827	0.5771	0.5771	0.5657	0.5714	0.5657	0.5629	0.5685	0.5685	0.5799	(40)
HLP (average)												0.5745	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3633 (42)
Average daily hot water use (litres/day)	90.3290 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.3619	95.7487	92.1356	88.5224	84.9092	81.2961	81.2961	84.9092	88.5224	92.1356	95.7487	99.3619	(44)
Energy conte	147.3508	128.8739	132.9864	115.9407	111.2479	95.9985	88.9567	102.0791	103.2983	120.3842	131.4087	142.7014	(45)
Energy content (annual)										Total = Sum(45)m =		1421.2266	(45)
Distribution loss (46)m = 0.15 x (45)m	22.1026	19.3311	19.9480	17.3911	16.6872	14.3998	13.3435	15.3119	15.4947	18.0576	19.7113	21.4052	(46)

Water storage loss:		
Store volume	110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
202.6276 178.8014 188.2632 169.4344 166.5247 149.4922 144.2335 157.3559 156.7919 175.6610 184.9024 197.9782 (64)
Total per year (kWh/year) = Sum(64)m = 2072.0663 (64)
Heat gains from water heating, kWh/month
93.2156 82.7925 88.4394 81.3452 81.2114 74.7144 73.7995 78.1627 77.1416 84.2492 86.4883 91.6696 (65)

---

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	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	141.7995	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.8927	41.6497	33.8718	25.6431	19.1685	16.1829	17.4862	22.7292	30.5071	38.7357	45.2103	48.1960	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	311.7858	315.0212	306.8682	289.5114	267.6015	247.0094	233.2526	230.0172	238.1702	255.5270	277.4368	298.0290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	51.5433	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	-94.5330	(71)
Water heating gains (Table 5)													
	125.2898	123.2032	118.8702	112.9795	109.1551	103.7701	99.1929	105.0575	107.1411	113.2381	120.1227	123.2119	(72)
Total internal gains													
	582.7780	578.6838	558.4199	526.9438	494.7349	465.7721	448.7415	456.6137	474.6282	506.3107	541.5797	568.2466	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Southwest	3.0000	39.0225	0.6800	0.8000	0.7700	44.1335	(79)

Solar gains	220.6674	331.0776	464.0354	596.5553	653.8694	694.8584	667.4563	628.0815	552.5913	407.2899	272.8874	193.5162	(83)
Total gains	803.4454	909.7614	1022.4553	1123.4990	1148.6043	1160.6305	1116.1978	1084.6951	1027.2195	913.6006	814.4671	761.7629	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.2073	47.4362	47.6674	48.1366	48.1366	49.1033	48.6151	49.1033	49.3510	48.8580	48.8580	47.9009	
alpha	4.1472	4.1624	4.1778	4.2091	4.2091	4.2736	4.2410	4.2736	4.2901	4.2572	4.2572	4.1934	
util living area													
	0.7307	0.6540	0.5269	0.3923	0.2708	0.1537	0.0884	0.0940	0.2097	0.3969	0.6055	0.7499	(86)
MIT	20.7371	20.8348	20.9365	20.9835	20.9972	20.9998	21.0000	21.0000	20.9994	20.9864	20.9047	20.7182	(87)
Th 2	20.4404	20.4430	20.4456	20.4507	20.4507	20.4610	20.4558	20.4610	20.4635	20.4584	20.4584	20.4481	(88)
util rest of house													
	0.7134	0.6354	0.5067	0.3723	0.2504	0.1340	0.0675	0.0729	0.1877	0.3729	0.5837	0.7331	(89)
MIT 2	20.1021	20.2338	20.3684	20.4319	20.4479	20.4609	20.4558	20.4610	20.4630	20.4437	20.3421	20.0842	(90)
Living area fraction									fLA = Living area / (4) =			0.3329	(91)
MIT	20.3135	20.4339	20.5575	20.6155	20.6308	20.6403	20.6370	20.6404	20.6416	20.6243	20.5294	20.2952	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3135	20.4339	20.5575	20.6155	20.6308	20.6403	20.6370	20.6404	20.6416	20.6243	20.5294	20.2952	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7093	0.6351	0.5109	0.3783	0.2571	0.1405	0.0745	0.0799	0.1950	0.3803	0.5866	0.7283	(94)
Useful gains	569.9180	577.7877	522.3243	425.0348	295.2958	163.1191	83.1155	86.6830	200.2844	347.4436	477.7756	554.7889	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	645.7774	625.9652	540.8133	429.7109	296.0266	163.1512	83.1168	86.6846	200.4300	351.1578	505.0854	635.6316	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	56.4394	32.3753	13.7558	3.3668	0.5437	0.0000	0.0000	0.0000	0.0000	2.7634	19.6630	60.1470	(98)
Space heating												189.0543	(98)
Space heating per m2											(98) / (4) =	2.5174	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	305.8859	227.4269	229.4145	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9983	0.9994	0.9993	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	305.3692	227.2821	229.2518	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1277.9442	1228.8852	1190.7349	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	700.2540	745.1927	715.3434	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2160.7902	(104)
Cooled fraction										fC = cooled area / (4) =		0.7989	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	139.8643	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												139.8643	(107)
Space cooling per m2												1.8624	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	189.0543	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	69.4774	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	129.0295	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2072.0663	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	761.4844	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1414.1853	(310b)
Electricity used for heat distribution	23.7418	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	32.3760	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	170.0733	(330a)
Total electricity for the above, kWh/year	170.0733	(331)
Electricity for lighting (calculated in Appendix L)	331.2558	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2907.8818	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	69.4774	5.0000	3.4739	(340a)
Space heating from Combined Heat and Power	129.0295	3.5000	4.5160	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	761.4844	5.0000	38.0742	(342a)
Water heating from Combined Heat and Power	1414.1853	3.5000	49.4965	(342b)
Space cooling	32.3760	15.7000	5.0830	(348)
Mechanical ventilation fans	170.0733	15.7000	26.7015	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	331.2558	15.7000	52.0072	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			221.2523	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	874.6967	0.2160	188.9345	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	234.5992	0.2160	50.6734	(363)
less credit emissions for electricity	-82.1097	0.5190	-42.6149	(364)
Water heating from Combined Heat and Power	2571.2460	0.2160	555.3891	(365)
less credit emissions for electricity	-899.9361	0.5190	-467.0668	(366)
Electrical energy for heat distribution	23.7418	0.5190	12.3220	(372)
Total CO2 associated with community systems			297.6372	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			297.6372	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	32.3760	0.5190	16.8031 (377)
Pumps and fans	170.0733	0.5190	88.2681 (378)
Energy for lighting	331.2558	0.5190	171.9218 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			418.9302 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	874.6967	1.2200	1067.1299	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	234.5992	1.2200	286.2110	(363)
less credit emissions for electricity	-82.1097	3.0700	-252.0768	(364)
Water heating from Combined Heat and Power	2571.2460	1.2200	3136.9201	(365)
less credit emissions for electricity	-899.9361	3.0700	-2762.8038	(366)
Electrical energy for heat distribution	23.7418	3.0700	72.8872	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1548.2676	(373)
Space and water heating			1548.2676	(376)
Space cooling	32.3760	3.0700	99.3943	(377)
Pumps and fans	170.0733	3.0700	522.1251	(378)
Energy for lighting	331.2558	3.0700	1016.9554	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2265.7425	(383)
Primary energy kWh/m2/year			30.1697	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£84	£84	£0
Community scheme	£185	£185	£0
Space heating	£124	£124	£0
Space cooling	£5	£5	£0
Water heating	£88	£88	£0
Lighting	£52	£52	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£222	£222	£0
Total cost of uses	£222	£222	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	30 kWh/m²	30 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	401.48 (P1)
Transmission heat loss coefficient	28.58 (37)
Summer heat loss coefficient	430.06 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	0.000	1.000	None
South West	1.000	0.360	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	0.360	0.260 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
South West	3.0000	119.9223	0.6800	0.8000	0.2600	45.7969
total:						679.9079

	Jun	Jul	Aug	
Solar gains	714	680	634	(P3)
Internal gains	466	449	457	
Total summer gains	1180	1129	1091	(P5)
Summer gain/loss ratio	2.74	2.62	2.54	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.04	21.82	21.64	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007039	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0106
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	7.16	**TER**	14.90
Environmental	94 A	**% DER<TER**	51.94		
CO_2 Emissions (t/year)	0.54	**DFEE**	33.48	**TFEE**	39.51
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.27		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               23.4, 87.7, 2.7
Living Area:                   30 m2, fraction: 34.2%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                36.18, 63.18, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 12.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
     SE                        Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.148
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 88 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.16 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.5 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing North East:		12.00 m², No overhang	
Windows facing South East:		12.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	63.1800	27.0000	36.1800	0.1500	5.4270			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3430			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	45.7030	(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	21.2201	20.9710	20.7219	19.4766	19.2275	17.9821	17.9821	17.7331	18.4803	19.2275	19.7256	20.2238	(38)
Heat transfer coeff	66.9231	66.6740	66.4250	65.1796	64.9305	63.6852	63.6852	63.4361	64.1833	64.9305	65.4287	65.9268	(39)
Average = Sum(39)m / 12 =												65.1173	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7631	0.7603	0.7574	0.7432	0.7404	0.7262	0.7262	0.7233	0.7319	0.7404	0.7461	0.7517	(40)
HLP (average)												0.7425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5929 (42)
Average daily hot water use (litres/day)	95.7817 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4368	20.4980	21.1521	18.4409	17.6945	15.2690	14.1490	16.2362	16.4301	19.1477	20.9012	22.6973	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (64)
Total per year (kWh/year) = Sum(64)m = 2157.8581 (64)
Heat gains from water heating, kWh/month
96.1731 85.3792 91.1086 83.6723 83.4443 76.6412 75.5850 80.2116 79.2149 86.6654 89.1259 94.5338 (65)

---

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	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
20.9310 18.5907 15.1190 11.4461 8.5561 7.2234 7.8051 10.1454 13.6171 17.2901 20.1801 21.5127 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
234.7821 237.2184 231.0790 218.0089 201.5103 186.0040 175.6447 173.2084 179.3479 192.4179 208.9165 224.4229 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 35.9646 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 -103.7165 (71)
Water heating gains (Table 5)
129.2649 127.0524 122.4578 116.2115 112.1563 106.4462 101.5928 107.8113 110.0208 116.4858 123.7859 127.0616 (72)
Total internal gains
446.8717 444.7552 430.5495 407.5602 384.1163 361.5672 346.9363 353.0588 364.8794 388.0875 414.7762 434.8909 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	677.1271	858.1584	1052.4782	1272.5147	1439.0600	1446.7646	1377.4174	1236.0079	1070.0557	860.1640	694.4286	629.4443	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4016	36.5376	36.6746	37.3754	37.5187	38.2524	38.2524	38.4026	37.9555	37.5187	37.2331	36.9517	
alpha	3.4268	3.4358	3.4450	3.4917	3.5012	3.5502	3.5502	3.5602	3.5304	3.5012	3.4822	3.4634	
util living area	0.9206	0.8524	0.7395	0.5696	0.4077	0.2795	0.2029	0.2350	0.4029	0.6761	0.8683	0.9337	(86)
MIT	19.8372	20.1945	20.5641	20.8485	20.9594	20.9922	20.9981	20.9969	20.9720	20.7774	20.2740	19.7714	(87)
Th 2	20.2854	20.2879	20.2904	20.3028	20.3053	20.3178	20.3178	20.3203	20.3128	20.3053	20.3003	20.2954	(88)
util rest of house	0.9118	0.8382	0.7185	0.5433	0.3795	0.2503	0.1716	0.2007	0.3654	0.6452	0.8530	0.9262	(89)
MIT 2	18.7266	19.2300	19.7385	20.1225	20.2614	20.3106	20.3165	20.3180	20.2857	20.0437	19.3590	18.6403	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	19.1065	19.5599	20.0209	20.3708	20.5002	20.5438	20.5496	20.5502	20.5205	20.2947	19.6720	19.0273	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1065	19.5599	20.0209	20.3708	20.5002	20.5438	20.5496	20.5502	20.5205	20.2947	19.6720	19.0273	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8946	0.8221	0.7101	0.5459	0.3875	0.2600	0.1823	0.2123	0.3768	0.6447	0.8376	0.9098	(94)
Useful gains	605.7377	705.4776	747.3505	694.6440	557.6090	376.1316	251.0417	262.4297	403.2461	554.5167	581.6495	572.6885	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	990.8997	977.4370	898.1253	747.6651	571.3992	378.5309	251.5332	263.2724	412.0880	629.4821	822.5702	977.5136	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	286.5605	182.7568	112.1764	38.1752	10.2599	0.0000	0.0000	0.0000	0.0000	55.7742	173.4629	301.1898	(98)
Space heating												1160.3559	(98)
Space heating per m2											(98) / (4) =	13.2310	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	598.6405	471.2702	482.1143	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9859	0.9923	0.9887	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	590.2186	467.6278	476.6620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1775.5436	1692.7290	1528.7219	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	853.4340	911.4753	782.7326	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2547.6419	(104)
Cooled fraction											fC = cooled area / (4) =	0.6842	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	145.9693	155.8966	133.8767	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												435.7426	(107)
Space cooling per m2												4.9686	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1160.3559	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	426.4308	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	791.9429	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2157.8581	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	793.0129	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1472.7382	(310b)
Electricity used for heat distribution	34.8412	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	100.8663	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	198.6076	(330a)
Total electricity for the above, kWh/year	198.6076	(331)
Electricity for lighting (calculated in Appendix L)	369.6479	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4153.2466	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1283.6249	0.2160	277.2630	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1439.8961	0.2160	311.0176	(363)
less credit emissions for electricity	-503.9637	0.5190	-261.5571	(364)
Water heating from Combined Heat and Power	2677.7058	0.2160	578.3845	(365)
less credit emissions for electricity	-937.1970	0.5190	-486.4053	(366)
Electrical energy for heat distribution	34.8412	0.5190	18.0826	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			436.7852	(373)
Space and water heating			436.7852	(376)
Space cooling	100.8663	0.5190	52.3496	(377)
Pumps and fans	198.6076	0.5190	103.0774	(378)
Energy for lighting	369.6479	0.5190	191.8473	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			628.3595	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1600	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1600	ZC1
Total Floor Area	TFA	87.7000	
Assumed number of occupants	N	2.5929	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.8640	ZC2
CO2 emissions from cooking, equation (L16)		2.0665	ZC3
Total CO2 emissions		25.0904	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.0904	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1267	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3767	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3202	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4082	0.4002	0.3922	0.3522	0.3442	0.3042	0.3042	0.2962	0.3202	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5463	0.5463	0.5439	0.5513	0.5592	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			21.9200	1.3258	29.0606			(27)
External Wall 1	63.1800	21.9200	41.2600	0.1800	7.4268			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.4874			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		41.8874	(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	45.5819	45.3290	45.0812	43.9171	43.6993	42.6854	42.6854	42.4976	43.0759	43.6993	44.1399	44.6005	(38)
Heat transfer coeff	87.4693	87.2165	86.9686	85.8045	85.5867	84.5728	84.5728	84.3850	84.9633	85.5867	86.0273	86.4879	(39)
Average = Sum(39)m / 12 =												85.8034	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9974	0.9945	0.9917	0.9784	0.9759	0.9643	0.9643	0.9622	0.9688	0.9759	0.9809	0.9862	(40)
HLP (average)												0.9784	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5929	(42)
Average daily hot water use (litres/day)												95.7817	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4368	20.4980	21.1521	18.4409	17.6945	15.2690	14.1490	16.2362	16.4301	19.1477	20.9012	22.6973	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	202.8405	178.7391	187.6089	168.0313	164.5582	146.8852	140.9214	154.8360	154.6257	174.2460	184.4330	197.9104	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.8405	178.7391	187.6089	168.0313	164.5582	146.8852	140.9214	154.8360	154.6257	174.2460	184.4330	197.9104	(64)
								Total per year (kWh/year) = Sum(64)m =				2055.6358	(64)
Heat gains from water heating, kWh/month													
	89.2276	79.1058	84.1631	76.9508	76.4987	69.9198	68.6395	73.2661	72.4935	79.7199	82.4044	87.5883	(65)

---

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	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9310	18.5907	15.1190	11.4461	8.5561	7.2234	7.8051	10.1454	13.6171	17.2901	20.1801	21.5127	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	234.7821	237.2184	231.0790	218.0089	201.5103	186.0040	175.6447	173.2084	179.3479	192.4179	208.9165	224.4229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)
Water heating gains (Table 5)													
	119.9295	117.7170	113.1224	106.8762	102.8209	97.1108	92.2574	98.4759	100.6854	107.1504	114.4506	117.7262	(72)
Total internal gains													
	440.5363	438.4198	424.2141	401.2248	377.7809	355.2318	340.6009	346.7234	358.5440	381.7521	408.4408	428.5556	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.7400	11.2829	0.6300	0.7000	0.7700	33.5856	(75)
Southeast	9.7400	36.7938	0.6300	0.7000	0.7700	109.5231	(77)
Northwest	2.4400	11.2829	0.6300	0.7000	0.7700	8.4136	(81)

Solar gains	151.5224	272.0491	409.2843	569.2328	694.2790	714.1947	678.1825	581.0801	464.0740	310.6631	184.0294	128.0277	(83)
Total gains	592.0587	710.4689	833.4984	970.4576	1072.0599	1069.4265	1018.7835	927.8036	822.6180	692.4152	592.4702	556.5832	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.6276	69.8295	70.0285	70.9785	71.1592	72.0123	72.0123	72.1725	71.6813	71.1592	70.7947	70.4177	
alpha	5.6418	5.6553	5.6686	5.7319	5.7439	5.8008	5.8008	5.8115	5.7788	5.7439	5.7196	5.6945	
util living area													
	0.9963	0.9894	0.9654	0.8786	0.7025	0.5013	0.3646	0.4168	0.6805	0.9357	0.9908	0.9974	(86)
MIT	20.0408	20.2272	20.4967	20.7949	20.9527	20.9942	20.9992	20.9984	20.9707	20.7321	20.3274	20.0089	(87)
Th 2	20.0855	20.0879	20.0903	20.1014	20.1035	20.1132	20.1132	20.1150	20.1094	20.1035	20.0993	20.0949	(88)
util rest of house													
	0.9952	0.9861	0.9549	0.8473	0.6470	0.4340	0.2915	0.3375	0.6051	0.9110	0.9874	0.9965	(89)
MIT 2	18.8085	19.0806	19.4669	19.8766	20.0619	20.1097	20.1129	20.1143	20.0886	19.8077	19.2362	18.7691	(90)
Living area fraction										fLA = Living area / (4) =		0.3421	(91)
MIT	19.2300	19.4728	19.8192	20.1907	20.3666	20.4123	20.4161	20.4168	20.3904	20.1239	19.6095	19.1932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2300	19.4728	19.8192	20.1907	20.3666	20.4123	20.4161	20.4168	20.3904	20.1239	19.6095	19.1932	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9832	0.9511	0.8507	0.6639	0.4569	0.3165	0.3647	0.6298	0.9116	0.9849	0.9954	(94)
Useful gains	588.3083	698.5392	792.7789	825.5891	711.6892	488.6203	322.4566	338.3351	518.0812	631.2150	583.5431	554.0021	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1305.9201	1270.9893	1158.3480	968.7924	741.7478	491.5596	322.7369	338.9541	534.4511	815.1190	1076.1585	1296.7308	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	533.9032	384.6865	271.9834	103.1063	22.3636	0.0000	0.0000	0.0000	0.0000	136.8246	354.6831	552.5901	(98)
Space heating												2360.1409	(98)
Space heating per m2											(98) / (4) =	26.9115	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2524.2149	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	533.9032	384.6865	271.9834	103.1063	22.3636	0.0000	0.0000	0.0000	0.0000	136.8246	354.6831	552.5901	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	571.0194	411.4294	290.8914	110.2742	23.9183	0.0000	0.0000	0.0000	0.0000	146.3364	379.3402	591.0055	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.8405	178.7391	187.6089	168.0313	164.5582	146.8852	140.9214	154.8360	154.6257	174.2460	184.4330	197.9104	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.2780	86.8075	85.8036	83.5568	80.9450	79.8000	79.8000	79.8000	79.8000	84.1776	86.5308	87.4093	(217)
Fuel for water heating, kWh/month													
	232.4073	205.9028	218.6493	201.0984	203.2963	184.0667	176.5933	194.0301	193.7665	206.9981	213.1416	226.4180	(219)
Water heating fuel used												2456.3684	(219)
Annual totals kWh/year													
Space heating fuel - main system												2524.2149	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.6479	(232)
Total delivered energy for all uses												5425.2312	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2524.2149	0.2160	545.2304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2456.3684	0.2160	530.5756	(264)
Space and water heating			1075.8060	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.6479	0.5190	191.8473	(268)
Total CO2, kg/m2/year			1306.5783	(272)
Emissions per m2 for space and water heating			12.2669	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1875	(272b)
Emissions per m2 for pumps and fans			0.4438	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.2669 * 1.00) + 2.1875 + 0.4438, rounded to 2 d.p.			14.9000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1267	(8)
Pressure test			Yes	
Measured/design q50			3.0000	
Infiltration rate			0.2767	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2352	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2999	0.2940	0.2881	0.2587	0.2528	0.2234	0.2234	0.2176	0.2352	0.2528	0.2646	0.2763	(22b)
Effective ac	0.5450	0.5432	0.5415	0.5335	0.5320	0.5250	0.5250	0.5237	0.5277	0.5320	0.5350	0.5382	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	63.1800	27.0000	36.1800	0.1500	5.4270			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3430			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		45.7030	(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	42.5836	42.4472	42.3134	41.6854	41.5678	41.0208	41.0208	40.9195	41.2315	41.5678	41.8056	42.0541	(38)
Heat transfer coeff	88.2866	88.1502	88.0165	87.3884	87.2709	86.7238	86.7238	86.6225	86.9345	87.2709	87.5086	87.7571	(39)
Average = Sum(39)m / 12 =												87.3878	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0067	1.0051	1.0036	0.9964	0.9951	0.9889	0.9889	0.9877	0.9913	0.9951	0.9978	1.0007	(40)
HLP (average)												0.9964	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5929	(42)
Average daily hot water use (litres/day)												95.7817	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	33.2022	29.0388	29.9655	26.1246	25.0672	21.6311	20.0444	23.0012	23.2759	27.1259	29.6100	32.1545 (65)

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	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	(66)

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

	20.9310	18.5907	15.1190	11.4461	8.5561	7.2234	7.8051	10.1454	13.6171	17.2901	20.1801	21.5127	(67)

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

	234.7821	237.2184	231.0790	218.0089	201.5103	186.0040	175.6447	173.2084	179.3479	192.4179	208.9165	224.4229	(68)

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

	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)

Water heating gains (Table 5)

	44.6266	43.2126	40.2762	36.2842	33.6925	30.0432	26.9414	30.9156	32.3277	36.4595	41.1250	43.2185	(72)

Total internal gains

	362.2334	360.9154	348.3679	327.6329	305.6525	285.1642	272.2849	276.1631	287.1863	308.0612	332.1153	351.0478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	592.4888	774.3186	970.2966	1192.5874	1360.5963	1370.3616	1302.7660	1159.1122	992.3627	780.1376	611.7677	545.6011	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.5932	27.6359	27.6779	27.8768	27.9144	28.0904	28.0904	28.1233	28.0224	27.9144	27.8385	27.7597	
alpha	2.8395	2.8424	2.8452	2.8585	2.8610	2.8727	2.8727	2.8749	2.8682	2.8610	2.8559	2.8506	
util living area	0.9537	0.9100	0.8313	0.6948	0.5330	0.3865	0.2868	0.3331	0.5386	0.7942	0.9249	0.9621	(86)
MIT	19.0507	19.4674	19.9921	20.5076	20.8139	20.9452	20.9827	20.9734	20.8592	20.3799	19.6009	18.9604	(87)
Th 2	20.0778	20.0791	20.0803	20.0863	20.0874	20.0926	20.0926	20.0936	20.0906	20.0874	20.0852	20.0828	(88)
util rest of house	0.9473	0.8986	0.8114	0.6634	0.4916	0.3365	0.2298	0.2711	0.4820	0.7626	0.9133	0.9568	(89)
MIT 2	18.2949	18.7016	19.2049	19.6852	19.9514	20.0599	20.0850	20.0811	19.9991	19.5858	18.8430	18.2100	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	18.5535	18.9636	19.4742	19.9666	20.2465	20.3627	20.3921	20.3864	20.2933	19.8574	19.1023	18.4667	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5535	18.9636	19.4742	19.9666	20.2465	20.3627	20.3921	20.3864	20.2933	19.8574	19.1023	18.4667	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9340	0.8822	0.7968	0.6590	0.4990	0.3517	0.2488	0.2914	0.4951	0.7538	0.8981	0.9449	(94)
Useful gains	553.3925	683.0792	773.1639	785.9622	678.9346	481.8949	324.1301	337.7806	491.3551	588.0756	549.4482	515.5326	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1258.3917	1239.7061	1141.9395	967.0896	745.8577	499.7653	328.8653	345.3080	538.4136	807.9040	1050.3021	1252.0027	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	524.5194	374.0533	274.3690	130.4117	49.7908	0.0000	0.0000	0.0000	0.0000	163.5523	360.6148	547.9337	(98)
Space heating												2425.2450	(98)
Space heating per m2											(98) / (4) =	27.6539	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	815.2040	641.7563	658.3312	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9330	0.9564	0.9410	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	760.6024	613.8009	619.4808	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1699.1406	1618.0776	1451.8262	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	675.7475	747.1818	619.2650	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2042.1944	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	168.9369	186.7955	154.8163	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												510.5486 (107)
Space cooling per m2												5.8215 (108)
Energy for space heating												27.6539 (99)
Energy for space cooling												5.8215 (108)
Total												33.4754 (109)
Dwelling Fabric Energy Efficiency (DFEE)												33.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1267	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3767	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3202	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4082	0.4002	0.3922	0.3522	0.3442	0.3042	0.3042	0.2962	0.3202	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5463	0.5463	0.5439	0.5513	0.5592	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			21.9200	1.3258	29.0606			(27)
External Wall 1	63.1800	21.9200	41.2600	0.1800	7.4268			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.4874			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		41.8874	(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	45.5819	45.3290	45.0812	43.9171	43.6993	42.6854	42.6854	42.4976	43.0759	43.6993	44.1399	44.6005	(38)
Heat transfer coeff	87.4693	87.2165	86.9686	85.8045	85.5867	84.5728	84.5728	84.3850	84.9633	85.5867	86.0273	86.4879	(39)
Average = Sum(39)m / 12 =												85.8034	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9974	0.9945	0.9917	0.9784	0.9759	0.9643	0.9643	0.9622	0.9688	0.9759	0.9809	0.9862	(40)
HLP (average)												0.9784	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5929 (42)
Average daily hot water use (litres/day)		95.7817 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.2022	29.0388	29.9655	26.1246	25.0672	21.6311	20.0444	23.0012	23.2759	27.1259	29.6100	32.1545	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	129.6456	(66)

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

	20.9310	18.5907	15.1190	11.4461	8.5561	7.2234	7.8051	10.1454	13.6171	17.2901	20.1801	21.5127	(67)

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

	234.7821	237.2184	231.0790	218.0089	201.5103	186.0040	175.6447	173.2084	179.3479	192.4179	208.9165	224.4229	(68)

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

	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	35.9646	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)

Water heating gains (Table 5)

	44.6266	43.2126	40.2762	36.2842	33.6925	30.0432	26.9414	30.9156	32.3277	36.4595	41.1250	43.2185	(72)

Total internal gains

	362.2334	360.9154	348.3679	327.6329	305.6525	285.1642	272.2849	276.1631	287.1863	308.0612	332.1153	351.0478	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.7400	11.2829	0.6300	0.7000	0.7700	33.5856	(75)
Southeast	9.7400	36.7938	0.6300	0.7000	0.7700	109.5231	(77)
Northwest	2.4400	11.2829	0.6300	0.7000	0.7700	8.4136	(81)

Solar gains	151.5224	272.0491	409.2843	569.2328	694.2790	714.1947	678.1825	581.0801	464.0740	310.6631	184.0294	128.0277	(83)
Total gains	513.7557	632.9645	757.6522	896.8657	999.9315	999.3589	950.4675	857.2433	751.2604	618.7243	516.1446	479.0755	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.6276	69.8295	70.0285	70.9785	71.1592	72.0123	72.0123	72.1725	71.6813	71.1592	70.7947	70.4177	
alpha	5.6418	5.6553	5.6686	5.7319	5.7439	5.8008	5.8008	5.8115	5.7788	5.7439	5.7196	5.6945	
util living area	0.9982	0.9939	0.9770	0.9061	0.7402	0.5344	0.3905	0.4503	0.7301	0.9587	0.9953	0.9988	(86)
MIT	19.9559	20.1458	20.4257	20.7506	20.9383	20.9920	20.9989	20.9976	20.9582	20.6716	20.2464	19.9243	(87)
Th 2	20.0855	20.0879	20.0903	20.1014	20.1035	20.1132	20.1132	20.1150	20.1094	20.1035	20.0993	20.0949	(88)
util rest of house	0.9976	0.9919	0.9696	0.8792	0.6852	0.4636	0.3123	0.3650	0.6544	0.9409	0.9935	0.9984	(89)
MIT 2	19.1292	19.3200	19.5970	19.9106	20.0657	20.1098	20.1129	20.1143	20.0884	19.8478	19.4302	19.1054	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	19.4120	19.6025	19.8805	20.1980	20.3642	20.4116	20.4160	20.4165	20.3860	20.1296	19.7094	19.3855	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4120	19.6025	19.8805	20.1980	20.3642	20.4116	20.4160	20.4165	20.3860	20.1296	19.7094	19.3855	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9906	0.9675	0.8825	0.7019	0.4877	0.3391	0.3943	0.6792	0.9415	0.9925	0.9980	(94)
Useful gains	512.2341	626.9960	733.0291	791.4447	701.8466	487.3993	322.3222	337.9962	510.2225	582.5598	512.2516	478.0988	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1321.8345	1282.2987	1163.6830	969.4170	741.5424	491.5038	322.7275	338.9303	534.0767	815.6058	1084.7550	1313.3655	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	602.3427	440.3634	320.4065	128.1400	29.5337	0.0000	0.0000	0.0000	0.0000	173.3862	412.2025	621.4384	(98)
Space heating												2727.8135	(98)
Space heating per m2										(98) / (4) =		31.1039	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	794.9841	625.8386	641.3261	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9738	0.9892	0.9813	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	774.1748	619.0680	629.3462	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1265.5012	1206.3000	1098.9924	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	353.7549	436.9006	349.4167	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1140.0723	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

Space cooling kWh

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	88.4387	109.2252	87.3542	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												285.0181 (107)
Space cooling per m2												3.2499 (108)
Energy for space heating												31.1039 (99)
Energy for space cooling												3.2499 (108)
Total												34.3538 (109)
Target Fabric Energy Efficiency (TFEE)												39.5 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	63.1800	27.0000	36.1800	0.1500	5.4270			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3430			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	45.7030	(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	18.2312	17.9821	17.7331	17.2349	17.2349	16.2386	16.7368	16.2386	15.9895	16.4877	16.4877	17.4840	(38)
Heat transfer coeff	63.9342	63.6852	63.4361	62.9379	62.9379	61.9416	62.4398	61.9416	61.6926	62.1907	62.1907	63.1870	(39)
Average = Sum(39)m / 12 =												62.7096	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7290	0.7262	0.7233	0.7177	0.7177	0.7063	0.7120	0.7063	0.7035	0.7091	0.7091	0.7205	(40)
HLP (average)												0.7150	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5929 (42)
Average daily hot water use (litres/day)	95.7817 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4368	20.4980	21.1521	18.4409	17.6945	15.2690	14.1490	16.2362	16.4301	19.1477	20.9012	22.6973	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (64)
Total per year (kWh/year) = Sum(64)m = 2157.8581 (64)
RHI water heating demand 2158 (64)
Heat gains from water heating, kWh/month
96.1731 85.3792 91.1086 83.6723 83.4443 76.6412 75.5850 80.2116 79.2149 86.6654 89.1259 94.5338 (65)

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	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.3275	46.4768	37.7975	28.6151	21.3901	18.0585	19.5128	25.3635	34.0428	43.2252	50.4502	53.7818	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	350.4211	354.0573	344.8941	325.3865	300.7617	277.6178	262.1563	258.5201	267.6834	287.1909	311.8157	334.9596	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)
Water heating gains (Table 5)													
	129.2649	127.0524	122.4578	116.2115	112.1563	106.4462	101.5928	107.8113	110.0208	116.4858	123.7859	127.0616	(72)
Total internal gains													
	637.0221	632.5951	610.1580	575.2218	539.3167	507.1311	488.2705	496.7035	516.7555	551.9105	591.0604	620.8116	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856	(83)
Total gains	884.1770	1024.8134	1216.9270	1451.1897	1581.9069	1652.8383	1573.2230	1454.0737	1273.9610	1051.2802	901.2952	834.5973	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.1034	38.2524	38.4026	38.7066	38.7066	39.3291	39.0154	39.3291	39.4879	39.1716	39.1716	38.5540	
alpha	3.5402	3.5502	3.5602	3.5804	3.5804	3.6219	3.6010	3.6219	3.6325	3.6114	3.6114	3.5703	
util living area													
	0.8173	0.7465	0.6048	0.4326	0.2841	0.1572	0.0913	0.1022	0.2458	0.4860	0.7149	0.8347	(86)
MIT	20.3906	20.5761	20.8183	20.9508	20.9912	20.9993	20.9999	20.9999	20.9964	20.9424	20.7100	20.3535	(87)
Th 2	20.3153	20.3178	20.3203	20.3253	20.3253	20.3353	20.3303	20.3353	20.3378	20.3328	20.3328	20.3228	(88)
util rest of house													
	0.8008	0.7266	0.5801	0.4066	0.2581	0.1324	0.0647	0.0739	0.2143	0.4526	0.6903	0.8191	(89)
MIT 2	19.5244	19.7776	20.0998	20.2700	20.3167	20.3348	20.3303	20.3353	20.3349	20.2709	19.9760	19.4802	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	19.8207	20.0508	20.3456	20.5029	20.5474	20.5622	20.5593	20.5626	20.5612	20.5006	20.2271	19.7789	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8207	20.0508	20.3456	20.5029	20.5474	20.5622	20.5593	20.5626	20.5612	20.5006	20.2271	19.7789	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7878	0.7184	0.5810	0.4135	0.2667	0.1409	0.0738	0.0836	0.2249	0.4611	0.6862	0.8054	(94)
Useful gains	696.5540	736.2461	707.0491	600.0466	421.8606	232.8678	116.0877	121.5539	286.5630	484.7276	618.4668	672.1973	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	902.7975	882.0877	770.4698	616.9729	424.6690	233.0338	116.0967	121.5678	287.5628	503.7821	716.8785	889.6053	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	153.4452	98.0055	47.1850	12.1869	2.0894	0.0000	0.0000	0.0000	0.0000	14.1765	70.8564	161.7515	(98)
Space heating												559.6964	(98)
RHI space heating demand												560	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	63.1800	27.0000	36.1800	0.1500	5.4270			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3430			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	45.7030	(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	21.2201	20.9710	20.7219	19.4766	19.2275	17.9821	17.9821	17.7331	18.4803	19.2275	19.7256	20.2238	(38)
Heat transfer coeff	66.9231	66.6740	66.4250	65.1796	64.9305	63.6852	63.6852	63.4361	64.1833	64.9305	65.4287	65.9268	(39)
Average = Sum(39)m / 12 =												65.1173	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7631	0.7603	0.7574	0.7432	0.7404	0.7262	0.7262	0.7233	0.7319	0.7404	0.7461	0.7517	(40)
HLP (average)												0.7425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5929 (42)
Average daily hot water use (litres/day)	95.7817 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4368	20.4980	21.1521	18.4409	17.6945	15.2690	14.1490	16.2362	16.4301	19.1477	20.9012	22.6973	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (64)
Total per year (kWh/year) = Sum(64)m = 2157.8581 (64)
Heat gains from water heating, kWh/month
96.1731 85.3792 91.1086 83.6723 83.4443 76.6412 75.5850 80.2116 79.2149 86.6654 89.1259 94.5338 (65)

---

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	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.3275	46.4768	37.7975	28.6151	21.3901	18.0585	19.5128	25.3635	34.0428	43.2252	50.4502	53.7818	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	350.4211	354.0573	344.8941	325.3865	300.7617	277.6178	262.1563	258.5201	267.6834	287.1909	311.8157	334.9596	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)
Water heating gains (Table 5)													
	129.2649	127.0524	122.4578	116.2115	112.1563	106.4462	101.5928	107.8113	110.0208	116.4858	123.7859	127.0616	(72)
Total internal gains													
	637.0221	632.5951	610.1580	575.2218	539.3167	507.1311	488.2705	496.7035	516.7555	551.9105	591.0604	620.8116	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	867.2775	1045.9983	1232.0867	1440.1763	1594.2604	1592.3285	1518.7516	1379.6526	1221.9319	1023.9870	870.7128	815.3650	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4016	36.5376	36.6746	37.3754	37.5187	38.2524	38.2524	38.4026	37.9555	37.5187	37.2331	36.9517	
alpha	3.4268	3.4358	3.4450	3.4917	3.5012	3.5502	3.5502	3.5602	3.5304	3.5012	3.4822	3.4634	
util living area													
	0.8607	0.7845	0.6719	0.5152	0.3708	0.2545	0.1841	0.2108	0.3559	0.5977	0.7935	0.8774	(86)
MIT	20.1270	20.4044	20.6810	20.8893	20.9699	20.9943	20.9986	20.9978	20.9811	20.8499	20.4823	20.0733	(87)
Th 2	20.2854	20.2879	20.2904	20.3028	20.3053	20.3178	20.3178	20.3203	20.3128	20.3053	20.3003	20.2954	(88)
util rest of house													
	0.8476	0.7670	0.6497	0.4899	0.3446	0.2277	0.1557	0.1799	0.3221	0.5667	0.7737	0.8655	(89)
MIT 2	19.1322	19.5163	19.8912	20.1721	20.2729	20.3125	20.3168	20.3187	20.2947	20.1318	19.6412	19.0651	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	19.4725	19.8201	20.1614	20.4174	20.5113	20.5457	20.5501	20.5510	20.5295	20.3774	19.9290	19.4100	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4725	19.8201	20.1614	20.4174	20.5113	20.5457	20.5501	20.5510	20.5295	20.3774	19.9290	19.4100	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8309	0.7547	0.6455	0.4941	0.3524	0.2367	0.1654	0.1904	0.3328	0.5700	0.7625	0.8486	(94)
Useful gains	720.5816	789.4574	795.2713	711.6598	561.8793	376.8920	251.2052	262.7364	406.7035	583.6596	663.8750	691.8954	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1015.3882	994.7859	907.4571	750.7008	572.1234	378.6556	251.5600	263.3225	412.6663	634.8542	839.3815	1002.7468	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	219.3361	137.9807	83.4662	28.1095	7.6216	0.0000	0.0000	0.0000	0.0000	38.0888	126.3647	231.2734	(98)
Space heating												872.2411	(98)
Space heating per m2											(98) / (4) =	9.9457	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	598.6405	471.2702	482.1143	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9859	0.9923	0.9887	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	590.2186	467.6278	476.6620	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1775.5436	1692.7290	1528.7219	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	853.4340	911.4753	782.7326	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2547.6419	(104)
Cooled fraction											fC = cooled area / (4) =	0.6842	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	145.9693	155.8966	133.8767	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												435.7426	(107)
Space cooling per m2												4.9686	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	872.2411	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	320.5486	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	595.3045	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2157.8581	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	793.0129	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1472.7382	(310b)
Electricity used for heat distribution	31.8160	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	100.8663	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	198.6076	(330a)
Total electricity for the above, kWh/year	198.6076	(331)
Electricity for lighting (calculated in Appendix L)	369.6479	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3850.7261	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	320.5486	4.2400	13.5913	(340a)
Space heating from Combined Heat and Power	595.3045	2.9700	17.6805	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	793.0129	4.2400	33.6237	(342a)
Water heating from Combined Heat and Power	1472.7382	2.9700	43.7403	(342b)
Space cooling	100.8663	13.1900	13.3043	(348)
Mechanical ventilation fans	198.6076	13.1900	26.1963	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	369.6479	13.1900	48.7566	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			277.3231	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8777	(357)
SAP value	87.7556	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1172.1700	0.2160	253.1887 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	1082.3719	0.2160	233.7923 (363)
less credit emissions for electricity	-378.8302	0.5190	-196.6129 (364)
Water heating from Combined Heat and Power	2677.7058	0.2160	578.3845 (365)
less credit emissions for electricity	-937.1970	0.5190	-486.4053 (366)
Electrical energy for heat distribution	31.8160	0.5190	16.5125 (372)
Total CO2 associated with community systems			398.8599 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			398.8599 (376)
Space cooling	100.8663	0.5190	52.3496 (377)
Pumps and fans	198.6076	0.5190	103.0774 (378)
Energy for lighting	369.6479	0.5190	191.8473 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			590.4342 (383)
CO2 emissions per m2			6.7300 (384)
EI value			94.0378 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	87.7000 (1b)	x	2.7000 (2b)	=	236.7900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	236.7900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	63.1800	27.0000	36.1800	0.1500	5.4270			(29a)
Total net area of external elements Aum(A, m2)			63.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3430			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	45.7030	(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	18.2312	17.9821	17.7331	17.2349	17.2349	16.2386	16.7368	16.2386	15.9895	16.4877	16.4877	17.4840	(38)
Heat transfer coeff	63.9342	63.6852	63.4361	62.9379	62.9379	61.9416	62.4398	61.9416	61.6926	62.1907	62.1907	63.1870	(39)
Average = Sum(39)m / 12 =												62.7096	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7290	0.7262	0.7233	0.7177	0.7177	0.7063	0.7120	0.7063	0.7035	0.7091	0.7091	0.7205	(40)
HLP (average)												0.7150	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5929 (42)
Average daily hot water use (litres/day)	95.7817 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.3598	101.5286	97.6973	93.8660	90.0348	86.2035	86.2035	90.0348	93.8660	97.6973	101.5286	105.3598	(44)
Energy conte	156.2456	136.6534	141.0140	122.9395	117.9633	101.7934	94.3265	108.2411	109.5338	127.6511	139.3412	151.3155	(45)
Energy content (annual)										Total = Sum(45)m =		1507.0184	(45)
Distribution loss (46)m = 0.15 x (45)m	23.4368	20.4980	21.1521	18.4409	17.6945	15.2690	14.1490	16.2362	16.4301	19.1477	20.9012	22.6973	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
211.5224 186.5808 196.2908 176.4331 173.2401 155.2871 149.6033 163.5179 163.0275 182.9279 192.8349 206.5923 (64)
Total per year (kWh/year) = Sum(64)m = 2157.8581 (64)
Heat gains from water heating, kWh/month
96.1731 85.3792 91.1086 83.6723 83.4443 76.6412 75.5850 80.2116 79.2149 86.6654 89.1259 94.5338 (65)

---
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	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	155.5747	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.3275	46.4768	37.7975	28.6151	21.3901	18.0585	19.5128	25.3635	34.0428	43.2252	50.4502	53.7818	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	350.4211	354.0573	344.8941	325.3865	300.7617	277.6178	262.1563	258.5201	267.6834	287.1909	311.8157	334.9596	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	53.1504	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	-103.7165	(71)
Water heating gains (Table 5)													
	129.2649	127.0524	122.4578	116.2115	112.1563	106.4462	101.5928	107.8113	110.0208	116.4858	123.7859	127.0616	(72)
Total internal gains													
	637.0221	632.5951	610.1580	575.2218	539.3167	507.1311	488.2705	496.7035	516.7555	551.9105	591.0604	620.8116	(73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856	(83)
Total gains	884.1770	1024.8134	1216.9270	1451.1897	1581.9069	1652.8383	1573.2230	1454.0737	1273.9610	1051.2802	901.2952	834.5973	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.1034	38.2524	38.4026	38.7066	38.7066	39.3291	39.0154	39.3291	39.4879	39.1716	39.1716	38.5540	
alpha	3.5402	3.5502	3.5602	3.5804	3.5804	3.6219	3.6010	3.6219	3.6325	3.6114	3.6114	3.5703	
util living area													
	0.8173	0.7465	0.6048	0.4326	0.2841	0.1572	0.0913	0.1022	0.2458	0.4860	0.7149	0.8347	(86)
MIT	20.3906	20.5761	20.8183	20.9508	20.9912	20.9993	20.9999	20.9999	20.9964	20.9424	20.7100	20.3535	(87)
Th 2	20.3153	20.3178	20.3203	20.3253	20.3253	20.3353	20.3303	20.3353	20.3378	20.3328	20.3328	20.3228	(88)
util rest of house													
	0.8008	0.7266	0.5801	0.4066	0.2581	0.1324	0.0647	0.0739	0.2143	0.4526	0.6903	0.8191	(89)
MIT 2	19.5244	19.7776	20.0998	20.2700	20.3167	20.3348	20.3303	20.3353	20.3349	20.2709	19.9760	19.4802	(90)
Living area fraction									fLA = Living area / (4) =			0.3421	(91)
MIT	19.8207	20.0508	20.3456	20.5029	20.5474	20.5622	20.5593	20.5626	20.5612	20.5006	20.2271	19.7789	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8207	20.0508	20.3456	20.5029	20.5474	20.5622	20.5593	20.5626	20.5612	20.5006	20.2271	19.7789	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7878	0.7184	0.5810	0.4135	0.2667	0.1409	0.0738	0.0836	0.2249	0.4611	0.6862	0.8054	(94)
Useful gains	696.5540	736.2461	707.0491	600.0466	421.8606	232.8678	116.0877	121.5539	286.5630	484.7276	618.4668	672.1973	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	902.7975	882.0877	770.4698	616.9729	424.6690	233.0338	116.0967	121.5678	287.5628	503.7821	716.8785	889.6053	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	153.4452	98.0055	47.1850	12.1869	2.0894	0.0000	0.0000	0.0000	0.0000	14.1765	70.8564	161.7515	(98)
Space heating												559.6964	(98)
Space heating per m2											(98) / (4) =	6.3819	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	445.9798	330.9309	334.4849	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9956	0.9980	0.9974	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	444.0066	330.2718	333.6006	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1846.2694	1756.3968	1615.7077	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1009.6292	1061.0370	953.8876	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												3024.5539	(104)
Cooled fraction											fC = cooled area / (4) =	0.6842	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	172.6846	0.0000	163.1507	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												335.8353	(107)
Space cooling per m2												3.8294	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	559.6964	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	205.6884	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	381.9928	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2157.8581	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	793.0129	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1472.7382	(310b)
Electricity used for heat distribution	28.5343	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	77.7396	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	198.6076	(330a)
Total electricity for the above, kWh/year	198.6076	(331)
Electricity for lighting (calculated in Appendix L)	369.6479	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3499.4275	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	205.6884	5.0000	10.2844	(340a)
Space heating from Combined Heat and Power	381.9928	3.5000	13.3697	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	793.0129	5.0000	39.6506	(342a)
Water heating from Combined Heat and Power	1472.7382	3.5000	51.5458	(342b)
Space cooling	77.7396	15.7000	12.2051	(348)
Mechanical ventilation fans	198.6076	15.7000	31.1814	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	369.6479	15.7000	58.0347	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			258.1719	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1051.2645	0.2160	227.0731	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	694.5324	0.2160	150.0190	(363)
less credit emissions for electricity	-243.0863	0.5190	-126.1618	(364)
Water heating from Combined Heat and Power	2677.7058	0.2160	578.3845	(365)
less credit emissions for electricity	-937.1970	0.5190	-486.4053	(366)
Electrical energy for heat distribution	28.5343	0.5190	14.8093	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			357.7188	(373)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space and water heating			357.7188 (376)
Space cooling	77.7396	0.5190	40.3469 (377)
Pumps and fans	198.6076	0.5190	103.0774 (378)
Energy for lighting	369.6479	0.5190	191.8473 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			537.2903 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1051.2645	1.2200	1282.5427	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	694.5324	1.2200	847.3295	(363)
less credit emissions for electricity	-243.0863	3.0700	-746.2751	(364)
Water heating from Combined Heat and Power	2677.7058	1.2200	3266.8011	(365)
less credit emissions for electricity	-937.1970	3.0700	-2877.1949	(366)
Electrical energy for heat distribution	28.5343	3.0700	87.6004	(372)
Total CO2 associated with community systems			1860.8038	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1860.8038	(376)
Space cooling	77.7396	3.0700	238.6607	(377)
Pumps and fans	198.6076	3.0700	609.7254	(378)
Energy for lighting	369.6479	3.0700	1134.8192	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2923.0090	(383)
Primary energy kWh/m2/year			33.3296	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£101	£101	£0
Community scheme	£204	£204	£0
Space heating	£144	£144	£0
Space cooling	£12	£12	£0
Water heating	£91	£91	£0
Lighting	£58	£58	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£258	£258	£0
Total cost of uses	£258	£258	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	33 kWh/m²	33 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversha ding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	468.84 (P1)
Transmission heat loss coefficient	45.70 (37)
Summer heat loss coefficient	514.55 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	12.0000	98.8453	0.6800	0.8000	0.9000	522.6622
South East	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						1227.9133

	Jun	Jul	Aug	
Solar gains	1307	1228	1077	(P3)
Internal gains	507	488	497	
Total summer gains	1814	1716	1574	(P5)
Summer gain/loss ratio	3.53	3.34	3.06	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.83	22.54	22.16	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007040	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0107
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	87 B	**DER**	7.84	**TER**	18.26
Environmental	95 A	**% DER<TER**	57.07		
CO_2 Emissions (t/year)	0.33	**DFEE**	35.20	**TFEE**	41.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.77		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           North East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               8.4, 50.4, 2.7
Living Area:                   30 m2, fraction: 59.5%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                11.68, 22.68, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.413
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	6.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	
Cooled Area	60.00
Data Source	SAP table
Type	Split or Multi-Split
Class	A
Control	Modulating
Light Fittings:	10
LEL Fittings:	10
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	None
Main Heating 2	None
Heating Systems Interaction	Each system heats separate parts of dwelling
Smoke Control Area	Unknown
Community Heating	
Type	Space and Water Combined
PCDF Index	n/a
Distribution Loss	Piping system >= 1991, pre-insulated, low temp, variable flow
Controls	CCJ
Ctrl SAP Code	2310
Community Heating Heat Sources:	Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
1	Boilers, Space and Water, 35, 95
2	Combined Heat and Power, Space and Water, 65, 90
Secondary Heating	None
Water Heating	
Type	CommunityHeating
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	More Dwellings, One Block
Apportioned Energy	300
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---

DWELLING AS DESIGNED

Mid-floor flat, total floor area 50 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.84 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)41.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.2 kWh/m²/yrOK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	(no floor)		

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		8.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	12.1949	12.0518	11.9086	11.1929	11.0498	10.3341	10.3341	10.1909	10.6204	11.0498	11.3361	11.6223	(38)
Heat transfer coeff	35.9023	35.7592	35.6160	34.9003	34.7572	34.0415	34.0415	33.8984	34.3278	34.7572	35.0435	35.3298	(39)
Average = Sum(39)m / 12 =												34.8646	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7123	0.7095	0.7067	0.6925	0.6896	0.6754	0.6754	0.6726	0.6811	0.6896	0.6953	0.7010	(40)
HLP (average)												0.6918	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	323.8652	322.2012	312.5507	297.1092	281.7042	266.6207	256.6651	261.4500	269.2424	284.8543	302.7872	315.9741	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
Total gains	370.6546	417.4423	484.1448	578.9161	660.5080	670.4657	634.4537	562.6275	478.3326	401.2465	361.6604	354.1847	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.9947	39.1508	39.3081	40.1142	40.2794	41.1263	41.1263	41.2999	40.7833	40.2794	39.9504	39.6267	
alpha	3.5996	3.6101	3.6205	3.6743	3.6853	3.7418	3.7418	3.7533	3.7189	3.6853	3.6634	3.6418	
util living area													
	0.9241	0.8885	0.8081	0.6492	0.4708	0.3217	0.2353	0.2755	0.4762	0.7437	0.8847	0.9323	(86)
MIT	19.9259	20.1432	20.4757	20.8042	20.9482	20.9907	20.9978	20.9961	20.9615	20.7341	20.2968	19.8946	(87)
Th 2	20.3299	20.3324	20.3349	20.3475	20.3500	20.3626	20.3626	20.3651	20.3576	20.3500	20.3450	20.3400	(88)
util rest of house													
	0.9158	0.8772	0.7904	0.6236	0.4412	0.2905	0.2015	0.2381	0.4362	0.7158	0.8713	0.9249	(89)
MIT 2	18.8853	19.1947	19.6598	20.1100	20.2929	20.3539	20.3610	20.3622	20.3193	20.0307	19.4264	18.8481	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.5047	19.7593	20.1455	20.5232	20.6830	20.7329	20.7401	20.7395	20.7016	20.4494	19.9445	19.4710	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5047	19.7593	20.1455	20.5232	20.6830	20.7329	20.7401	20.7395	20.7016	20.4494	19.9445	19.4710	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9042	0.8663	0.7851	0.6307	0.4565	0.3087	0.2215	0.2602	0.4578	0.7202	0.8621	0.9136	(94)
Useful gains	335.1396	361.6427	380.0870	365.0978	301.4963	206.9395	140.5396	146.3944	218.9809	288.9865	311.8020	323.5693	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	545.8851	531.3572	485.9971	405.6537	312.2226	208.7737	140.9335	147.1024	226.6177	342.3373	450.1154	539.5208	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	156.7946	114.0481	78.7971	29.2003	7.9804	0.0000	0.0000	0.0000	0.0000	39.6930	99.5857	160.6679	(98)
Space heating												686.7671	(98)
Space heating per m2											(98) / (4) =	13.6263	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	319.9901	251.9071	257.6276	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9828	0.9906	0.9857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	314.4949	249.5403	253.9337	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	835.7742	792.6922	709.3921	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	375.3211	404.1051	338.8611	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1118.2872	(104)
Cooled fraction										fC = cooled area / (4) =		1.1905	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	111.7027	120.2694	100.8515	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												332.8236	(107)
Space cooling per m2												6.6036	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	686.7671	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	252.3869	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	468.7186	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1824.8985	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932	(310b)
Electricity used for heat distribution	26.3725	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	77.0425	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	114.1371	(330a)
Total electricity for the above, kWh/year	114.1371	(331)
Electricity for lighting (calculated in Appendix L)	233.5912	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3062.0197	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	971.6180	0.2160	209.8695	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	852.2156	0.2160	184.0786	(363)
less credit emissions for electricity	-298.2754	0.5190	-154.8050	(364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391	(365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524	(366)
Electrical energy for heat distribution	26.3725	0.5190	13.6873	(372)
Total CO2 associated with community systems			330.6171	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			330.6171	(376)
Space cooling	77.0425	0.5190	39.9851	(377)
Pumps and fans	114.1371	0.5190	59.2372	(378)
Energy for lighting	233.5912	0.5190	121.2339	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			395.3732	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.8400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.8400	ZC1
Total Floor Area	TFA	50.4000	
Assumed number of occupants	N	1.7019	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4332	ZC2
CO2 emissions from cooking, equation (L16)		3.1715	ZC3
Total CO2 emissions		28.4447	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4447	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3374	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4302	0.4218	0.4133	0.3712	0.3627	0.3206	0.3206	0.3121	0.3374	0.3627	0.3796	0.3965	(22b)
Effective ac	0.5925	0.5890	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1800	2.1024			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6857			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	22.0857	(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	26.6090	26.4476	26.2895	25.5465	25.4075	24.7604	24.7604	24.6406	25.0096	25.4075	25.6887	25.9827	(38)
Heat transfer coeff	48.6948	48.5334	48.3752	47.6322	47.4932	46.8461	46.8461	46.7263	47.0954	47.4932	47.7744	48.0684	(39)
Average = Sum(39)m / 12 =												47.6316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9662	0.9630	0.9598	0.9451	0.9423	0.9295	0.9295	0.9271	0.9344	0.9423	0.9479	0.9537	(40)
HLP (average)												0.9451	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(64)
									Total per year (kWh/year) = Sum(64)m =			1722.6761	(64)
Heat gains from water heating, kWh/month													
	77.7494	69.0669	73.8039	67.9194	67.8329	62.4418	61.7100	65.3144	64.4469	70.3424	72.1681	76.4723	(65)

---

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	104.5019	102.7782	99.1987	94.3325	91.1732	86.7247	82.9436	87.7882	89.5095	94.5462	100.2334	102.7854	(72)
Total internal gains													
	317.5298	315.8658	306.2153	290.7738	275.3688	260.2854	250.3297	255.1146	262.9070	278.5189	296.4519	309.6388	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6300	0.7000	0.7700	27.5857	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	37.9303	77.2083	139.1048	228.4501	307.0818	327.3817	306.2588	244.1531	169.5014	94.3547	47.7262	30.9758	(83)
Total gains	355.4602	393.0742	445.3201	519.2239	582.4506	587.6670	556.5885	499.2677	432.4084	372.8736	344.1781	340.6146	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.8763	72.1153	72.3511	73.4797	73.6947	74.7127	74.7127	74.9043	74.3173	73.6947	73.2609	72.8129	
alpha	5.7918	5.8077	5.8234	5.8986	5.9130	5.9808	5.9808	5.9936	5.9545	5.9130	5.8841	5.8542	
util living area													
	0.9953	0.9907	0.9729	0.8957	0.7164	0.5057	0.3697	0.4289	0.7120	0.9457	0.9898	0.9963	(86)
MIT	20.1143	20.2439	20.4823	20.7846	20.9527	20.9949	20.9993	20.9985	20.9669	20.7264	20.3744	20.0952	(87)
Th 2	20.1116	20.1143	20.1169	20.1293	20.1317	20.1425	20.1425	20.1445	20.1383	20.1317	20.1270	20.1221	(88)
util rest of house													
	0.9938	0.9878	0.9644	0.8674	0.6622	0.4400	0.2980	0.3500	0.6380	0.9242	0.9861	0.9951	(89)
MIT 2	18.9350	19.1251	19.4688	19.8898	20.0898	20.1394	20.1423	20.1439	20.1142	19.8251	19.3252	18.9152	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.6370	19.7910	20.0721	20.4224	20.6035	20.6486	20.6524	20.6526	20.6218	20.3616	19.9497	19.6176	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6370	19.7910	20.0721	20.4224	20.6035	20.6486	20.6524	20.6526	20.6218	20.3616	19.9497	19.6176	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9865	0.9639	0.8777	0.6924	0.4790	0.3407	0.3970	0.6807	0.9306	0.9851	0.9943	(94)
Useful gains	352.9161	387.7727	429.2428	455.6978	403.2695	281.4721	189.6394	198.2283	294.3518	347.0017	339.0605	338.6619	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	746.8298	722.7111	656.5518	548.8381	422.8541	283.3533	189.8406	198.7074	307.1443	463.6078	613.8862	741.0991	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	293.0718	225.0786	169.1179	67.0610	14.5709	0.0000	0.0000	0.0000	0.0000	86.7549	197.8745	299.4133	(98)
Space heating												1352.9429	(98)
Space heating per m2											(98) / (4) =	26.8441	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1446.9977	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	293.0718	225.0786	169.1179	67.0610	14.5709	0.0000	0.0000	0.0000	0.0000	86.7549	197.8745	299.4133	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	313.4457	240.7258	180.8747	71.7230	15.5839	0.0000	0.0000	0.0000	0.0000	92.7860	211.6305	320.2281	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.3197	148.5470	156.4534	140.8691	138.4955	124.3951	120.0810	130.9213	130.4253	146.0429	153.6471	164.4788	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2796	85.9196	85.0217	82.9636	80.7084	79.8000	79.8000	79.8000	79.8000	83.4781	85.4897	86.3927	(217)
Fuel for water heating, kWh/month													
	195.0863	172.8906	184.0159	169.7964	171.5999	155.8835	150.4774	164.0617	163.4403	174.9475	179.7259	190.3850	(219)
Water heating fuel used												2072.3106	(219)
Annual totals kWh/year													
Space heating fuel - main system												1446.9977	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												233.5912	(232)
Total delivered energy for all uses												3827.8995	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1446.9977	0.2160	312.5515	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2072.3106	0.2160	447.6191	(264)
Space and water heating			760.1706	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	233.5912	0.5190	121.2339	(268)
Total CO2, kg/m2/year			920.3294	(272)
Emissions per m2 for space and water heating			15.0827	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4054	(272b)
Emissions per m2 for pumps and fans			0.7723	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0827 * 1.00) + 2.4054 + 0.7723, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3218	0.3155	0.3092	0.2777	0.2714	0.2398	0.2398	0.2335	0.2524	0.2714	0.2840	0.2966	(22b)
Effective ac	0.5518	0.5498	0.5478	0.5386	0.5368	0.5288	0.5288	0.5273	0.5319	0.5368	0.5403	0.5440	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		23.7074	(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	24.7790	24.6887	24.6001	24.1843	24.1066	23.7444	23.7444	23.6773	23.8839	24.1066	24.2639	24.4285	(38)
Heat transfer coeff	48.4864	48.3961	48.3076	47.8918	47.8140	47.4518	47.4518	47.3848	47.5913	47.8140	47.9713	48.1359	(39)
Average = Sum(39)m / 12 =												47.8914	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9620	0.9602	0.9585	0.9502	0.9487	0.9415	0.9415	0.9402	0.9443	0.9487	0.9518	0.9551	(40)
HLP (average)												0.9502	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7019 (42)
Average daily hot water use (litres/day)		74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	25.8665	22.6230	23.3449	20.3527	19.5289	16.8519	15.6158	17.9194	18.1334	21.1327	23.0680	25.0503 (65)

---

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)

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

	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)

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

	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)

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

	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)

Water heating gains (Table 5)

	34.7668	33.6652	31.3776	28.2676	26.2485	23.4055	20.9890	24.0852	25.1852	28.4042	32.0389	33.6698	(72)

Total internal gains

	244.7948	243.7529	235.3941	221.7089	207.4441	193.9661	185.3750	188.4115	195.5827	209.3769	225.2573	237.5232	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
Total gains	291.5841	338.9940	406.9883	503.5158	586.2479	597.8111	563.1637	489.5890	404.6729	325.7690	284.1304	275.7337	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.8741	28.9280	28.9810	29.2326	29.2801	29.5036	29.5036	29.5454	29.4171	29.2801	29.1841	29.0843	
alpha	2.9249	2.9285	2.9321	2.9488	2.9520	2.9669	2.9669	2.9697	2.9611	2.9520	2.9456	2.9390	
util living area	0.9671	0.9487	0.9033	0.7966	0.6366	0.4720	0.3582	0.4219	0.6651	0.8781	0.9518	0.9717	(86)
MIT	18.9990	19.2638	19.7363	20.3206	20.7277	20.9179	20.9730	20.9564	20.7738	20.1952	19.4914	18.9443	(87)
Th 2	20.1151	20.1166	20.1181	20.1250	20.1263	20.1324	20.1324	20.1335	20.1300	20.1263	20.1237	20.1209	(88)
util rest of house	0.9625	0.9416	0.8901	0.7707	0.5953	0.4169	0.2919	0.3499	0.6089	0.8558	0.9440	0.9677	(89)
MIT 2	18.2717	18.5335	18.9957	19.5555	19.9210	20.0815	20.1199	20.1121	19.9752	19.4530	18.7666	18.2219	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	18.7046	18.9682	19.4366	20.0109	20.4012	20.5793	20.6277	20.6147	20.4506	19.8948	19.1980	18.6519	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7046	18.9682	19.4366	20.0109	20.4012	20.5793	20.6277	20.6147	20.4506	19.8948	19.1980	18.6519	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9532	0.9304	0.8783	0.7670	0.6088	0.4458	0.3302	0.3906	0.6306	0.8490	0.9338	0.9592	(94)
Useful gains	277.9448	315.3861	357.4499	386.2006	356.9032	266.4987	185.9369	191.2230	255.1941	276.5857	265.3143	264.4727	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	698.4286	680.8466	624.9341	532.1220	416.0381	283.7298	191.1231	199.7116	302.2328	444.4203	580.3584	695.6550	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	312.8399	245.5894	199.0082	105.0634	43.9964	0.0000	0.0000	0.0000	0.0000	124.8690	226.8317	320.7996	(98)
Space heating												1578.9977	(98)
Space heating per m2											(98) / (4) =	31.3293	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	446.0472	351.1435	360.1242	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9042	0.9357	0.9106	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	403.2946	328.5598	327.9400	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	763.1195	721.4022	636.3537	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	259.0739	292.2748	229.4598	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												780.8084	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	64.7685	73.0687	57.3649	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	195.2021 (107)
Space cooling per m2	3.8731 (108)
Energy for space heating	31.3293 (99)
Energy for space cooling	3.8731 (108)
Total	35.2024 (109)
Dwelling Fabric Energy Efficiency (DFEE)	35.2 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1470	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3970	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3374	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4302	0.4218	0.4133	0.3712	0.3627	0.3206	0.3206	0.3121	0.3374	0.3627	0.3796	0.3965	(22b)
Effective ac	0.5925	0.5890	0.5854	0.5689	0.5658	0.5514	0.5514	0.5487	0.5569	0.5658	0.5720	0.5786	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1800	2.1024			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6857			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	22.0857	(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	26.6090	26.4476	26.2895	25.5465	25.4075	24.7604	24.7604	24.6406	25.0096	25.4075	25.6887	25.9827	(38)
Heat transfer coeff	48.6948	48.5334	48.3752	47.6322	47.4932	46.8461	46.8461	46.7263	47.0954	47.4932	47.7744	48.0684	(39)
Average = Sum(39)m / 12 =												47.6316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9662	0.9630	0.9598	0.9451	0.9423	0.9295	0.9295	0.9271	0.9344	0.9423	0.9479	0.9537	(40)
HLP (average)												0.9451	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	25.8665	22.6230	23.3449	20.3527	19.5289	16.8519	15.6158	17.9194	18.1334	21.1327	23.0680	25.0503	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	85.0941	(66)

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

	13.2269	11.7480	9.5541	7.2331	5.4068	4.5647	4.9323	6.4112	8.6051	10.9261	12.7524	13.5945	(67)

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

	148.2728	149.8114	145.9342	137.6800	127.2605	117.4677	110.9256	109.3869	113.2642	121.5184	131.9378	141.7306	(68)

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

	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	31.5094	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)

Water heating gains (Table 5)

	34.7668	33.6652	31.3776	28.2676	26.2485	23.4055	20.9890	24.0852	25.1852	28.4042	32.0389	33.6698	(72)

Total internal gains

	244.7948	243.7529	235.3941	221.7089	207.4441	193.9661	185.3750	188.4115	195.5827	209.3769	225.2573	237.5232	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6300	0.7000	0.7700	27.5857	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	37.9303	77.2083	139.1048	228.4501	307.0818	327.3817	306.2588	244.1531	169.5014	94.3547	47.7262	30.9758	(83)
Total gains	282.7251	320.9612	374.4990	450.1590	514.5259	521.3478	491.6339	432.5646	365.0841	303.7316	272.9835	268.4990	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.8763	72.1153	72.3511	73.4797	73.6947	74.7127	74.7127	74.9043	74.3173	73.6947	73.2609	72.8129	
alpha	5.7918	5.8077	5.8234	5.8986	5.9130	5.9808	5.9808	5.9936	5.9545	5.9130	5.8841	5.8542	
util living area	0.9986	0.9966	0.9878	0.9377	0.7828	0.5660	0.4179	0.4931	0.8020	0.9775	0.9968	0.9989	(86)
MIT	19.9765	20.1097	20.3601	20.7015	20.9247	20.9908	20.9987	20.9968	20.9376	20.6184	20.2417	19.9577	(87)
Th 2	20.1116	20.1143	20.1169	20.1293	20.1317	20.1425	20.1425	20.1445	20.1383	20.1317	20.1270	20.1221	(88)
util rest of house	0.9981	0.9955	0.9836	0.9177	0.7307	0.4941	0.3372	0.4034	0.7317	0.9668	0.9956	0.9986	(89)
MIT 2	19.1712	19.3062	19.5564	19.8936	20.0842	20.1386	20.1422	20.1436	20.1049	19.8237	19.4487	19.1612	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.6505	19.7845	20.0348	20.3745	20.5845	20.6458	20.6520	20.6515	20.6006	20.2967	19.9208	19.6353	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6505	19.7845	20.0348	20.3745	20.5845	20.6458	20.6520	20.6515	20.6006	20.2967	19.9208	19.6353	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9950	0.9831	0.9239	0.7589	0.5367	0.3853	0.4569	0.7714	0.9692	0.9952	0.9983	(94)
Useful gains	282.0941	319.3511	368.1642	415.8982	390.4667	279.8111	189.4279	197.6381	281.6119	294.3806	271.6761	268.0523	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	747.4911	722.3942	654.7481	546.5548	421.9531	283.2236	189.8216	198.6553	306.1462	460.5291	612.5046	741.9515	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	346.2554	270.8450	213.2184	94.0728	23.4259	0.0000	0.0000	0.0000	0.0000	123.6145	245.3965	352.5810	(98)
Space heating												1669.4096	(98)
Space heating per m2											(98) / (4) =	33.1232	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	440.3536	346.6613	355.1198	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9713	0.9879	0.9770	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	427.7161	342.4740	346.9498	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	673.7468	637.7959	569.7018	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	177.1421	219.7195	165.7274	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												562.5891	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	44.2855	54.9299	41.4319	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	140.6473 (107)
Space cooling per m2	2.7906 (108)
Energy for space heating	33.1232 (99)
Energy for space cooling	2.7906 (108)
Total	35.9138 (109)
Target Fabric Energy Efficiency (TFEE)	41.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	10.4772	10.3341	10.1909	9.9047	9.9047	9.3321	9.6184	9.3321	9.1890	9.4753	9.4753	10.0478	(38)
Heat transfer coeff	34.1846	34.0415	33.8984	33.6121	33.6121	33.0395	33.3258	33.0395	32.8964	33.1827	33.1827	33.7552	(39)
Average = Sum(39)m / 12 =												33.4809	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6783	0.6754	0.6726	0.6669	0.6669	0.6555	0.6612	0.6555	0.6527	0.6584	0.6584	0.6697	(40)
HLP (average)												0.6643	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              177.0016   156.3887   165.1353   149.2710   147.1774   132.7969   128.7629   139.6032   138.8272   154.7248   162.0489   173.1607 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              177.0016   156.3887   165.1353   149.2710   147.1774   132.7969   128.7629   139.6032   138.8272   154.7248   162.0489   173.1607 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1824.8985 (64)
RHI water heating demand                                                                                    1825 (64)
Heat gains from water heating, kWh/month
               84.6949    75.3403    80.7494    74.6409    74.7784    69.1633    68.6556    72.2600    71.1683    77.2879    78.8896    83.4179 (65)
```

---

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         102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130   102.1130 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               33.0673    29.3700    23.8853    18.0827    13.5171    11.4117    12.3307    16.0279    21.5126    27.3152    31.8809    33.9863 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              221.3027   223.5991   217.8122   205.4925   189.9411   175.3250   165.5605   163.2641   169.0510   181.3707   196.9221   211.5382 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132    46.9132 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753   -68.0753 (71)
Water heating gains (Table 5)
              113.8373   112.1136   108.5341   103.6679   100.5086    96.0601    92.2790    97.1236    98.8449   103.8816   109.5688   112.1208 (72)
Total internal gains
              449.1580   446.0335   431.1825   408.1940   384.9176   363.7476   351.1211   357.3665   370.3594   393.5183   419.3227   438.5961 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data       factor              W
                                                         W/m2       or Table 6b      or Table 6c       Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                8.0000          12.4885          0.6800           0.8000          0.7700          37.6645 (75)
Northwest                                3.0000          12.4885          0.6800           0.8000          0.7700          14.1242 (81)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    51.7887    93.3945   172.7298   292.3974   380.9628   432.5351   404.0574   333.5971   231.0971   127.2610    67.4115    43.2466 (83)
Total gains   500.9467   539.4281   603.9123   700.5913   765.8804   796.2826   755.1785   690.9635   601.4565   520.7794   486.7342   481.8427 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           40.9541    41.1263    41.2999    41.6517    41.6517    42.3735    42.0095    42.3735    42.5579    42.1907    42.1907    41.4751
alpha          3.7303     3.7418     3.7533     3.7768     3.7768     3.8249     3.8006     3.8249     3.8372     3.8127     3.8127     3.7650
util living area
               0.8053     0.7614     0.6447     0.4761     0.3132     0.1741     0.1015     0.1147     0.2774     0.5215     0.7175     0.8166 (86)

MIT           20.4931    20.6050    20.8107    20.9461    20.9909    20.9994    21.0000    20.9999    20.9961    20.9411    20.7483    20.4771 (87)
Th 2          20.3601    20.3626    20.3651    20.3702    20.3702    20.3803    20.3752    20.3803    20.3828    20.3777    20.3777    20.3676 (88)
util rest of house
               0.7888     0.7427     0.6210     0.4499     0.2865     0.1485     0.0739     0.0851     0.2443     0.4886     0.6940     0.8007 (89)
MIT 2         19.7020    19.8563    20.1329    20.3088    20.3612    20.3798    20.3752    20.3802    20.3796    20.3135    20.0666    19.6870 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.5952 (91)
MIT           20.1729    20.3019    20.5363    20.6882    20.7360    20.7486    20.7471    20.7491    20.7466    20.6871    20.4724    20.1573 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT  20.1729    20.3019    20.5363    20.6882    20.7360    20.7486    20.7471    20.7491    20.7466    20.6871    20.4724    20.1573 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.7837     0.7409     0.6275     0.4632     0.3020     0.1637     0.0903     0.1027     0.2639     0.5051     0.6977     0.7951 (94)
Useful gains 392.5723   399.6387   378.9717   324.5246   231.3117   130.3525    68.2137    70.9946   158.7160   263.0653   339.5782   383.1279 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              494.7507   480.0511   418.1814   335.7231   233.1336   130.4604    68.2203    71.0052   159.4353   274.9881   390.6384   488.0090 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               76.0207    54.0372    29.1720     8.0630     1.3555     0.0000     0.0000     0.0000     0.0000     8.8706    36.7633    78.0315 (98)
Space heating                                                                                                                 292.3138 (98)
RHI space heating demand                                                                                                      292 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	12.1949	12.0518	11.9086	11.1929	11.0498	10.3341	10.3341	10.1909	10.6204	11.0498	11.3361	11.6223	(38)
Heat transfer coeff	35.9023	35.7592	35.6160	34.9003	34.7572	34.0415	34.0415	33.8984	34.3278	34.7572	35.0435	35.3298	(39)
Average = Sum(39)m / 12 =												34.8646	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7123	0.7095	0.7067	0.6925	0.6896	0.6754	0.6754	0.6726	0.6811	0.6896	0.6953	0.7010	(40)
HLP (average)												0.6918	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

---

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	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.0673	29.3700	23.8853	18.0827	13.5171	11.4117	12.3307	16.0279	21.5126	27.3152	31.8809	33.9863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.3027	223.5991	217.8122	205.4925	189.9411	175.3250	165.5605	163.2641	169.0510	181.3707	196.9221	211.5382	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	46.9132	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	-68.0753	(71)
Water heating gains (Table 5)													
	113.8373	112.1136	108.5341	103.6679	100.5086	96.0601	92.2790	97.1236	98.8449	103.8816	109.5688	112.1208	(72)
Total internal gains													
	449.1580	446.0335	431.1825	408.1940	384.9176	363.7476	351.1211	357.3665	370.3594	393.5183	419.3227	438.5961	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
Total gains	495.9474	541.2747	602.7766	690.0009	763.7214	767.5925	728.9097	658.5440	579.4496	509.9105	478.1958	476.8067	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.9947	39.1508	39.3081	40.1142	40.2794	41.1263	41.1263	41.2999	40.7833	40.2794	39.9504	39.6267	
alpha	3.5996	3.6101	3.6205	3.6743	3.6853	3.7418	3.7418	3.7533	3.7189	3.6853	3.6634	3.6418	
util living area													
	0.8501	0.8066	0.7194	0.5685	0.4128	0.2820	0.2051	0.2360	0.4000	0.6364	0.7928	0.8612	(86)
MIT	20.2563	20.4179	20.6532	20.8736	20.9663	20.9940	20.9986	20.9977	20.9784	20.8440	20.5455	20.2321	(87)
Th 2	20.3299	20.3324	20.3349	20.3475	20.3500	20.3626	20.3626	20.3651	20.3576	20.3500	20.3450	20.3400	(88)
util rest of house													
	0.8367	0.7906	0.6988	0.5435	0.3859	0.2544	0.1755	0.2037	0.3648	0.6066	0.7737	0.8486	(89)
MIT 2	19.3474	19.5732	19.8960	20.1964	20.3133	20.3571	20.3616	20.3634	20.3364	20.1673	19.7646	19.3219	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	19.8884	20.0760	20.3468	20.5995	20.7020	20.7362	20.7408	20.7410	20.7186	20.5701	20.2294	19.8637	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8884	20.0760	20.3468	20.5995	20.7020	20.7362	20.7408	20.7410	20.7186	20.5701	20.2294	19.8637	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8272	0.7841	0.6991	0.5533	0.4005	0.2706	0.1930	0.2228	0.3847	0.6169	0.7702	0.8388	(94)
Useful gains	410.2582	424.4121	421.4218	381.7822	305.8872	207.7168	140.7158	146.7394	222.9013	314.5528	368.2868	399.9564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	559.6608	542.6808	493.1664	408.3169	312.8842	208.8862	140.9590	147.1521	227.2005	346.5323	460.1013	553.3942	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	111.1555	79.4766	53.3780	19.1049	5.2058	0.0000	0.0000	0.0000	0.0000	23.7927	66.1065	114.1577	(98)
Space heating												472.3777	(98)
Space heating per m2											(98) / (4) =	9.3726	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	319.9901	251.9071	257.6276	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9828	0.9906	0.9857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	314.4949	249.5403	253.9337	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	835.7742	792.6922	709.3921	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	375.3211	404.1051	338.8611	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1118.2872	(104)
Cooled fraction										fC = cooled area / (4) =		1.1905	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	111.7027	120.2694	100.8515	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												332.8236	(107)
Space cooling per m2												6.6036	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	472.3777	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	173.5988	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	322.3978	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1824.8985	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932	(310b)
Electricity used for heat distribution	24.1214	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	77.0425	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	114.1371	(330a)
Total electricity for the above, kWh/year	114.1371	(331)
Electricity for lighting (calculated in Appendix L)	233.5912	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2836.9108	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	173.5988	4.2400	7.3606	(340a)
Space heating from Combined Heat and Power	322.3978	2.9700	9.5752	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	670.6502	4.2400	28.4356	(342a)
Water heating from Combined Heat and Power	1245.4932	2.9700	36.9911	(342b)
Space cooling	77.0425	13.1900	10.1619	(348)
Mechanical ventilation fans	114.1371	13.1900	15.0547	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	233.5912	13.1900	30.8107	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			218.8198	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.9634	(357)
SAP value	86.5612	
SAP rating (Section 12)	87	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	888.6831	0.2160	191.9556 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	586.1778	0.2160	126.6144 (363)
less credit emissions for electricity	-205.1622	0.5190	-106.4792 (364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391 (365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524 (366)
Electrical energy for heat distribution	24.1214	0.5190	12.5190 (372)
Total CO2 associated with community systems			302.3965 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			302.3965 (376)
Space cooling	77.0425	0.5190	39.9851 (377)
Pumps and fans	114.1371	0.5190	59.2372 (378)
Energy for lighting	233.5912	0.5190	121.2339 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			367.1525 (383)
CO2 emissions per m2			7.2800 (384)
EI value			94.8429 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.4000 (1b)	x	2.7000 (2b)	=	136.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.0800	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	22.6800	11.0000	11.6800	0.1500	1.7520			(29a)
Total net area of external elements Aum(A, m2)			22.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3474			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	23.7074	(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	10.4772	10.3341	10.1909	9.9047	9.9047	9.3321	9.6184	9.3321	9.1890	9.4753	9.4753	10.0478	(38)
Heat transfer coeff	34.1846	34.0415	33.8984	33.6121	33.6121	33.0395	33.3258	33.0395	32.8964	33.1827	33.1827	33.7552	(39)
Average = Sum(39)m / 12 =												33.4809	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6783	0.6754	0.6726	0.6669	0.6669	0.6555	0.6612	0.6555	0.6527	0.6584	0.6584	0.6697	(40)
HLP (average)												0.6643	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7019 (42)
Average daily hot water use (litres/day)	74.6197 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.0817	79.0969	76.1121	73.1273	70.1425	67.1577	67.1577	70.1425	73.1273	76.1121	79.0969	82.0817	(44)
Energy conte	121.7248	106.4613	109.8585	95.7773	91.9006	79.3032	73.4861	84.3264	85.3335	99.4480	108.5552	117.8839	(45)
Energy content (annual)										Total = Sum(45)m =		1174.0587	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2587	15.9692	16.4788	14.3666	13.7851	11.8955	11.0229	12.6490	12.8000	14.9172	16.2833	17.6826	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.0016 156.3887 165.1353 149.2710 147.1774 132.7969 128.7629 139.6032 138.8272 154.7248 162.0489 173.1607 (64)
Total per year (kWh/year) = Sum(64)m = 1824.8985 (64)
Heat gains from water heating, kWh/month
84.6949 75.3403 80.7494 74.6409 74.7784 69.1633 68.6556 72.2600 71.1683 77.2879 78.8896 83.4179 (65)

---

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	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	102.1130	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
33.0673 29.3700 23.8853 18.0827 13.5171 11.4117 12.3307 16.0279 21.5126 27.3152 31.8809 33.9863 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
221.3027 223.5991 217.8122 205.4925 189.9411 175.3250 165.5605 163.2641 169.0510 181.3707 196.9221 211.5382 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 46.9132 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 -68.0753 (71)
Water heating gains (Table 5)
113.8373 112.1136 108.5341 103.6679 100.5086 96.0601 92.2790 97.1236 98.8449 103.8816 109.5688 112.1208 (72)
Total internal gains
449.1580 446.0335 431.1825 408.1940 384.9176 363.7476 351.1211 357.3665 370.3594 393.5183 419.3227 438.5961 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	12.4885	0.6800	0.8000	0.7700	37.6645	(75)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains 51.7887 93.3945 172.7298 292.3974 380.9628 432.5351 404.0574 333.5971 231.0971 127.2610 67.4115 43.2466 (83)
Total gains 500.9467 539.4281 603.9123 700.5913 765.8804 796.2826 755.1785 690.9635 601.4565 520.7794 486.7342 481.8427 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.9541	41.1263	41.2999	41.6517	41.6517	42.3735	42.0095	42.3735	42.5579	42.1907	42.1907	41.4751	
alpha	3.7303	3.7418	3.7533	3.7768	3.7768	3.8249	3.8006	3.8249	3.8372	3.8127	3.8127	3.7650	
util living area	0.8053	0.7614	0.6447	0.4761	0.3132	0.1741	0.1015	0.1147	0.2774	0.5215	0.7175	0.8166	(86)
MIT	20.4931	20.6050	20.8107	20.9461	20.9909	20.9994	21.0000	20.9999	20.9961	20.9411	20.7483	20.4771	(87)
Th 2	20.3601	20.3626	20.3651	20.3702	20.3702	20.3803	20.3752	20.3803	20.3828	20.3777	20.3777	20.3676	(88)
util rest of house	0.7888	0.7427	0.6210	0.4499	0.2865	0.1485	0.0739	0.0851	0.2443	0.4886	0.6940	0.8007	(89)
MIT 2	19.7020	19.8563	20.1329	20.3088	20.3612	20.3798	20.3752	20.3802	20.3796	20.3135	20.0666	19.6870	(90)
Living area fraction									fLA = Living area / (4) =			0.5952	(91)
MIT	20.1729	20.3019	20.5363	20.6882	20.7360	20.7486	20.7471	20.7491	20.7466	20.6871	20.4724	20.1573	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1729	20.3019	20.5363	20.6882	20.7360	20.7486	20.7471	20.7491	20.7466	20.6871	20.4724	20.1573	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7837	0.7409	0.6275	0.4632	0.3020	0.1637	0.0903	0.1027	0.2639	0.5051	0.6977	0.7951	(94)
Useful gains	392.5723	399.6387	378.9717	324.5246	231.3117	130.3525	68.2137	70.9946	158.7160	263.0653	339.5782	383.1279	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	494.7507	480.0511	418.1814	335.7231	233.1336	130.4604	68.2203	71.0052	159.4353	274.9881	390.6384	488.0090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	76.0207	54.0372	29.1720	8.0630	1.3555	0.0000	0.0000	0.0000	0.0000	8.8706	36.7633	78.0315	(98)
Space heating												292.3138	(98)
Space heating per m2											(98) / (4) =	5.7999	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	237.8846	176.6268	178.4135	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9949	0.9977	0.9968	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	236.6666	176.2273	177.8458	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	869.3080	823.3960	747.2851	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	455.5019	481.4935	423.6628	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1360.6582	(104)
Cooled fraction										fC = cooled area / (4) =		1.1905	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	135.5660	0.0000	126.0901	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												261.6562	(107)
Space cooling per m2												5.1916	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	292.3138	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	107.4253	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	199.5042	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1824.8985	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	670.6502	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1245.4932	(310b)
Electricity used for heat distribution	22.2307	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	60.5686	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	114.1371	(330a)
Total electricity for the above, kWh/year	114.1371	(331)
Electricity for lighting (calculated in Appendix L)	233.5912	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2631.3698	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	107.4253	5.0000	5.3713	(340a)
Space heating from Combined Heat and Power	199.5042	3.5000	6.9826	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	670.6502	5.0000	33.5325	(342a)
Water heating from Combined Heat and Power	1245.4932	3.5000	43.5923	(342b)
Space cooling	60.5686	15.7000	9.5093	(348)
Mechanical ventilation fans	114.1371	15.7000	17.9195	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	233.5912	15.7000	36.6738	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			195.4813	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	819.0269	0.2160	176.9098	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	362.7349	0.2160	78.3507	(363)
less credit emissions for electricity	-126.9572	0.5190	-65.8908	(364)
Water heating from Combined Heat and Power	2264.5331	0.2160	489.1391	(365)
less credit emissions for electricity	-792.5866	0.5190	-411.3524	(366)
Electrical energy for heat distribution	22.2307	0.5190	11.5377	(372)
Total CO2 associated with community systems			278.6942	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			278.6942	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	60.5686	0.5190	31.4351 (377)
Pumps and fans	114.1371	0.5190	59.2372 (378)
Energy for lighting	233.5912	0.5190	121.2339 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			334.9003 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	819.0269	1.2200	999.2128	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	362.7349	1.2200	442.5366	(363)
less credit emissions for electricity	-126.9572	3.0700	-389.7587	(364)
Water heating from Combined Heat and Power	2264.5331	1.2200	2762.7304	(365)
less credit emissions for electricity	-792.5866	3.0700	-2433.2408	(366)
Electrical energy for heat distribution	22.2307	3.0700	68.2483	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1449.7286	(373)
Space and water heating			1449.7286	(376)
Space cooling	60.5686	3.0700	185.9455	(377)
Pumps and fans	114.1371	3.0700	350.4009	(378)
Energy for lighting	233.5912	3.0700	717.1251	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			1782.2001	(383)
Primary energy kWh/m2/year			35.3611	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£64	£64	£0
Community scheme	£178	£178	£0
Space heating	£119	£119	£0
Space cooling	£10	£10	£0
Water heating	£77	£77	£0
Lighting	£37	£37	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£195	£195	£0
Total cost of uses	£196	£196	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 kg/m²	0 kg/m²
Primary energy	35 kWh/m²	35 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Oversheding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	269.44 (P1)
Transmission heat loss coefficient	23.71 (37)
Summer heat loss coefficient	293.15 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.0000	98.8453	0.6800	0.8000	0.9000	348.4414
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						419.5816

	Jun	Jul	Aug	
Solar gains	453	420	343	(P3)
Internal gains	364	351	357	
Total summer gains	817	771	701	(P5)
Summer gain/loss ratio	2.79	2.63	2.39	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.09	21.83	21.49	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007041	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0201
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	6.38	**TER**	13.62
Environmental	95 A	**% DER<TER**	53.17		
CO_2 Emissions (t/year)	0.45	**DFEE**	25.56	**TFEE**	30.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.70		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South West
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               10.6, 82.7, 2.7
Living Area:                   30 m2, fraction: 36.3%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                13.62, 28.62, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, South West, , None, 0, , 0, 0, 0, 12.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.327
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	6.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	
Cooled Area	60.00
Data Source	SAP table
Type	Split or Multi-Split
Class	A
Control	Modulating
Light Fittings:	10
LEL Fittings:	10
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	None
Main Heating 2	None
Heating Systems Interaction	Each system heats separate parts of dwelling
Smoke Control Area	Unknown
Community Heating	
Type	Space and Water Combined
PCDF Index	n/a
Distribution Loss	Piping system >= 1991, pre-insulated, low temp, variable flow
Controls	CCJ
Ctrl SAP Code	2310
Community Heating Heat Sources:	Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
1	Boilers, Space and Water, 35, 95
2	Combined Heat and Power, Space and Water, 65, 90
Secondary Heating	None
Water Heating	
Type	CommunityHeating
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	More Dwellings, One Block
Apportioned Energy	300
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---

DWELLING AS DESIGNED

Mid-floor flat, total floor area 83 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.62 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)30.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)25.6 kWh/m²/yrOK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	(no floor)		

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing South West:		12.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	20.0103	19.7754	19.5405	18.3662	18.1313	16.9569	16.9569	16.7220	17.4267	18.1313	18.6010	19.0708	(38)
Heat transfer coeff	48.5888	48.3540	48.1191	46.9447	46.7099	45.5355	45.5355	45.3006	46.0052	46.7099	47.1796	47.6494	(39)
Average = Sum(39)m / 12 =												46.8860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5875	0.5847	0.5819	0.5677	0.5648	0.5506	0.5506	0.5478	0.5563	0.5648	0.5705	0.5762	(40)
HLP (average)												0.5669	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5121 (42)
Average daily hot water use (litres/day)	93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9672	20.0873	20.7282	18.0714	17.3399	14.9630	13.8655	15.9108	16.1008	18.7640	20.4823	22.2425	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	208.3914	183.8425	193.4651	173.9696	170.8763	153.2473	147.7132	161.3489	160.8326	180.3700	190.0426	203.5601 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	208.3914	183.8425	193.4651	173.9696	170.8763	153.2473	147.7132	161.3489	160.8326	180.3700	190.0426	203.5601 (64)

Total per year (kWh/year) = Sum(64)m = 2127.6595 (64)
Heat gains from water heating, kWh/month

	95.1321	84.4687	90.1691	82.8532	82.6583	75.9630	74.9565	79.4904	78.4851	85.8149	88.1975	93.5256 (65)

---

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	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	(66)

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

	20.4618	18.1740	14.7801	11.1895	8.3642	7.0615	7.6301	9.9180	13.3119	16.9025	19.7277	21.0305	(67)

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

	224.9908	227.3255	221.4421	208.9171	193.1066	178.2469	168.3197	165.9850	171.8684	184.3934	200.2039	215.0636	(68)

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

	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)

Water heating gains (Table 5)

	127.8657	125.6975	121.1950	115.0739	111.0998	105.5042	100.7480	106.8419	109.0071	115.3426	122.4965	125.7065	(72)

Total internal gains

	433.9997	431.8784	418.0986	395.8619	373.2521	351.4940	337.3793	343.4264	354.8688	377.3199	403.1095	422.4821	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	179.2125	309.5038	434.7351	557.5288	641.7032	644.6392	618.3480	554.3918	477.0780	345.1032	215.4272	152.8691	(83)
Total gains	613.2122	741.3822	852.8337	953.3907	1014.9553	996.1332	955.7273	897.8182	831.9468	722.4231	618.5367	575.3511	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.2788	47.5084	47.7403	48.9346	49.1807	50.4490	50.4490	50.7106	49.9339	49.1807	48.6910	48.2110	
alpha	4.1519	4.1672	4.1827	4.2623	4.2787	4.3633	4.3633	4.3807	4.3289	4.2787	4.2461	4.2141	
util living area	0.9000	0.8256	0.7188	0.5675	0.4214	0.2916	0.2095	0.2318	0.3779	0.6265	0.8323	0.9149	(86)
MIT	20.3036	20.5530	20.7720	20.9269	20.9820	20.9974	20.9995	20.9993	20.9917	20.9100	20.6189	20.2608	(87)
Th 2	20.4412	20.4438	20.4464	20.4592	20.4618	20.4747	20.4747	20.4772	20.4695	20.4618	20.4566	20.4515	(88)
util rest of house	0.8907	0.8120	0.7004	0.5458	0.3983	0.2679	0.1845	0.2056	0.3497	0.6005	0.8168	0.9067	(89)
MIT 2	19.5055	19.8550	20.1556	20.3708	20.4417	20.4721	20.4743	20.4767	20.4612	20.3553	19.9621	19.4534	(90)
Living area fraction									fLA = Living area / (4) =			0.3628	(91)
MIT	19.7951	20.1082	20.3792	20.5725	20.6377	20.6627	20.6648	20.6662	20.6537	20.5565	20.2003	19.7463	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7951	20.1082	20.3792	20.5725	20.6377	20.6627	20.6648	20.6662	20.6537	20.5565	20.2003	19.7463	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8787	0.8032	0.6981	0.5504	0.4059	0.2764	0.1935	0.2151	0.3595	0.6051	0.8091	0.8949	(94)
Useful gains	538.8493	595.4631	595.3343	524.7107	411.9354	275.3270	184.9781	193.0818	299.1168	437.1710	500.4423	514.8607	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	752.8868	735.3777	667.8569	547.9615	417.4783	276.0663	185.0938	193.2633	301.5023	465.0666	618.0687	740.7715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	159.2439	94.0227	53.9568	16.7406	4.1239	0.0000	0.0000	0.0000	0.0000	20.7543	84.6910	168.0776	(98)

Space heating 601.6109 (98)
Space heating per m2 (98) / (4) = 7.2746 (99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	428.0336	336.9627	344.2847	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9938	0.9971	0.9962	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	425.3665	336.0010	342.9713	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1245.4990	1196.6179	1130.1927	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	590.4954	640.2989	585.6927	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1816.4870	(104)
Cooled fraction										fC = cooled area / (4) =		0.7255	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.1032	116.1364	106.2320	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												329.4716	(107)
Space cooling per m2												3.9839	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	601.6109	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	221.0920	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	410.5994	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2127.6595	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	781.9149	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1452.1276	(310b)
Electricity used for heat distribution	28.6573	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	76.2666	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	187.2845	(330a)
Total electricity for the above, kWh/year	187.2845	(331)
Electricity for lighting (calculated in Appendix L)	361.3612	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3490.6462	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1055.7967	0.2160	228.0521	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	746.5444	0.2160	161.2536	(363)
less credit emissions for electricity	-261.2905	0.5190	-135.6098	(364)
Water heating from Combined Heat and Power	2640.2320	0.2160	570.2901	(365)
less credit emissions for electricity	-924.0812	0.5190	-479.5981	(366)
Electrical energy for heat distribution	28.6573	0.5190	14.8732	(372)
Total CO2 associated with community systems			359.2610	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			359.2610	(376)
Space cooling	76.2666	0.5190	39.5824	(377)
Pumps and fans	187.2845	0.5190	97.2006	(378)
Energy for lighting	361.3612	0.5190	187.5465	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			527.8905	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.3800	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.3800	ZC1
Total Floor Area	TFA	82.7000	
Assumed number of occupants	N	2.5121	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.1215	ZC2
CO2 emissions from cooking, equation (L16)		2.1680	ZC3
Total CO2 emissions		24.6695	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.6695	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1344	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3844	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3267	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4165	0.4084	0.4002	0.3594	0.3512	0.3104	0.3104	0.3022	0.3267	0.3512	0.3675	0.3839	(22b)
Effective ac	0.5868	0.5834	0.5801	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5675	0.5737	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			15.0000	1.3258	19.8864			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1800	2.4516			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3380			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		27.7380	(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	43.2354	42.9872	42.7439	41.6010	41.3872	40.3918	40.3918	40.2075	40.7752	41.3872	41.8198	42.2720	(38)
Heat transfer coeff	70.9734	70.7251	70.4818	69.3390	69.1252	68.1298	68.1298	67.9455	68.5132	69.1252	69.5577	70.0099	(39)
Average = Sum(39)m / 12 =												69.3380	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8582	0.8552	0.8523	0.8384	0.8359	0.8238	0.8238	0.8216	0.8285	0.8359	0.8411	0.8466	(40)
HLP (average)												0.8384	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5121	(42)
Average daily hot water use (litres/day)	93.8623	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9672	20.0873	20.7282	18.0714	17.3399	14.9630	13.8655	15.9108	16.1008	18.7640	20.4823	22.2425	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	199.7095	176.0007	184.7832	165.5678	162.1944	144.8454	139.0313	152.6670	152.4308	171.6881	181.6408	194.8782	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.7095	176.0007	184.7832	165.5678	162.1944	144.8454	139.0313	152.6670	152.4308	171.6881	181.6408	194.8782	(64)
								Total per year (kWh/year) = Sum(64)m =				2025.4371	(64)
Heat gains from water heating, kWh/month													
	88.1865	78.1953	83.2235	76.1317	75.7128	69.2415	68.0110	72.5449	71.7637	78.8694	81.4760	86.5801	(65)

---

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	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4618	18.1740	14.7801	11.1895	8.3642	7.0615	7.6301	9.9180	13.3119	16.9025	19.7277	21.0305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.9908	227.3255	221.4421	208.9171	193.1066	178.2469	168.3197	165.9850	171.8684	184.3934	200.2039	215.0636	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)
Water heating gains (Table 5)													
	118.5303	116.3621	111.8596	105.7385	101.7645	96.1688	91.4127	97.5066	99.6718	106.0073	113.1611	116.3711	(72)
Total internal gains													
	427.6643	425.5430	411.7632	389.5266	366.9168	345.1586	331.0440	337.0910	348.5334	370.9845	396.7742	416.1467	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	36.7938	0.6300	0.7000	0.7700	134.9361	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	145.2807	250.9029	352.4231	451.9673	520.2042	522.5844	501.2711	449.4242	386.7489	279.7620	174.6386	123.9251	(83)
Total gains	572.9450	676.4459	764.1863	841.4938	887.1210	867.7430	832.3150	786.5152	735.2823	650.7465	571.4127	540.0718	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	80.9184	81.2025	81.4828	82.8258	83.0820	84.2958	84.2958	84.5245	83.8241	83.0820	82.5653	82.0320	
alpha	6.3946	6.4135	6.4322	6.5217	6.5388	6.6197	6.6197	6.6350	6.5883	6.5388	6.5044	6.4688	
util living area													
	0.9950	0.9853	0.9560	0.8658	0.6980	0.4998	0.3599	0.3969	0.6300	0.9064	0.9864	0.9965	(86)
MIT	20.2622	20.4334	20.6501	20.8670	20.9715	20.9972	20.9997	20.9995	20.9885	20.8445	20.5148	20.2331	(87)
Th 2	20.2032	20.2057	20.2083	20.2201	20.2224	20.2327	20.2327	20.2347	20.2287	20.2224	20.2179	20.2132	(88)
util rest of house													
	0.9935	0.9810	0.9439	0.8350	0.6480	0.4411	0.2973	0.3311	0.5649	0.8767	0.9816	0.9954	(89)
MIT 2	19.2204	19.4695	19.7777	20.0751	20.1972	20.2310	20.2326	20.2345	20.2207	20.0553	19.5983	19.1859	(90)
Living area fraction									fLA = Living area / (4) =			0.3628	(91)
MIT	19.5983	19.8191	20.0942	20.3624	20.4781	20.5090	20.5109	20.5120	20.4992	20.3416	19.9308	19.5657	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5983	19.8191	20.0942	20.3624	20.4781	20.5090	20.5109	20.5120	20.4992	20.3416	19.9308	19.5657	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9920	0.9785	0.9419	0.8410	0.6649	0.4624	0.3200	0.3550	0.5881	0.8817	0.9795	0.9942	(94)
Useful gains	568.3646	661.8824	719.8146	707.7342	589.8164	401.2363	266.3529	279.2029	432.4434	573.7700	559.6918	536.9362	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1085.7722	1055.1583	958.1419	794.7897	606.7872	402.5771	266.4492	279.3906	438.4309	673.3917	892.4796	1075.7549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	384.9513	264.2814	177.3154	62.6800	12.6263	0.0000	0.0000	0.0000	0.0000	74.1186	239.6072	400.8811	(98)
Space heating												1616.4613	(98)
Space heating per m2											(98) / (4) =	19.5461	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1728.8356	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	384.9513	264.2814	177.3154	62.6800	12.6263	0.0000	0.0000	0.0000	0.0000	74.1186	239.6072	400.8811	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	411.7126	282.6539	189.6422	67.0374	13.5041	0.0000	0.0000	0.0000	0.0000	79.2712	256.2644	428.7498	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.7095	176.0007	184.7832	165.5678	162.1944	144.8454	139.0313	152.6670	152.4308	171.6881	181.6408	194.8782	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5365	85.8960	84.7041	82.4779	80.4873	79.8000	79.8000	79.8000	79.8000	82.7501	85.5535	86.6974	(217)
Fuel for water heating, kWh/month													
	230.7806	204.8999	218.1514	200.7420	201.5155	181.5106	174.2246	191.3120	191.0160	207.4778	212.3124	224.7798	(219)
Water heating fuel used												2438.7225	(219)
Annual totals kWh/year													
Space heating fuel - main system												1728.8356	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.3612	(232)
Total delivered energy for all uses												4603.9193	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1728.8356	0.2160	373.4285	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2438.7225	0.2160	526.7641	(264)
Space and water heating			900.1926	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.3612	0.5190	187.5465	(268)
Total CO2, kg/m2/year			1126.6640	(272)
Emissions per m2 for space and water heating			10.8850	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2678	(272b)
Emissions per m2 for pumps and fans			0.4707	(272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8850 * 1.00) + 2.2678 + 0.4707, rounded to 2 d.p.			13.6200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1344	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2844	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2417	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3082	0.3021	0.2961	0.2659	0.2598	0.2296	0.2296	0.2236	0.2417	0.2598	0.2719	0.2840	(22b)
Effective ac	0.5475	0.5456	0.5438	0.5353	0.5338	0.5264	0.5264	0.5250	0.5292	0.5338	0.5370	0.5403	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		28.5786	(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	40.3417	40.2059	40.0727	39.4472	39.3301	38.7853	38.7853	38.6844	38.9952	39.3301	39.5669	39.8144	(38)
Heat transfer coeff	68.9203	68.7845	68.6513	68.0258	67.9087	67.3639	67.3639	67.2630	67.5738	67.9087	68.1455	68.3930	(39)
Average = Sum(39)m / 12 =												68.0252	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8334	0.8317	0.8301	0.8226	0.8211	0.8146	0.8146	0.8133	0.8171	0.8211	0.8240	0.8270	(40)
HLP (average)												0.8226	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5121 (42)
Average daily hot water use (litres/day)		93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	32.5369	28.4569	29.3650	25.6011	24.5649	21.1976	19.6427	22.5403	22.8095	26.5823	29.0167	31.5102 (65)

---

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	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4618	18.1740	14.7801	11.1895	8.3642	7.0615	7.6301	9.9180	13.3119	16.9025	19.7277	21.0305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.9908	227.3255	221.4421	208.9171	193.1066	178.2469	168.3197	165.9850	171.8684	184.3934	200.2039	215.0636	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)
Water heating gains (Table 5)													
	43.7323	42.3466	39.4691	35.5571	33.0173	29.4412	26.4015	30.2961	31.6799	35.7289	40.3009	42.3524	(72)
Total internal gains													
	349.8664	348.5276	336.3728	316.3452	295.1696	275.4310	263.0328	266.8805	277.5416	297.7062	320.9140	339.1280	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	179.2125	309.5038	434.7351	557.5288	641.7032	644.6392	618.3480	554.3918	477.0780	345.1032	215.4272	152.8691	(83)
Total gains	529.0789	658.0314	771.1078	873.8740	936.8728	920.0702	881.3808	821.2723	754.6195	642.8094	536.3411	491.9971	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.3316	33.3974	33.4622	33.7699	33.8281	34.1017	34.1017	34.1528	33.9958	33.8281	33.7106	33.5886	
alpha	3.2221	3.2265	3.2308	3.2513	3.2552	3.2734	3.2734	3.2769	3.2664	3.2552	3.2474	3.2392	
util living area													
	0.9541	0.9149	0.8505	0.7414	0.5993	0.4469	0.3299	0.3670	0.5617	0.7996	0.9249	0.9623	(86)
MIT	19.4321	19.7729	20.1748	20.5730	20.8291	20.9513	20.9863	20.9805	20.8964	20.5313	19.9012	19.3567	(87)
Th 2	20.2245	20.2259	20.2273	20.2338	20.2350	20.2407	20.2407	20.2418	20.2385	20.2350	20.2326	20.2300	(88)
util rest of house													
	0.9483	0.9049	0.8338	0.7148	0.5619	0.3993	0.2752	0.3097	0.5117	0.7717	0.9143	0.9574	(89)
MIT 2	18.7788	19.1120	19.4998	19.8773	20.1054	20.2099	20.2341	20.2319	20.1685	19.8493	19.2473	18.7090	(90)
Living area fraction										fLA = Living area / (4) =		0.3628	(91)
MIT	19.0158	19.3518	19.7447	20.1297	20.3679	20.4788	20.5070	20.5035	20.4326	20.0967	19.4845	18.9439	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0158	19.3518	19.7447	20.1297	20.3679	20.4788	20.5070	20.5035	20.4326	20.0967	19.4845	18.9439	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9372	0.8918	0.8223	0.7110	0.5686	0.4145	0.2946	0.3298	0.5248	0.7662	0.9021	0.9474	(94)
Useful gains	495.8571	586.8082	634.0833	621.3497	532.6881	381.3358	259.6376	270.8185	396.0381	492.5453	483.8309	466.1149	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1014.2150	994.0569	909.2632	763.9083	588.6256	396.0199	263.1899	276.0109	427.9151	644.9074	843.9484	1008.3826	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	385.6582	273.6711	204.7339	102.6422	41.6175	0.0000	0.0000	0.0000	0.0000	113.3573	259.2846	403.4472	(98)
Space heating												1784.4121	(98)
Space heating per m2											(98) / (4) =	21.5769	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	633.2208	498.4929	511.1989	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9336	0.9597	0.9496	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	591.1891	478.4178	485.4278	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.4360	1122.2714	1053.6469	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	416.3377	479.0271	422.7550	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1318.1198	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   104.0844   119.7568   105.6887     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          329.5299 (107)
Space cooling per m2                                                                                                                     3.9846 (108)
Energy for space heating                                                                                                                21.5769 (99)
Energy for space cooling                                                                                                                 3.9846 (108)
Total                                                                                                                                   25.5616 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   25.6 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1344	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3844	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3267	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4165	0.4084	0.4002	0.3594	0.3512	0.3104	0.3104	0.3022	0.3267	0.3512	0.3675	0.3839	(22b)
Effective ac	0.5868	0.5834	0.5801	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5675	0.5737	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			15.0000	1.3258	19.8864			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1800	2.4516			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.3380			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		27.7380	(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	43.2354	42.9872	42.7439	41.6010	41.3872	40.3918	40.3918	40.2075	40.7752	41.3872	41.8198	42.2720	(38)
Heat transfer coeff	70.9734	70.7251	70.4818	69.3390	69.1252	68.1298	68.1298	67.9455	68.5132	69.1252	69.5577	70.0099	(39)
Average = Sum(39)m / 12 =												69.3380	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8582	0.8552	0.8523	0.8384	0.8359	0.8238	0.8238	0.8216	0.8285	0.8359	0.8411	0.8466	(40)
HLP (average)												0.8384	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5121 (42)
Average daily hot water use (litres/day)		93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.5369	28.4569	29.3650	25.6011	24.5649	21.1976	19.6427	22.5403	22.8095	26.5823	29.0167	31.5102	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	125.6049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4618	18.1740	14.7801	11.1895	8.3642	7.0615	7.6301	9.9180	13.3119	16.9025	19.7277	21.0305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.9908	227.3255	221.4421	208.9171	193.1066	178.2469	168.3197	165.9850	171.8684	184.3934	200.2039	215.0636	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	35.5605	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)
Water heating gains (Table 5)													
	43.7323	42.3466	39.4691	35.5571	33.0173	29.4412	26.4015	30.2961	31.6799	35.7289	40.3009	42.3524	(72)
Total internal gains													
	349.8664	348.5276	336.3728	316.3452	295.1696	275.4310	263.0328	266.8805	277.5416	297.7062	320.9140	339.1280	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	36.7938	0.6300	0.7000	0.7700	134.9361	(79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	145.2807	250.9029	352.4231	451.9673	520.2042	522.5844	501.2711	449.4242	386.7489	279.7620	174.6386	123.9251	(83)
Total gains	495.1471	599.4305	688.7959	768.3124	815.3739	798.0153	764.3039	716.3048	664.2904	577.4681	495.5525	463.0531	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	80.9184	81.2025	81.4828	82.8258	83.0820	84.2958	84.2958	84.5245	83.8241	83.0820	82.5653	82.0320	
alpha	6.3946	6.4135	6.4322	6.5217	6.5388	6.6197	6.6197	6.6350	6.5883	6.5388	6.5044	6.4688	
util living area													
	0.9978	0.9922	0.9728	0.9020	0.7461	0.5418	0.3917	0.4353	0.6880	0.9419	0.9936	0.9985	(86)
MIT	20.1710	20.3473	20.5774	20.8242	20.9585	20.9956	20.9996	20.9991	20.9811	20.7892	20.4291	20.1420	(87)
Th 2	20.2032	20.2057	20.2083	20.2201	20.2224	20.2327	20.2327	20.2347	20.2287	20.2224	20.2179	20.2132	(88)
util rest of house													
	0.9971	0.9898	0.9646	0.8761	0.6963	0.4789	0.3237	0.3635	0.6204	0.9202	0.9913	0.9981	(89)
MIT 2	19.4416	19.6187	19.8459	20.0856	20.1966	20.2308	20.2326	20.2344	20.2194	20.0612	19.7110	19.4211	(90)
Living area fraction										fLA = Living area / (4) =		0.3628	(91)
MIT	19.7062	19.8830	20.1113	20.3535	20.4730	20.5083	20.5108	20.5118	20.4957	20.3253	19.9715	19.6826	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7062	19.8830	20.1113	20.3535	20.4730	20.5083	20.5108	20.5118	20.4957	20.3253	19.9715	19.6826	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9886	0.9634	0.8810	0.7129	0.5017	0.3484	0.3896	0.6445	0.9235	0.9904	0.9977	(94)
Useful gains	493.4331	592.5906	663.5867	676.8523	581.3131	400.3666	266.2819	279.0494	428.1428	533.2788	490.7750	461.9692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1093.4292	1059.6740	959.3467	794.1758	606.4345	402.5283	266.4441	279.3796	438.1892	672.2646	895.3121	1083.9366	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	446.3971	313.8800	220.0455	84.4729	18.6903	0.0000	0.0000	0.0000	0.0000	103.4054	291.2667	462.7437	(98)
Space heating												1940.9017	(98)
Space heating per m2											(98) / (4) =	23.4692	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	640.4199	504.1604	516.3854	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9830	0.9942	0.9910	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	629.5323	501.2278	511.7270	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1026.7745	985.4282	930.9575	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	286.0144	360.2451	311.9075	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												958.1670	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	71.5036	90.0613	77.9769	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	239.5417 (107)
Space cooling per m2	2.8965 (108)
Energy for space heating	23.4692 (99)
Energy for space cooling	2.8965 (108)
Total	26.3657 (109)
Target Fabric Energy Efficiency (TFEE)	30.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	17.1918	16.9569	16.7220	16.2523	16.2523	15.3128	15.7826	15.3128	15.0779	15.5477	15.5477	16.4872	(38)
Heat transfer coeff	45.7704	45.5355	45.3006	44.8309	44.8309	43.8914	44.3611	43.8914	43.6565	44.1263	44.1263	45.0657	(39)
Average = Sum(39)m / 12 =												44.6156	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5535	0.5506	0.5478	0.5421	0.5421	0.5307	0.5364	0.5307	0.5279	0.5336	0.5336	0.5449	(40)
HLP (average)												0.5395	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5121 (42)
Average daily hot water use (litres/day)	93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9672	20.0873	20.7282	18.0714	17.3399	14.9630	13.8655	15.9108	16.1008	18.7640	20.4823	22.2425	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (64)
Total per year (kWh/year) = Sum(64)m = 2127.6595 (64)
RHI water heating demand 2128 (64)
Heat gains from water heating, kWh/month
95.1321 84.4687 90.1691 82.8532 82.6583 75.9630 74.9565 79.4904 78.4851 85.8149 88.1975 93.5256 (65)

---

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	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1544	45.4349	36.9501	27.9736	20.9106	17.6536	19.0754	24.7949	33.2796	42.2562	49.3192	52.5762	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	335.8072	339.2918	330.5107	311.8166	288.2188	266.0401	251.2234	247.7388	256.5199	275.2140	298.8118	320.9905	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)
Water heating gains (Table 5)													
	127.8657	125.6975	121.1950	115.0739	111.0998	105.5042	100.7480	106.8419	109.0071	115.3426	122.4965	125.7065	(72)
Total internal gains													
	617.6539	613.2508	591.4824	557.6908	523.0559	492.0246	473.8734	482.2023	501.6333	535.6394	573.4541	602.0998	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	190.6581	290.3333	418.3365	556.9890	626.9944	673.8508	644.1625	593.4462	505.0995	360.5395	236.6949	166.6075	(83)
Total gains	808.3120	903.5841	1009.8189	1114.6797	1150.0503	1165.8754	1118.0360	1075.6484	1006.7329	896.1789	810.1490	768.7073	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.1902	50.4490	50.7106	51.2420	51.2420	52.3388	51.7846	52.3388	52.6204	52.0602	52.0602	50.9749	
alpha	4.3460	4.3633	4.3807	4.4161	4.4161	4.4893	4.4523	4.4893	4.5080	4.4707	4.4707	4.3983	
util living area													
	0.7505	0.6793	0.5515	0.4093	0.2799	0.1581	0.0913	0.0979	0.2210	0.4182	0.6284	0.7679	(86)
MIT	20.7449	20.8361	20.9375	20.9848	20.9977	20.9999	21.0000	21.0000	20.9995	20.9870	20.9076	20.7289	(87)
Th 2	20.4721	20.4747	20.4772	20.4824	20.4824	20.4927	20.4876	20.4927	20.4953	20.4902	20.4902	20.4798	(88)
util rest of house													
	0.7341	0.6615	0.5319	0.3895	0.2600	0.1390	0.0709	0.0772	0.1992	0.3944	0.6074	0.7521	(89)
MIT 2	20.1421	20.2659	20.4009	20.4650	20.4801	20.4927	20.4876	20.4927	20.4949	20.4760	20.3767	20.1279	(90)
Living area fraction									fLA = Living area / (4) =			0.3628	(91)
MIT	20.3608	20.4727	20.5956	20.6535	20.6678	20.6767	20.6735	20.6767	20.6779	20.6613	20.5693	20.3459	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3608	20.4727	20.5956	20.6535	20.6678	20.6767	20.6735	20.6767	20.6779	20.6613	20.5693	20.3459	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7305	0.6614	0.5364	0.3961	0.2671	0.1459	0.0783	0.0847	0.2071	0.4024	0.6107	0.7479	(94)
Useful gains	590.5085	597.6699	541.6184	441.4968	307.2209	170.1264	87.5436	91.1501	208.4505	360.6362	494.7405	574.9238	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	671.0286	649.9162	561.5268	446.2251	307.8907	170.1521	87.5446	91.1514	208.5875	364.5417	523.7464	660.0304	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	59.9069	35.1095	14.8118	3.4043	0.4984	0.0000	0.0000	0.0000	0.0000	2.9058	20.8843	63.3194	(98)
Space heating												200.8403	(98)
RHI space heating demand												201	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	20.0103	19.7754	19.5405	18.3662	18.1313	16.9569	16.9569	16.7220	17.4267	18.1313	18.6010	19.0708	(38)
Heat transfer coeff	48.5888	48.3540	48.1191	46.9447	46.7099	45.5355	45.5355	45.3006	46.0052	46.7099	47.1796	47.6494	(39)
Average = Sum(39)m / 12 =												46.8860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5875	0.5847	0.5819	0.5677	0.5648	0.5506	0.5506	0.5478	0.5563	0.5648	0.5705	0.5762	(40)
HLP (average)												0.5669	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5121 (42)
Average daily hot water use (litres/day)	93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9672	20.0873	20.7282	18.0714	17.3399	14.9630	13.8655	15.9108	16.1008	18.7640	20.4823	22.2425	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (64)
Total per year (kWh/year) = Sum(64)m = 2127.6595 (64)
Heat gains from water heating, kWh/month
95.1321 84.4687 90.1691 82.8532 82.6583 75.9630 74.9565 79.4904 78.4851 85.8149 88.1975 93.5256 (65)

---

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	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
51.1544 45.4349 36.9501 27.9736 20.9106 17.6536 19.0754 24.7949 33.2796 42.2562 49.3192 52.5762 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
335.8072 339.2918 330.5107 311.8166 288.2188 266.0401 251.2234 247.7388 256.5199 275.2140 298.8118 320.9905 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 52.5847 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 -100.4839 (71)
Water heating gains (Table 5)
127.8657 125.6975 121.1950 115.0739 111.0998 105.5042 100.7480 106.8419 109.0071 115.3426 122.4965 125.7065 (72)
Total internal gains
617.6539 613.2508 591.4824 557.6908 523.0559 492.0246 473.8734 482.2023 501.6333 535.6394 573.4541 602.0998 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(79)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	179.2125	309.5038	434.7351	557.5288	641.7032	644.6392	618.3480	554.3918	477.0780	345.1032	215.4272	152.8691	(83)
Total gains	796.8664	922.7546	1026.2175	1115.2195	1164.7591	1136.6638	1092.2215	1036.5941	978.7113	880.7426	788.8813	754.9689	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.2788	47.5084	47.7403	48.9346	49.1807	50.4490	50.4490	50.7106	49.9339	49.1807	48.6910	48.2110	
alpha	4.1519	4.1672	4.1827	4.2623	4.2787	4.3633	4.3633	4.3807	4.3289	4.2787	4.2461	4.2141	
util living area	0.8131	0.7326	0.6298	0.4948	0.3695	0.2559	0.1833	0.2009	0.3227	0.5313	0.7282	0.8311	(86)
MIT	20.5613	20.7246	20.8616	20.9562	20.9891	20.9984	20.9997	20.9996	20.9955	20.9516	20.7801	20.5334	(87)
Th 2	20.4412	20.4438	20.4464	20.4592	20.4618	20.4747	20.4747	20.4772	20.4695	20.4618	20.4566	20.4515	(88)
util rest of house	0.7994	0.7162	0.6109	0.4747	0.3488	0.2350	0.1615	0.1781	0.2983	0.5069	0.7094	0.8183	(89)
MIT 2	19.8626	20.0868	20.2723	20.4068	20.4497	20.4732	20.4744	20.4769	20.4651	20.4055	20.1773	19.8332	(90)
Living area fraction									fLA = Living area / (4) =			0.3628	(91)
MIT	20.1161	20.3182	20.4861	20.6061	20.6454	20.6637	20.6650	20.6665	20.6575	20.6036	20.3960	20.0872	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1161	20.3182	20.4861	20.6061	20.6454	20.6637	20.6650	20.6665	20.6575	20.6036	20.3960	20.0872	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7910	0.7124	0.6123	0.4802	0.3559	0.2425	0.1694	0.1864	0.3069	0.5134	0.7072	0.8093	(94)
Useful gains	630.3309	657.3671	628.3103	535.5512	414.4882	275.6788	185.0350	193.1758	300.3977	452.1698	557.8893	610.9984	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	768.4837	745.5301	672.9968	549.5389	417.8377	276.1144	185.1016	193.2761	301.6793	467.2663	627.2984	757.0141	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	102.7857	59.2455	33.2468	10.0712	2.4921	0.0000	0.0000	0.0000	0.0000	11.2318	49.9746	108.6357	(98)
Space heating												377.6833	(98)
Space heating per m2										(98) / (4) =		4.5669	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	428.0336	336.9627	344.2847	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9938	0.9971	0.9962	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	425.3665	336.0010	342.9713	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1245.4990	1196.6179	1130.1927	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	590.4954	640.2989	585.6927	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1816.4870	(104)
Cooled fraction										fC = cooled area / (4) =		0.7255	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	107.1032	116.1364	106.2320	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												329.4716	(107)
Space cooling per m2												3.9839	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	377.6833	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	138.7986	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	257.7688	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2127.6595	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	781.9149	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1452.1276	(310b)
Electricity used for heat distribution	26.3061	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	76.2666	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	187.2845	(330a)
Total electricity for the above, kWh/year	187.2845	(331)
Electricity for lighting (calculated in Appendix L)	361.3612	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3255.5222	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	138.7986	4.2400	5.8851	(340a)
Space heating from Combined Heat and Power	257.7688	2.9700	7.6557	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	781.9149	4.2400	33.1532	(342a)
Water heating from Combined Heat and Power	1452.1276	2.9700	43.1282	(342b)
Space cooling	76.2666	13.1900	10.0596	(348)
Mechanical ventilation fans	187.2845	13.1900	24.7028	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	361.3612	13.1900	47.6635	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			252.6781	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8310	(357)
SAP value	88.4069	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	969.1721	0.2160	209.3412 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	468.6706	0.2160	101.2329 (363)
less credit emissions for electricity	-164.0347	0.5190	-85.1340 (364)
Water heating from Combined Heat and Power	2640.2320	0.2160	570.2901 (365)
less credit emissions for electricity	-924.0812	0.5190	-479.5981 (366)
Electrical energy for heat distribution	26.3061	0.5190	13.6529 (372)
Total CO2 associated with community systems			329.7848 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			329.7848 (376)
Space cooling	76.2666	0.5190	39.5824 (377)
Pumps and fans	187.2845	0.5190	97.2006 (378)
Energy for lighting	361.3612	0.5190	187.5465 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			498.4143 (383)
CO2 emissions per m2			6.0300 (384)
EI value			94.7700 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	82.7000 (1b)	x	2.7000 (2b)	=	223.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	223.2900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			15.0000	1.1450	17.1756			(27)
External Wall 1	28.6200	15.0000	13.6200	0.1500	2.0430			(29a)
Total net area of external elements Aum(A, m2)			28.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2186			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	28.5786	(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	17.1918	16.9569	16.7220	16.2523	16.2523	15.3128	15.7826	15.3128	15.0779	15.5477	15.5477	16.4872	(38)
Heat transfer coeff	45.7704	45.5355	45.3006	44.8309	44.8309	43.8914	44.3611	43.8914	43.6565	44.1263	44.1263	45.0657	(39)
Average = Sum(39)m / 12 =												44.6156	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5535	0.5506	0.5478	0.5421	0.5421	0.5307	0.5364	0.5307	0.5279	0.5336	0.5336	0.5449	(40)
HLP (average)												0.5395	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5121 (42)
Average daily hot water use (litres/day)	93.8623 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.2485	99.4941	95.7396	91.9851	88.2306	84.4761	84.4761	88.2306	91.9851	95.7396	99.4941	103.2485	(44)
Energy conte	153.1146	133.9150	138.1883	120.4759	115.5995	99.7536	92.4364	106.0721	107.3389	125.0932	136.5490	148.2833	(45)
Energy content (annual)										Total = Sum(45)m =		1476.8197	(45)
Distribution loss (46)m = 0.15 x (45)m	22.9672	20.0873	20.7282	18.0714	17.3399	14.9630	13.8655	15.9108	16.1008	18.7640	20.4823	22.2425	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
208.3914 183.8425 193.4651 173.9696 170.8763 153.2473 147.7132 161.3489 160.8326 180.3700 190.0426 203.5601 (64)
Total per year (kWh/year) = Sum(64)m = 2127.6595 (64)
Heat gains from water heating, kWh/month
95.1321 84.4687 90.1691 82.8532 82.6583 75.9630 74.9565 79.4904 78.4851 85.8149 88.1975 93.5256 (65)

---

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	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	150.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1544	45.4349	36.9501	27.9736	20.9106	17.6536	19.0754	24.7949	33.2796	42.2562	49.3192	52.5762	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	335.8072	339.2918	330.5107	311.8166	288.2188	266.0401	251.2234	247.7388	256.5199	275.2140	298.8118	320.9905	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	52.5847	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	-100.4839	(71)
Water heating gains (Table 5)													
	127.8657	125.6975	121.1950	115.0739	111.0998	105.5042	100.7480	106.8419	109.0071	115.3426	122.4965	125.7065	(72)
Total internal gains													
	617.6539	613.2508	591.4824	557.6908	523.0559	492.0246	473.8734	482.2023	501.6333	535.6394	573.4541	602.0998	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(79)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	190.6581	290.3333	418.3365	556.9890	626.9944	673.8508	644.1625	593.4462	505.0995	360.5395	236.6949	166.6075	(83)
Total gains	808.3120	903.5841	1009.8189	1114.6797	1150.0503	1165.8754	1118.0360	1075.6484	1006.7329	896.1789	810.1490	768.7073	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.1902	50.4490	50.7106	51.2420	51.2420	52.3388	51.7846	52.3388	52.6204	52.0602	52.0602	50.9749	
alpha	4.3460	4.3633	4.3807	4.4161	4.4161	4.4893	4.4523	4.4893	4.5080	4.4707	4.4707	4.3983	
util living area													
	0.7505	0.6793	0.5515	0.4093	0.2799	0.1581	0.0913	0.0979	0.2210	0.4182	0.6284	0.7679	(86)
MIT	20.7449	20.8361	20.9375	20.9848	20.9977	20.9999	21.0000	21.0000	20.9995	20.9870	20.9076	20.7289	(87)
Th 2	20.4721	20.4747	20.4772	20.4824	20.4824	20.4927	20.4876	20.4927	20.4953	20.4902	20.4902	20.4798	(88)
util rest of house													
	0.7341	0.6615	0.5319	0.3895	0.2600	0.1390	0.0709	0.0772	0.1992	0.3944	0.6074	0.7521	(89)
MIT 2	20.1421	20.2659	20.4009	20.4650	20.4801	20.4927	20.4876	20.4927	20.4949	20.4760	20.3767	20.1279	(90)
Living area fraction									fLA = Living area / (4) =			0.3628	(91)
MIT	20.3608	20.4727	20.5956	20.6535	20.6678	20.6767	20.6735	20.6767	20.6779	20.6613	20.5693	20.3459	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3608	20.4727	20.5956	20.6535	20.6678	20.6767	20.6735	20.6767	20.6779	20.6613	20.5693	20.3459	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7305	0.6614	0.5364	0.3961	0.2671	0.1459	0.0783	0.0847	0.2071	0.4024	0.6107	0.7479	(94)
Useful gains	590.5085	597.6699	541.6184	441.4968	307.2209	170.1264	87.5436	91.1501	208.4505	360.6362	494.7405	574.9238	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	671.0286	649.9162	561.5268	446.2251	307.8907	170.1521	87.5446	91.1514	208.5875	364.5417	523.7464	660.0304	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	59.9069	35.1095	14.8118	3.4043	0.4984	0.0000	0.0000	0.0000	0.0000	2.9058	20.8843	63.3194	(98)
Space heating												200.8403	(98)
Space heating per m2											(98) / (4) =	2.4285	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	316.0180	235.1140	237.0135	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9986	0.9995	0.9994	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	315.5712	234.9925	236.8708	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1279.6424	1226.7907	1175.8407	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	694.1312	737.8978	698.5936	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2130.6227	(104)
Cooled fraction										fC = cooled area / (4) =		0.7255	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	125.9005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												125.9005	(107)
Space cooling per m2												1.5224	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	200.8403	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	73.8088	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	137.0735	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2127.6595	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	781.9149	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1452.1276	(310b)
Electricity used for heat distribution	24.4492	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	29.1436	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	187.2845	(330a)
Total electricity for the above, kWh/year	187.2845	(331)
Electricity for lighting (calculated in Appendix L)	361.3612	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3022.7141	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	73.8088	5.0000	3.6904	(340a)
Space heating from Combined Heat and Power	137.0735	3.5000	4.7976	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	781.9149	5.0000	39.0957	(342a)
Water heating from Combined Heat and Power	1452.1276	3.5000	50.8245	(342b)
Space cooling	29.1436	15.7000	4.5755	(348)
Mechanical ventilation fans	187.2845	15.7000	29.4037	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	361.3612	15.7000	56.7337	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			231.0211	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	900.7618	0.2160	194.5645	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	249.2245	0.2160	53.8325	(363)
less credit emissions for electricity	-87.2286	0.5190	-45.2716	(364)
Water heating from Combined Heat and Power	2640.2320	0.2160	570.2901	(365)
less credit emissions for electricity	-924.0812	0.5190	-479.5981	(366)
Electrical energy for heat distribution	24.4492	0.5190	12.6892	(372)
Total CO2 associated with community systems			306.5065	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			306.5065	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	29.1436	0.5190	15.1255 (377)
Pumps and fans	187.2845	0.5190	97.2006 (378)
Energy for lighting	361.3612	0.5190	187.5465 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			450.6792 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	900.7618	1.2200	1098.9293	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	249.2245	1.2200	304.0539	(363)
less credit emissions for electricity	-87.2286	3.0700	-267.7917	(364)
Water heating from Combined Heat and Power	2640.2320	1.2200	3221.0831	(365)
less credit emissions for electricity	-924.0812	3.0700	-2836.9293	(366)
Electrical energy for heat distribution	24.4492	3.0700	75.0592	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1594.4045	(373)
Space and water heating			1594.4045	(376)
Space cooling	29.1436	3.0700	89.4709	(377)
Pumps and fans	187.2845	3.0700	574.9634	(378)
Energy for lighting	361.3612	3.0700	1109.3790	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2447.2177	(383)
Primary energy kWh/m2/year			29.5915	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£91	£91	£0
Community scheme	£187	£187	£0
Space heating	£127	£127	£0
Space cooling	£5	£5	£0
Water heating	£90	£90	£0
Lighting	£57	£57	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£231	£231	£0
Total cost of uses	£232	£232	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	30 kWh/m²	30 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	442.11 (P1)
Transmission heat loss coefficient	28.58 (37)
Summer heat loss coefficient	470.69 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South West	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						705.2511

	Jun	Jul	Aug	
Solar gains	742	705	650	(P3)
Internal gains	492	474	482	
Total summer gains	1234	1179	1132	(P5)
Summer gain/loss ratio	2.62	2.51	2.40	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.92	21.71	21.50	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007042	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0207
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	87 B	**DER**	7.54	**TER**	17.35
Environmental	95 A	**% DER<TER**	56.53		
CO_2 Emissions (t/year)	0.34	**DFEE**	33.37	**TFEE**	39.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.24		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           North East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               9.2, 55.8, 2.7
Living Area:                   30 m2, fraction: 53.8%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                13.84, 24.84, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.377
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	3
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows fully open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	6.00
Approved Installation	Yes
DataType	Database
Type	Balanced mechanical ventilation with heat recovery
Database Ref Number	500167
Configuration	2
HR Duct Insulated	Yes
ManufacturerSFP	0.55
DuctType	Rigid
HR Efficiency	92
Wet Rooms	2
Chimneys MHS:	0
Chimneys SHS:	0
Chimneys Other:	0
Chimneys Total:	0
Open Flues MHS:	0
Open Flues SHS:	0
Open Flues Other:	0
Open Flues Total:	0
Intermittent Fans:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	
Cooled Area	60.00
Data Source	SAP table
Type	Split or Multi-Split
Class	A
Control	Modulating
Light Fittings:	10
LEL Fittings:	10
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	None
Main Heating 2	None
Heating Systems Interaction	Each system heats separate parts of dwelling
Smoke Control Area	Unknown
Community Heating	
Type	Space and Water Combined
PCDF Index	n/a
Distribution Loss	Piping system >= 1991, pre-insulated, low temp, variable flow
Controls	CCJ
Ctrl SAP Code	2310
Community Heating Heat Sources:	Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
1	Boilers, Space and Water, 35, 95
2	Combined Heat and Power, Space and Water, 65, 90
Secondary Heating	None
Water Heating	
Type	CommunityHeating
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	More Dwellings, One Block
Apportioned Energy	300
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---

DWELLING AS DESIGNED

Mid-floor flat, total floor area 56 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.35 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.4 kWh/m²/yrOK

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	(no floor)		

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		8.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1500	2.0760			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6714			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	24.0314	(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	13.5015	13.3430	13.1845	12.3922	12.2337	11.4413	11.4413	11.2828	11.7583	12.2337	12.5506	12.8676	(38)
Heat transfer coeff	37.5329	37.3744	37.2160	36.4236	36.2651	35.4727	35.4727	35.3143	35.7897	36.2651	36.5821	36.8990	(39)
Average = Sum(39)m / 12 =												36.3840	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6726	0.6698	0.6670	0.6528	0.6499	0.6357	0.6357	0.6329	0.6414	0.6499	0.6556	0.6613	(40)
HLP (average)												0.6520	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608 (42)
Average daily hot water use (litres/day)	78.3930 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	19.1820	16.7767	17.3121	15.0931	14.4822	12.4970	11.5803	13.2886	13.4473	15.6715	17.1067	18.5767	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)

If cylinder contains dedicated solar storage

32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Primary loss
Total heat required for water heating calculated for each month

183.1568	161.7721	170.6905	154.1141	151.8245	136.8070	132.4789	143.8673	143.1422	159.7535	167.5382	179.1218	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)

Solar input
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

183.1568	161.7721	170.6905	154.1141	151.8245	136.8070	132.4789	143.8673	143.1422	159.7535	167.5382	179.1218	(64)

Total per year (kWh/year) = Sum(64)m = 1884.2671 (64)
Heat gains from water heating, kWh/month

86.7416	77.1303	82.5965	76.2512	76.3236	70.4966	69.8911	73.6778	72.6031	78.9600	80.7148	85.3999	(65)

---

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	
93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	(66)m

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

14.5890	12.9579	10.5380	7.9780	5.9636	5.0347	5.4402	7.0714	9.4912	12.0513	14.0656	14.9945	(67)

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

162.2448	163.9284	159.6858	150.6538	139.2525	128.5369	121.3782	119.6947	123.9373	132.9692	144.3705	155.0861	(68)

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

32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	(69)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Pumps, fans
Losses e.g. evaporation (negative values) (Table 5)

-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	(71)

Water heating gains (Table 5)

116.5881	114.7772	111.0168	105.9045	102.5854	97.9120	93.9397	99.0293	100.8376	106.1290	112.1038	114.7848	(72)
344.3333	342.5748	332.1520	315.4476	298.7129	282.3950	271.6695	276.7067	285.1775	302.0609	321.4514	335.7768	(73)

Total internal gains

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
391.1227	437.8160	503.7462	597.2546	677.5168	686.2400	649.4582	577.8842	494.2677	418.4531	380.3245	373.9874	(84)

Solar gains
Total gains

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
41.2971	41.4722	41.6488	42.5548	42.7408	43.6955	43.6955	43.8916	43.3086	42.7408	42.3705	42.0065	
3.7531	3.7648	3.7766	3.8370	3.8494	3.9130	3.9130	3.9261	3.8872	3.8494	3.8247	3.8004	

tau
alpha
util living area

0.9283	0.8946	0.8169	0.6597	0.4801	0.3279	0.2396	0.2797	0.4822	0.7507	0.8899	0.9362	(86)

19.9884	20.1931	20.5074	20.8192	20.9537	20.9922	20.9983	20.9969	20.9665	20.7559	20.3430	19.9602	(87)
20.3651	20.3676	20.3701	20.3828	20.3853	20.3980	20.3980	20.4005	20.3929	20.3853	20.3802	20.3752	(88)

MIT
Th 2
util rest of house

0.9206	0.8839	0.8002	0.6352	0.4515	0.2978	0.2071	0.2437	0.4437	0.7239	0.8772	0.9293	(89)
19.0004	19.2925	19.7331	20.1624	20.3339	20.3906	20.3967	20.3981	20.3593	20.0906	19.5189	18.9678	(90)

MIT 2
Living area fraction fLA = Living area / (4) = 0.5376 (91)

19.5315	19.7767	20.1494	20.5155	20.6671	20.7140	20.7201	20.7200	20.6858	20.4483	19.9620	19.5013	(92)

MIT
Temperature adjustment 0.0000

19.5315	19.7767	20.1494	20.5155	20.6671	20.7140	20.7201	20.7200	20.6858	20.4483	19.9620	19.5013	(93)

adjusted MIT

---

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9090	0.8728	0.7939	0.6406	0.4647	0.3136	0.2245	0.2630	0.4625	0.7268	0.8677	0.9181	(94)
355.5417	382.1375	399.9433	382.5742	314.8757	215.2391	145.8204	151.9554	228.5794	304.1122	329.9917	343.3579	(95)
4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Utilisation
Useful gains
Ext temp.
Heat loss rate W

571.6840	556.0091	507.9759	423.0799	325.1938	216.8807	146.1513	152.5580	235.7020	357.1488	470.5168	564.6046	(97)
1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Month fracti
Space heating kWh

160.8098	116.8417	80.3763	29.1640	7.6767	0.0000	0.0000	0.0000	0.0000	39.4592	101.1781	164.6075	(98)

Space heating
Space heating 700.1133 (98)
Space heating per m2 (98) / (4) = 12.5468 (99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	333.4436	262.4982	268.3883	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9848	0.9919	0.9876	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	328.3778	260.3814	265.0657	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.6121	815.5135	732.6227	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	382.4887	413.0183	347.8624	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1143.3693	(104)
Cooled fraction										fC = cooled area / (4) =		1.0753	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8195	111.0264	93.5114	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												307.3573	(107)
Space cooling per m2												5.5082	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	700.1133	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	257.2916	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	477.8273	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1884.2671	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	692.4682	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1286.0123	(310b)
Electricity used for heat distribution	27.1360	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	71.1475	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	126.3661	(330a)
Total electricity for the above, kWh/year	126.3661	(331)
Electricity for lighting (calculated in Appendix L)	257.6471	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3168.7602	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	999.7472	0.2160	215.9454	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	868.7770	0.2160	187.6558	(363)
less credit emissions for electricity	-304.0719	0.5190	-157.8133	(364)
Water heating from Combined Heat and Power	2338.2042	0.2160	505.0521	(365)
less credit emissions for electricity	-818.3715	0.5190	-424.7348	(366)
Electrical energy for heat distribution	27.1360	0.5190	14.0836	(372)
Total CO2 associated with community systems			340.1888	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			340.1888	(376)
Space cooling	71.1475	0.5190	36.9256	(377)
Pumps and fans	126.3661	0.5190	65.5840	(378)
Energy for lighting	257.6471	0.5190	133.7188	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			420.7172	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5400	ZC1
Total Floor Area	TFA	55.8000	
Assumed number of occupants	N	1.8608	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2299	ZC2
CO2 emissions from cooking, equation (L16)		2.9329	ZC3
Total CO2 emissions		27.7028	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7028	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1327	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3827	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3253	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4148	0.4067	0.3985	0.3579	0.3497	0.3091	0.3091	0.3009	0.3253	0.3497	0.3660	0.3823	(22b)
Effective ac	0.5860	0.5827	0.5794	0.5640	0.5612	0.5478	0.5478	0.5453	0.5529	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1800	2.4912			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0745			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		22.4745	(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	29.1362	28.9701	28.8073	28.0426	27.8995	27.2335	27.2335	27.1102	27.4901	27.8995	28.1890	28.4916	(38)
Heat transfer coeff	51.6107	51.4446	51.2818	50.5171	50.3741	49.7081	49.7081	49.5847	49.9646	50.3741	50.6635	50.9661	(39)
Average = Sum(39)m / 12 =												50.5165	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9249	0.9219	0.9190	0.9053	0.9028	0.8908	0.8908	0.8886	0.8954	0.9028	0.9079	0.9134	(40)
HLP (average)												0.9053	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8608	(42)
Average daily hot water use (litres/day)												78.3930	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	19.1820	16.7767	17.3121	15.0931	14.4822	12.4970	11.5803	13.2886	13.4473	15.6715	17.1067	18.5767	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	174.4749	153.9304	162.0086	145.7123	143.1426	128.4052	123.7970	135.1854	134.7404	151.0716	159.1364	170.4399	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.4749	153.9304	162.0086	145.7123	143.1426	128.4052	123.7970	135.1854	134.7404	151.0716	159.1364	170.4399	(64)
									Total per year (kWh/year) = Sum(64)m =			1782.0448	(64)
Heat gains from water heating, kWh/month													
	79.7960	70.8569	75.6510	69.5298	69.3780	63.7752	62.9456	66.7323	65.8816	72.0144	73.9933	78.4544	(65)

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	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.5890	12.9579	10.5380	7.9780	5.9636	5.0347	5.4402	7.0714	9.4912	12.0513	14.0656	14.9945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	162.2448	163.9284	159.6858	150.6538	139.2525	128.5369	121.3782	119.6947	123.9373	132.9692	144.3705	155.0861	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	(71)
Water heating gains (Table 5)													
	107.2527	105.4419	101.6814	96.5691	93.2501	88.5766	84.6043	89.6939	91.5022	96.7936	102.7684	105.4494	(72)
Total internal gains													
	337.9979	336.2395	325.8166	309.1123	292.3776	276.0597	265.3342	270.3713	278.8421	295.7255	315.1160	329.4414	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6300	0.7000	0.7700	27.5857	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	37.9303	77.2083	139.1048	228.4501	307.0818	327.3817	306.2588	244.1531	169.5014	94.3547	47.7262	30.9758	(83)
Total gains	375.9283	413.4478	464.9214	537.5624	599.4593	603.4413	571.5930	514.5244	448.3435	390.0802	362.8422	360.4173	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.0813	75.3237	75.5628	76.7066	76.9245	77.9552	77.9552	78.1491	77.5549	76.9245	76.4850	76.0309	
alpha	6.0054	6.0216	6.0375	6.1138	6.1283	6.1970	6.1970	6.2099	6.1703	6.1283	6.0990	6.0687	
util living area													
	0.9961	0.9923	0.9772	0.9082	0.7360	0.5224	0.3820	0.4417	0.7275	0.9523	0.9914	0.9970	(86)
MIT	20.1445	20.2660	20.4917	20.7833	20.9519	20.9949	20.9994	20.9986	20.9672	20.7313	20.3935	20.1260	(87)
Th 2	20.1464	20.1489	20.1514	20.1630	20.1652	20.1753	20.1753	20.1772	20.1714	20.1652	20.1607	20.1561	(88)
util rest of house													
	0.9949	0.9899	0.9699	0.8826	0.6834	0.4573	0.3108	0.3636	0.6557	0.9329	0.9883	0.9960	(89)
MIT 2	19.0055	19.1839	19.5103	19.9191	20.1219	20.1722	20.1751	20.1766	20.1472	19.8608	19.3791	18.9859	(90)
Living area fraction									fLA = Living area / (4) =			0.5376	(91)
MIT	19.6179	19.7657	20.0379	20.3837	20.5681	20.6145	20.6183	20.6185	20.5881	20.3288	19.9244	19.5989	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6179	19.7657	20.0379	20.3837	20.5681	20.6145	20.6183	20.6185	20.5881	20.3288	19.9244	19.5989	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9885	0.9688	0.8900	0.7095	0.4922	0.3491	0.4056	0.6930	0.9373	0.9872	0.9952	(94)
Useful gains	373.6455	408.7051	450.4133	478.4105	425.3218	297.0145	199.5470	208.7094	310.7184	365.6158	358.1804	358.6772	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	790.5675	764.7585	694.2502	580.1252	446.7244	298.9696	199.7395	209.1740	324.1730	490.0806	649.7308	784.8201	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	310.1900	239.2679	181.4146	73.2346	15.9235	0.0000	0.0000	0.0000	0.0000	92.6019	209.9163	317.0504	(98)
Space heating												1439.5991	(98)
Space heating per m2											(98) / (4) =	25.7993	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1539.6782	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	310.1900	239.2679	181.4146	73.2346	15.9235	0.0000	0.0000	0.0000	0.0000	92.6019	209.9163	317.0504	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	331.7540	255.9015	194.0263	78.3258	17.0305	0.0000	0.0000	0.0000	0.0000	99.0394	224.5094	339.0913	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.4749	153.9304	162.0086	145.7123	143.1426	128.4052	123.7970	135.1854	134.7404	151.0716	159.1364	170.4399	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.3328	85.9864	85.1161	83.0858	80.7558	79.8000	79.8000	79.8000	79.8000	83.5542	85.5535	86.4474	(217)
Fuel for water heating, kWh/month													
	202.0959	179.0172	190.3385	175.3757	177.2537	160.9088	155.1340	169.4053	168.8476	180.8068	186.0081	197.1603	(219)
Water heating fuel used												2142.3518	(219)
Annual totals kWh/year													
Space heating fuel - main system												1539.6782	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												257.6471	(232)
Total delivered energy for all uses												4014.6771	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1539.6782	0.2160	332.5705	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2142.3518	0.2160	462.7480	(264)
Space and water heating			795.3185	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	257.6471	0.5190	133.7188	(268)
Total CO2, kg/m2/year			967.9623	(272)
Emissions per m2 for space and water heating			14.2530	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3964	(272b)
Emissions per m2 for pumps and fans			0.6976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2530 * 1.00) + 2.3964 + 0.6976, rounded to 2 d.p.			17.3500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1327	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2827	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2403	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3064	0.3004	0.2944	0.2644	0.2584	0.2283	0.2283	0.2223	0.2403	0.2584	0.2704	0.2824	(22b)
Effective ac	0.5469	0.5451	0.5433	0.5349	0.5334	0.5261	0.5261	0.5247	0.5289	0.5334	0.5366	0.5399	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1500	2.0760			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.6714			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	24.0314	(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	27.1931	27.1025	27.0136	26.5963	26.5183	26.1548	26.1548	26.0875	26.2948	26.5183	26.6762	26.8413	(38)
Heat transfer coeff	51.2245	51.1339	51.0451	50.6278	50.5497	50.1862	50.1862	50.1189	50.3262	50.5497	50.7076	50.8728	(39)
Average = Sum(39)m / 12 =												50.6274	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9180	0.9164	0.9148	0.9073	0.9059	0.8994	0.8994	0.8982	0.9019	0.9059	0.9087	0.9117	(40)
HLP (average)												0.9073	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608	(42)
Average daily hot water use (litres/day)	78.3930	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)											Total = Sum(45)m =	1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	27.1745	23.7670	24.5254	21.3818	20.5164	17.7041	16.4054	18.8255	19.0503	22.2013	24.2345	26.3171 (65)

---

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	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.5890	12.9579	10.5380	7.9780	5.9636	5.0347	5.4402	7.0714	9.4912	12.0513	14.0656	14.9945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	162.2448	163.9284	159.6858	150.6538	139.2525	128.5369	121.3782	119.6947	123.9373	132.9692	144.3705	155.0861	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	(71)
Water heating gains (Table 5)													
	36.5249	35.3676	32.9643	29.6970	27.5758	24.5890	22.0503	25.3031	26.4588	29.8405	33.6590	35.3724	(72)
Total internal gains													
	264.2701	263.1652	254.0994	239.2401	223.7033	209.0720	199.7802	202.9805	210.7986	225.7724	243.0065	256.3644	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
Total gains	311.0594	358.4063	425.6936	521.0471	602.5071	612.9170	577.5688	504.1580	419.8888	342.1646	301.8796	294.5749	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.2589	30.3126	30.3653	30.6156	30.6629	30.8850	30.8850	30.9265	30.7991	30.6629	30.5674	30.4682	
alpha	3.0173	3.0208	3.0244	3.0410	3.0442	3.0590	3.0590	3.0618	3.0533	3.0442	3.0378	3.0312	
util living area													
	0.9694	0.9525	0.9106	0.8097	0.6531	0.4868	0.3696	0.4337	0.6778	0.8854	0.9550	0.9737	(86)
MIT	19.0715	19.3213	19.7712	20.3334	20.7320	20.9199	20.9742	20.9583	20.7806	20.2208	19.5447	19.0183	(87)
Th 2	20.1522	20.1536	20.1550	20.1613	20.1625	20.1680	20.1680	20.1690	20.1659	20.1625	20.1601	20.1576	(88)
util rest of house													
	0.9652	0.9460	0.8984	0.7853	0.6132	0.4325	0.3040	0.3629	0.6237	0.8644	0.9478	0.9700	(89)
MIT 2	18.3703	18.6176	19.0584	19.5987	19.9585	20.1177	20.1559	20.1481	20.0138	19.5063	18.8460	18.3216	(90)
Living area fraction										fLA = Living area / (4) =		0.5376	(91)
MIT	18.7473	18.9959	19.4416	19.9937	20.3743	20.5490	20.5958	20.5837	20.4261	19.8905	19.2216	18.6962	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7473	18.9959	19.4416	19.9937	20.3743	20.5490	20.5958	20.5837	20.4261	19.8905	19.2216	18.6962	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9562	0.9352	0.8865	0.7800	0.6237	0.4579	0.3382	0.3989	0.6414	0.8567	0.9378	0.9619	(94)
Useful gains	297.4502	335.1728	377.3755	406.4237	375.7654	280.6278	195.3171	201.0924	269.3374	293.1173	283.1004	283.3403	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	740.0568	720.7801	660.6062	561.6483	438.4848	298.5585	200.5363	209.6822	318.3664	469.6302	614.6593	737.4611	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	329.2993	259.1281	210.7237	111.7617	46.6632	0.0000	0.0000	0.0000	0.0000	131.3256	238.7224	337.8659	(98)
Space heating												1665.4899	(98)
Space heating per m2											(98) / (4) =	29.8475	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	471.7504	371.3780	380.9037	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9041	0.9363	0.9117	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	426.5172	347.7390	347.2568	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	786.2891	743.6241	658.8965	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	259.0357	294.5386	231.8599	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												785.4342	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    64.7589    73.6346    57.9650     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          196.3586 (107)
Space cooling per m2                                                                                                                     3.5190 (108)
Energy for space heating                                                                                                                29.8475 (99)
Energy for space cooling                                                                                                                 3.5190 (108)
Total                                                                                                                                   33.3665 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   33.4 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1327	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3827	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3253	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4148	0.4067	0.3985	0.3579	0.3497	0.3091	0.3091	0.3009	0.3253	0.3497	0.3660	0.3823	(22b)
Effective ac	0.5860	0.5827	0.5794	0.5640	0.5612	0.5478	0.5478	0.5453	0.5529	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			11.0000	1.3258	14.5833			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1800	2.4912			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0745			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4000	(36)
Total fabric heat loss (33) + (36) =	22.4745	(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	29.1362	28.9701	28.8073	28.0426	27.8995	27.2335	27.2335	27.1102	27.4901	27.8995	28.1890	28.4916	(38)
Heat transfer coeff	51.6107	51.4446	51.2818	50.5171	50.3741	49.7081	49.7081	49.5847	49.9646	50.3741	50.6635	50.9661	(39)
Average = Sum(39)m / 12 =												50.5165	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9249	0.9219	0.9190	0.9053	0.9028	0.8908	0.8908	0.8886	0.8954	0.9028	0.9079	0.9134	(40)
HLP (average)												0.9053	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608 (42)
Average daily hot water use (litres/day)	78.3930 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.1745	23.7670	24.5254	21.3818	20.5164	17.7041	16.4054	18.8255	19.0503	22.2013	24.2345	26.3171	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	93.0379	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.5890	12.9579	10.5380	7.9780	5.9636	5.0347	5.4402	7.0714	9.4912	12.0513	14.0656	14.9945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	162.2448	163.9284	159.6858	150.6538	139.2525	128.5369	121.3782	119.6947	123.9373	132.9692	144.3705	155.0861	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	32.3038	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	(71)
Water heating gains (Table 5)													
	36.5249	35.3676	32.9643	29.6970	27.5758	24.5890	22.0503	25.3031	26.4588	29.8405	33.6590	35.3724	(72)
Total internal gains													
	264.2701	263.1652	254.0994	239.2401	223.7033	209.0720	199.7802	202.9805	210.7986	225.7724	243.0065	256.3644	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6300	0.7000	0.7700	27.5857	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	37.9303	77.2083	139.1048	228.4501	307.0818	327.3817	306.2588	244.1531	169.5014	94.3547	47.7262	30.9758	(83)
Total gains	302.2004	340.3735	393.2043	467.6902	530.7851	536.4537	506.0390	447.1336	380.3001	320.1271	290.7327	287.3402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.0813	75.3237	75.5628	76.7066	76.9245	77.9552	77.9552	78.1491	77.5549	76.9245	76.4850	76.0309	
alpha	6.0054	6.0216	6.0375	6.1138	6.1283	6.1970	6.1970	6.2099	6.1703	6.1283	6.0990	6.0687	
util living area													
	0.9988	0.9972	0.9898	0.9463	0.8008	0.5833	0.4309	0.5063	0.8150	0.9804	0.9973	0.9991	(86)
MIT	20.0171	20.1416	20.3774	20.7028	20.9235	20.9908	20.9988	20.9970	20.9386	20.6298	20.2706	19.9989	(87)
Th 2	20.1464	20.1489	20.1514	20.1630	20.1652	20.1753	20.1753	20.1772	20.1714	20.1652	20.1607	20.1561	(88)
util rest of house													
	0.9984	0.9963	0.9863	0.9286	0.7511	0.5124	0.3509	0.4178	0.7478	0.9710	0.9963	0.9988	(89)
MIT 2	19.2406	19.3668	19.6027	19.9257	20.1163	20.1713	20.1750	20.1763	20.1379	19.8638	19.5057	19.2306	(90)
Living area fraction									fLA = Living area / (4) =			0.5376	(91)
MIT	19.6580	19.7834	20.0192	20.3435	20.5503	20.6119	20.6179	20.6175	20.5684	20.2756	19.9169	19.6437	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6580	19.7834	20.0192	20.3435	20.5503	20.6119	20.6179	20.6175	20.5684	20.2756	19.9169	19.6437	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9856	0.9329	0.7751	0.5504	0.3939	0.4655	0.7819	0.9725	0.9959	0.9986	(94)
Useful gains	301.6285	338.9348	387.5545	436.2899	411.3904	295.2622	199.3407	208.1272	297.3663	311.3305	289.5342	286.9370	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	792.6394	765.6691	693.2890	578.0947	445.8234	298.8403	199.7216	209.1247	323.1896	487.4017	649.3502	787.1040	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	365.3122	286.7654	227.4664	102.0994	25.6181	0.0000	0.0000	0.0000	0.0000	130.9970	259.0675	372.1243	(98)
Space heating												1769.4503	(98)
Space heating per m2											(98) / (4) =	31.7106	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	467.2558	367.8397	376.8439	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9707	0.9880	0.9772	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	453.5577	363.4254	368.2407	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	696.9164	660.0178	592.2445	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	175.2182	220.6648	166.6588	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												562.5418	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	43.8046	55.1662	41.6647	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	140.6355 (107)
Space cooling per m2	2.5203 (108)
Energy for space heating	31.7106 (99)
Energy for space cooling	2.5203 (108)
Total	34.2309 (109)
Target Fabric Energy Efficiency (TFEE)	39.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1500	2.0760			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6714			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	24.0314	(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	11.5998	11.4413	11.2828	10.9659	10.9659	10.3320	10.6489	10.3320	10.1735	10.4905	10.4905	11.1244	(38)
Heat transfer coeff	35.6312	35.4727	35.3143	34.9973	34.9973	34.3634	34.6804	34.3634	34.2049	34.5219	34.5219	35.1558	(39)
Average = Sum(39)m / 12 =												34.8520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6386	0.6357	0.6329	0.6272	0.6272	0.6158	0.6215	0.6158	0.6130	0.6187	0.6187	0.6300	(40)
HLP (average)												0.6246	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608 (42)
Average daily hot water use (litres/day)	78.3930 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	19.1820	16.7767	17.3121	15.0931	14.4822	12.4970	11.5803	13.2886	13.4473	15.6715	17.1067	18.5767	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              183.1568   161.7721   170.6905   154.1141   151.8245   136.8070   132.4789   143.8673   143.1422   159.7535   167.5382   179.1218 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              183.1568   161.7721   170.6905   154.1141   151.8245   136.8070   132.4789   143.8673   143.1422   159.7535   167.5382   179.1218 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1884.2671 (64)
RHI water heating demand                                                                                    1884 (64)
Heat gains from water heating, kWh/month
               86.7416    77.1303    82.5965    76.2512    76.3236    70.4966    69.8911    73.6778    72.6031    78.9600    80.7148    85.3999 (65)


-------------------------------------------------------------------------------------------------------------
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          111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455   111.6455 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               36.4726    32.3947    26.3451    19.9449    14.9091    12.5869    13.6006    17.6785    23.7281    30.1282    35.1641    37.4863 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              242.1564   244.6692   238.3370   224.8564   207.8396   191.8461   181.1616   178.6487   184.9810   198.4616   215.4784   231.4718 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253    48.0253 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303   -74.4303 (71)
Water heating gains (Table 5)
              116.5881   114.7772   111.0168   105.9045   102.5854    97.9120    93.9397    99.0293   100.8376   106.1290   112.1038   114.7848 (72)
Total internal gains
              480.4576   477.0816   460.9393   435.9463   410.5745   387.5855   373.9423   380.5970   394.7871   419.9593   447.9868   468.9834 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2            Table 6a       Specific data     Specific data      factor             W
                                                       W/m2       or Table 6b       or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------
Northeast                           8.0000           12.4885            0.6800            0.8000            0.7700           37.6645 (75)
Northwest                           3.0000           12.4885            0.6800            0.8000            0.7700           14.1242 (81)
-------------------------------------------------------------------------------------------------------------

Solar gains    51.7887    93.3945   172.7298   292.3974   380.9628   432.5351   404.0574   333.5971   231.0971   127.2610    67.4115    43.2466 (83)
Total gains   532.2463   570.4761   633.6692   728.3437   791.5374   820.1205   777.9997   714.1941   625.8843   547.2203   515.3983   512.2300 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            43.5012    43.6955    43.8916    44.2891    44.2891    45.1061    44.6939    45.1061    45.3151    44.8991    44.8991    44.0895
alpha           3.9001     3.9130     3.9261     3.9526     3.9526     4.0071     3.9796     4.0071     4.0210     3.9933     3.9933     3.9393
util living area
                0.8053     0.7621     0.6464     0.4789     0.3160     0.1758     0.1025     0.1155     0.2775     0.5199     0.7159     0.8165 (86)

MIT            20.5466    20.6485    20.8345    20.9544    20.9927    20.9996    21.0000    20.9999    20.9971    20.9513    20.7816    20.5328 (87)
Th 2           20.3954    20.3980    20.4005    20.4056    20.4056    20.4158    20.4107    20.4158    20.4183    20.4132    20.4132    20.4030 (88)
util rest of house
                0.7894     0.7441     0.6237     0.4539     0.2905     0.1514     0.0763     0.0874     0.2463     0.4886     0.6932     0.8011 (89)
MIT 2          19.8057    19.9464    20.1968    20.3535    20.3983    20.4155    20.4107    20.4158    20.4159    20.3599    20.1426    19.7937 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.5376 (91)
MIT            20.2040    20.3238    20.5396    20.6766    20.7179    20.7295    20.7275    20.7298    20.7284    20.6779    20.4862    20.1911 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   20.2040    20.3238    20.5396    20.6766    20.7179    20.7295    20.7275    20.7298    20.7284    20.6779    20.4862    20.1911 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.7840     0.7418     0.6290     0.4654     0.3039     0.1645     0.0904     0.1025     0.2630     0.5028     0.6961     0.7954 (94)
Useful gains  417.2995   423.1834   398.5973   338.9458   240.5471   134.9488    70.3098    73.1813   164.5800   275.1548   358.7796   407.4086 (95)
Ext temp.       5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              516.7956   501.0113   435.7648   349.1534   242.1074   135.0306    70.3142    73.1885   165.1539   285.7674   406.8808   509.4455 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               74.0250    52.3004    27.6527     7.3495     1.1609     0.0000     0.0000     0.0000     0.0000     7.8958    34.6328    75.9154 (98)
Space heating                                                                                                                280.9326 (98)
RHI space heating demand                                                                                                     281 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1500	2.0760			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6714			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	24.0314	(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	13.5015	13.3430	13.1845	12.3922	12.2337	11.4413	11.4413	11.2828	11.7583	12.2337	12.5506	12.8676	(38)
Heat transfer coeff	37.5329	37.3744	37.2160	36.4236	36.2651	35.4727	35.4727	35.3143	35.7897	36.2651	36.5821	36.8990	(39)
Average = Sum(39)m / 12 =												36.3840	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6726	0.6698	0.6670	0.6528	0.6499	0.6357	0.6357	0.6329	0.6414	0.6499	0.6556	0.6613	(40)
HLP (average)												0.6520	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608 (42)
Average daily hot water use (litres/day)	78.3930 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	19.1820	16.7767	17.3121	15.0931	14.4822	12.4970	11.5803	13.2886	13.4473	15.6715	17.1067	18.5767	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
183.1568 161.7721 170.6905 154.1141 151.8245 136.8070 132.4789 143.8673 143.1422 159.7535 167.5382 179.1218 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
183.1568 161.7721 170.6905 154.1141 151.8245 136.8070 132.4789 143.8673 143.1422 159.7535 167.5382 179.1218 (64)
Total per year (kWh/year) = Sum(64)m = 1884.2671 (64)
Heat gains from water heating, kWh/month
86.7416 77.1303 82.5965 76.2512 76.3236 70.4966 69.8911 73.6778 72.6031 78.9600 80.7148 85.3999 (65)

---

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	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.4726	32.3947	26.3451	19.9449	14.9091	12.5869	13.6006	17.6785	23.7281	30.1282	35.1641	37.4863	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	242.1564	244.6692	238.3370	224.8564	207.8396	191.8461	181.1616	178.6487	184.9810	198.4616	215.4784	231.4718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	48.0253	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	-74.4303	(71)
Water heating gains (Table 5)													
	116.5881	114.7772	111.0168	105.9045	102.5854	97.9120	93.9397	99.0293	100.8376	106.1290	112.1038	114.7848	(72)
Total internal gains													
	480.4576	477.0816	460.9393	435.9463	410.5745	387.5855	373.9423	380.5970	394.7871	419.9593	447.9868	468.9834	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	11.2829	0.6800	0.8000	0.7700	34.0286	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	46.7894	95.2411	171.5942	281.8069	378.8038	403.8450	377.7887	301.1775	209.0902	116.3922	58.8731	38.2105	(83)
Total gains	527.2469	572.3227	632.5335	717.7532	789.3784	791.4304	751.7310	681.7745	603.8773	536.3514	506.8599	507.1939	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2971	41.4722	41.6488	42.5548	42.7408	43.6955	43.6955	43.8916	43.3086	42.7408	42.3705	42.0065	
alpha	3.7531	3.7648	3.7766	3.8370	3.8494	3.9130	3.9130	3.9261	3.8872	3.8494	3.8247	3.8004	
util living area													
	0.8519	0.8095	0.7238	0.5737	0.4178	0.2853	0.2073	0.2376	0.4014	0.6375	0.7940	0.8629	(86)
MIT	20.3186	20.4682	20.6854	20.8881	20.9712	20.9952	20.9990	20.9983	20.9822	20.8635	20.5903	20.2975	(87)
Th 2	20.3651	20.3676	20.3701	20.3828	20.3853	20.3980	20.3980	20.4005	20.3929	20.3853	20.3802	20.3752	(88)
util rest of house													
	0.8391	0.7941	0.7039	0.5497	0.3920	0.2589	0.1790	0.2069	0.3679	0.6089	0.7756	0.8508	(89)
MIT 2	19.4628	19.6721	19.9706	20.2484	20.3537	20.3935	20.3972	20.3992	20.3754	20.2247	19.8557	19.4417	(90)
Living area fraction									fLA = Living area / (4) =			0.5376	(91)
MIT	19.9229	20.1001	20.3549	20.5924	20.6857	20.7170	20.7207	20.7213	20.7016	20.5681	20.2506	19.9018	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9229	20.1001	20.3549	20.5924	20.6857	20.7170	20.7207	20.7213	20.7016	20.5681	20.2506	19.9018	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8294	0.7872	0.7034	0.5580	0.4047	0.2729	0.1942	0.2233	0.3850	0.6175	0.7716	0.8408	(94)
Useful gains	437.2961	450.5267	444.9474	400.4708	319.4292	215.9895	145.9797	152.2702	232.4852	331.2188	391.0679	426.4627	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	586.3743	568.0962	515.6244	425.8773	325.8663	216.9871	146.1738	152.6024	236.2704	361.4956	481.0772	579.3806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	110.9141	79.0067	52.5837	18.2927	4.7892	0.0000	0.0000	0.0000	0.0000	22.5259	64.8067	113.7709	(98)
Space heating												466.6900	(98)
Space heating per m2											(98) / (4) =	8.3636	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	333.4436	262.4982	268.3883	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9848	0.9919	0.9876	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	328.3778	260.3814	265.0657	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	859.6121	815.5135	732.6227	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	382.4887	413.0183	347.8624	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1143.3693	(104)
Cooled fraction										fC = cooled area / (4) =		1.0753	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8195	111.0264	93.5114	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												307.3573	(107)
Space cooling per m2												5.5082	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	466.6900	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	171.5086	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	318.5159	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1884.2671	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	692.4682	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1286.0123	(310b)
Electricity used for heat distribution	24.6851	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	71.1475	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	126.3661	(330a)
Total electricity for the above, kWh/year	126.3661	(331)
Electricity for lighting (calculated in Appendix L)	257.6471	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2923.6657	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	171.5086	4.2400	7.2720	(340a)
Space heating from Combined Heat and Power	318.5159	2.9700	9.4599	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	692.4682	4.2400	29.3607	(342a)
Water heating from Combined Heat and Power	1286.0123	2.9700	38.1946	(342b)
Space cooling	71.1475	13.1900	9.3844	(348)
Mechanical ventilation fans	126.3661	13.1900	16.6677	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	257.6471	13.1900	33.9837	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			224.7528	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.9365	(357)
SAP value	86.9362	
SAP rating (Section 12)	87	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	909.4492	0.2160	196.4410 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	579.1199	0.2160	125.0899 (363)
less credit emissions for electricity	-202.6920	0.5190	-105.1971 (364)
Water heating from Combined Heat and Power	2338.2042	0.2160	505.0521 (365)
less credit emissions for electricity	-818.3715	0.5190	-424.7348 (366)
Electrical energy for heat distribution	24.6851	0.5190	12.8115 (372)
Total CO2 associated with community systems			309.4627 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			309.4627 (376)
Space cooling	71.1475	0.5190	36.9256 (377)
Pumps and fans	126.3661	0.5190	65.5840 (378)
Energy for lighting	257.6471	0.5190	133.7188 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			389.9911 (383)
CO2 emissions per m2			6.9900 (384)
EI value			94.8156 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.8000 (1b)	x	2.7000 (2b)	=	150.6600	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	150.6600	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.0000	1.1450	12.5954			(27)
External Wall 1	24.8400	11.0000	13.8400	0.1500	2.0760			(29a)
Total net area of external elements Aum(A, m2)			24.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6714			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	24.0314	(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	11.5998	11.4413	11.2828	10.9659	10.9659	10.3320	10.6489	10.3320	10.1735	10.4905	10.4905	11.1244	(38)
Heat transfer coeff	35.6312	35.4727	35.3143	34.9973	34.9973	34.3634	34.6804	34.3634	34.2049	34.5219	34.5219	35.1558	(39)
Average = Sum(39)m / 12 =												34.8520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6386	0.6357	0.6329	0.6272	0.6272	0.6158	0.6215	0.6158	0.6130	0.6187	0.6187	0.6300	(40)
HLP (average)												0.6246	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8608 (42)
Average daily hot water use (litres/day)	78.3930 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.2323	83.0966	79.9609	76.8252	73.6894	70.5537	70.5537	73.6894	76.8252	79.9609	83.0966	86.2323	(44)
Energy conte	127.8800	111.8447	115.4137	100.6205	96.5477	83.3134	77.2021	88.5905	89.6486	104.4767	114.0445	123.8450	(45)
Energy content (annual)										Total = Sum(45)m =		1233.4274	(45)
Distribution loss (46)m = 0.15 x (45)m	19.1820	16.7767	17.3121	15.0931	14.4822	12.4970	11.5803	13.2886	13.4473	15.6715	17.1067	18.5767	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
183.1568 161.7721 170.6905 154.1141 151.8245 136.8070 132.4789 143.8673 143.1422 159.7535 167.5382 179.1218 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
183.1568 161.7721 170.6905 154.1141 151.8245 136.8070 132.4789 143.8673 143.1422 159.7535 167.5382 179.1218 (64)
Total per year (kWh/year) = Sum(64)m = 1884.2671 (64)
Heat gains from water heating, kWh/month
86.7416 77.1303 82.5965 76.2512 76.3236 70.4966 69.8911 73.6778 72.6031 78.9600 80.7148 85.3999 (65)

---

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	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	111.6455	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
36.4726 32.3947 26.3451 19.9449 14.9091 12.5869 13.6006 17.6785 23.7281 30.1282 35.1641 37.4863 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
242.1564 244.6692 238.3370 224.8564 207.8396 191.8461 181.1616 178.6487 184.9810 198.4616 215.4784 231.4718 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 48.0253 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 -74.4303 (71)
Water heating gains (Table 5)
116.5881 114.7772 111.0168 105.9045 102.5854 97.9120 93.9397 99.0293 100.8376 106.1290 112.1038 114.7848 (72)
Total internal gains
480.4576 477.0816 460.9393 435.9463 410.5745 387.5855 373.9423 380.5970 394.7871 419.9593 447.9868 468.9834 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.0000	12.4885	0.6800	0.8000	0.7700	37.6645	(75)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	51.7887	93.3945	172.7298	292.3974	380.9628	432.5351	404.0574	333.5971	231.0971	127.2610	67.4115	43.2466	(83)
Total gains	532.2463	570.4761	633.6692	728.3437	791.5374	820.1205	777.9997	714.1941	625.8843	547.2203	515.3983	512.2300	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5012	43.6955	43.8916	44.2891	44.2891	45.1061	44.6939	45.1061	45.3151	44.8991	44.8991	44.0895	
alpha	3.9001	3.9130	3.9261	3.9526	3.9526	4.0071	3.9796	4.0071	4.0210	3.9933	3.9933	3.9393	
util living area	0.8053	0.7621	0.6464	0.4789	0.3160	0.1758	0.1025	0.1155	0.2775	0.5199	0.7159	0.8165	(86)
MIT	20.5466	20.6485	20.8345	20.9544	20.9927	20.9996	21.0000	20.9999	20.9971	20.9513	20.7816	20.5328	(87)
Th 2	20.3954	20.3980	20.4005	20.4056	20.4056	20.4158	20.4107	20.4158	20.4183	20.4132	20.4132	20.4030	(88)
util rest of house	0.7894	0.7441	0.6237	0.4539	0.2905	0.1514	0.0763	0.0874	0.2463	0.4886	0.6932	0.8011	(89)
MIT 2	19.8057	19.9464	20.1968	20.3535	20.3983	20.4155	20.4107	20.4158	20.4159	20.3599	20.1426	19.7937	(90)
Living area fraction									fLA = Living area / (4) =			0.5376	(91)
MIT	20.2040	20.3238	20.5396	20.6766	20.7179	20.7295	20.7275	20.7298	20.7284	20.6779	20.4862	20.1911	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2040	20.3238	20.5396	20.6766	20.7179	20.7295	20.7275	20.7298	20.7284	20.6779	20.4862	20.1911	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7840	0.7418	0.6290	0.4654	0.3039	0.1645	0.0904	0.1025	0.2630	0.5028	0.6961	0.7954	(94)
Useful gains	417.2995	423.1834	398.5973	338.9458	240.5471	134.9488	70.3098	73.1813	164.5800	275.1548	358.7796	407.4086	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	516.7956	501.0113	435.7648	349.1534	242.1074	135.0306	70.3142	73.1885	165.1539	285.7674	406.8808	509.4455	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	74.0250	52.3004	27.6527	7.3495	1.1609	0.0000	0.0000	0.0000	0.0000	7.8958	34.6328	75.9154	(98)
Space heating												280.9326	(98)
Space heating per m2											(98) / (4) =	5.0346	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	247.4165	183.8059	185.5624	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9958	0.9982	0.9975	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	246.3709	183.4753	185.0929	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	893.1459	846.2172	770.5157	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	465.6780	493.0800	435.5546	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1394.3126	(104)
Cooled fraction										fC = cooled area / (4) =		1.0753	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	125.1823	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												125.1823	(107)
Space cooling per m2												2.2434	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	280.9326	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	103.2427	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	191.7365	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	1884.2671	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	692.4682	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1286.0123	(310b)
Electricity used for heat distribution	22.7346	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	28.9774	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	126.3661	(330a)
Total electricity for the above, kWh/year	126.3661	(331)
Electricity for lighting (calculated in Appendix L)	257.6471	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2686.4503	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	103.2427	5.0000	5.1621	(340a)
Space heating from Combined Heat and Power	191.7365	3.5000	6.7108	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	692.4682	5.0000	34.6234	(342a)
Water heating from Combined Heat and Power	1286.0123	3.5000	45.0104	(342b)
Space cooling	28.9774	15.7000	4.5494	(348)
Mechanical ventilation fans	126.3661	15.7000	19.8395	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	257.6471	15.7000	40.4506	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			198.2463	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	837.5904	0.2160	180.9195	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	348.6118	0.2160	75.3002	(363)
less credit emissions for electricity	-122.0141	0.5190	-63.3253	(364)
Water heating from Combined Heat and Power	2338.2042	0.2160	505.0521	(365)
less credit emissions for electricity	-818.3715	0.5190	-424.7348	(366)
Electrical energy for heat distribution	22.7346	0.5190	11.7993	(372)
Total CO2 associated with community systems			285.0109	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			285.0109	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	28.9774	0.5190	15.0393 (377)
Pumps and fans	126.3661	0.5190	65.5840 (378)
Energy for lighting	257.6471	0.5190	133.7188 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			343.6530 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	837.5904	1.2200	1021.8603	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	348.6118	1.2200	425.3064	(363)
less credit emissions for electricity	-122.0141	3.0700	-374.5834	(364)
Water heating from Combined Heat and Power	2338.2042	1.2200	2852.6092	(365)
less credit emissions for electricity	-818.3715	3.0700	-2512.4005	(366)
Electrical energy for heat distribution	22.7346	3.0700	69.7952	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1482.5873	(373)
Space and water heating			1482.5873	(376)
Space cooling	28.9774	3.0700	88.9605	(377)
Pumps and fans	126.3661	3.0700	387.9439	(378)
Energy for lighting	257.6471	3.0700	790.9766	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			1829.4682	(383)
Primary energy kWh/m2/year			32.7862	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£65	£65	£0
Community scheme	£181	£181	£0
Space heating	£121	£121	£0
Space cooling	£5	£5	£0
Water heating	£80	£80	£0
Lighting	£40	£40	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£199	£199	£0
Total cost of uses	£199	£199	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	33 kWh/m²	33 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	298.31 (P1)
Transmission heat loss coefficient	24.03 (37)
Summer heat loss coefficient	322.34 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.0000	98.8453	0.6800	0.8000	0.9000	348.4414
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						419.5816

	Jun	Jul	Aug	
Solar gains	453	420	343	(P3)
Internal gains	388	374	381	
Total summer gains	841	794	724	(P5)
Summer gain/loss ratio	2.61	2.46	2.25	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.91	21.66	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007043	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0208
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	85 B	**DER**	10.47	**TER**	24.37
Environmental	92 A	**% DER<TER**	57.04		
CO_2 Emissions (t/year)	0.62	**DFEE**	58.71	**TFEE**	81.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	28.11		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           North East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               106, 69.6, 2.7
Living Area:                   30 m2, fraction: 43.1%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                272.2, 286.2, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 14.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.033
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System  None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 70 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 24.37 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.47 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)81.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)58.7 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
Floor           (no floor)
Roof            (no roof)
```

SAP2012 - 9.92 input data (DesignData) -

Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		14.00 m², No overhang	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Thermal bridging y-value		0.033 W/m²K	
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1500	40.8300			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.8605			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	66.2205	(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	16.8406	16.6429	16.4452	15.4569	15.2592	14.2709	14.2709	14.0732	14.6662	15.2592	15.6546	16.0499	(38)
Heat transfer coeff	83.0611	82.8634	82.6658	81.6774	81.4798	80.4914	80.4914	80.2937	80.8868	81.4798	81.8751	82.2704	(39)
Average = Sum(39)m / 12 =												81.6280	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1934	1.1906	1.1877	1.1735	1.1707	1.1565	1.1565	1.1536	1.1622	1.1707	1.1764	1.1820	(40)
HLP (average)												1.1728	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364 (42)
Average daily hot water use (litres/day)	87.3139 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	21.3649	18.6858	19.2821	16.8106	16.1302	13.9191	12.8981	14.8008	14.9775	17.4549	19.0534	20.6907	(46)

Water storage loss:	
Store volume	110.0000 (47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (64)
Total per year (kWh/year) = Sum(64)m = 2024.6274 (64)
Heat gains from water heating, kWh/month
91.5802 81.3622 86.9635 80.0585 79.9767 73.6490 72.8123 77.0298 75.9952 82.9131 85.0299 90.0859 (65)

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	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6188	15.6488	12.7265	9.6348	7.2021	6.0803	6.5700	8.5399	11.4623	14.5540	16.9866	18.1084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	196.3617	198.3993	193.2646	182.3333	168.5346	155.5657	146.9017	144.8641	149.9988	160.9301	174.7288	187.6977	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	123.0917	121.0747	116.8864	111.1923	107.4955	102.2903	97.8659	103.5347	105.5488	111.4423	118.0971	121.0832	(72)
Total internal gains													
	393.6177	391.6685	379.4230	359.7060	339.7779	320.4819	307.8833	313.4844	323.5556	343.4720	366.3582	383.4349	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	11.2829	0.6800	0.8000	0.7700	59.5501	(75)

Solar gains	59.5501	121.2160	218.3926	358.6634	482.1139	513.9845	480.8220	383.3168	266.1148	148.1355	74.9294	48.6316	(83)
Total gains	453.1678	512.8844	597.8156	718.3694	821.8918	834.4664	788.7052	696.8012	589.6704	491.6075	441.2876	432.0665	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.2760	23.3316	23.3874	23.6704	23.7278	24.0191	24.0191	24.0783	23.9017	23.7278	23.6132	23.4997	
alpha	2.5517	2.5554	2.5592	2.5780	2.5819	2.6013	2.6013	2.6052	2.5934	2.5819	2.5742	2.5666	
util living area													
	0.9605	0.9447	0.9077	0.8237	0.6910	0.5356	0.4164	0.4770	0.7016	0.8800	0.9447	0.9647	(86)
MIT	18.5929	18.8494	19.3378	19.9902	20.5161	20.8253	20.9340	20.9052	20.6309	19.9429	19.1656	18.5493	(87)
Th 2	19.9253	19.9276	19.9298	19.9412	19.9435	19.9550	19.9550	19.9573	19.9504	19.9435	19.9390	19.9344	(88)
util rest of house													
	0.9545	0.9363	0.8936	0.7967	0.6449	0.4672	0.3282	0.3852	0.6386	0.8553	0.9350	0.9593	(89)
MIT 2	16.7203	17.0913	17.7922	18.7126	19.4148	19.8005	19.9131	19.8927	19.5885	18.6711	17.5598	16.6623	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	17.5274	17.8491	18.4585	19.2633	19.8895	20.2422	20.3532	20.3291	20.0378	19.2193	18.2519	17.4757	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5274	17.8491	18.4585	19.2633	19.8895	20.2422	20.3532	20.3291	20.0378	19.2193	18.2519	17.4757	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9359	0.9147	0.8690	0.7768	0.6423	0.4869	0.3629	0.4194	0.6444	0.8344	0.9141	0.9419	(94)
Useful gains	424.1296	469.1175	519.5138	557.9971	527.9260	406.2688	286.2403	292.2404	379.9627	410.1936	403.3884	406.9848	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1098.6851	1073.0047	988.5549	846.4466	667.2753	454.1478	302.0968	315.4848	480.2884	702.2984	913.0646	1092.1949	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	501.8693	405.8122	348.9666	207.6836	103.6759	0.0000	0.0000	0.0000	0.0000	217.3259	366.9668	509.7963	(98)
Space heating												2662.0967	(98)
Space heating per m2										(98) / (4) =		38.2485	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	756.6193	595.6365	610.2325	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8269	0.8737	0.8402	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	625.6548	520.3885	512.7057	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1045.8219	990.9290	884.5144	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	302.5204	350.0821	276.6257	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												929.2282	(104)
Cooled fraction										fC = cooled area / (4) =		0.8621	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	65.1984	75.4487	59.6176	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												200.2647	(107)
Space cooling per m2												2.8774	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2662.0967	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	978.3205	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	1816.8810	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2024.6274	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	744.0506	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1381.8082	(310b)
Electricity used for heat distribution	49.2106	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	46.3576	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	157.6179	(330a)
Total electricity for the above, kWh/year	157.6179	(331)
Electricity for lighting (calculated in Appendix L)	311.1527	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	5436.1884	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1813.0222	0.2160	391.6128	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	3303.4200	0.2160	713.5387	(363)
less credit emissions for electricity	-1156.1970	0.5190	-600.0662	(364)
Water heating from Combined Heat and Power	2512.3785	0.2160	542.6738	(365)
less credit emissions for electricity	-879.3325	0.5190	-456.3736	(366)
Electrical energy for heat distribution	49.2106	0.5190	25.5403	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			616.9258	(373)
Space and water heating			616.9258	(376)
Space cooling	46.3576	0.5190	24.0596	(377)
Pumps and fans	157.6179	0.5190	81.8037	(378)
Energy for lighting	311.1527	0.5190	161.4882	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			728.5773	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			10.4700	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		10.4700	ZC1
Total Floor Area	TFA	69.6000	
Assumed number of occupants	N	2.2364	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.7184	ZC2
CO2 emissions from cooking, equation (L16)		2.4809	ZC3
Total CO2 emissions		29.6693	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.6693	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1064	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3564	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3787	0.3711	0.3333	0.3257	0.2878	0.2878	0.2802	0.3030	0.3257	0.3408	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5530	0.5414	0.5414	0.5393	0.5459	0.5530	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			14.0000	1.3258	18.5606			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1800	48.9960			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.5566			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		72.9566	(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	35.6334	35.4537	35.2776	34.4505	34.2957	33.5753	33.5753	33.4419	33.8528	34.2957	34.6088	34.9361	(38)
Heat transfer coeff	108.5900	108.4103	108.2342	107.4071	107.2523	106.5319	106.5319	106.3985	106.8094	107.2523	107.5654	107.8927	(39)
Average = Sum(39)m / 12 =												107.4064	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5602	1.5576	1.5551	1.5432	1.5410	1.5306	1.5306	1.5287	1.5346	1.5410	1.5455	1.5502	(40)
HLP (average)												1.5432	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364	(42)
Average daily hot water use (litres/day)	87.3139	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	21.3649	18.6858	19.2821	16.8106	16.1302	13.9191	12.8981	14.8008	14.9775	17.4549	19.0534	20.6907	(46)

Water storage loss:		
Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7527	(55)

Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	189.0273	166.6580	175.1423	157.1626	154.1295	137.8860	132.5823	145.2667	144.9421	162.9608	172.1143	184.5331	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	189.0273	166.6580	175.1423	157.1626	154.1295	137.8860	132.5823	145.2667	144.9421	162.9608	172.1143	184.5331	(64)
								Total per year (kWh/year) = Sum(64)m =				1922.4050	(64)
Heat gains from water heating, kWh/month													
	84.6347	75.0889	80.0179	73.3370	73.0312	66.9275	65.8667	70.0843	69.2737	75.9676	78.3084	83.1404	(65)

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	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6188	15.6488	12.7265	9.6348	7.2021	6.0803	6.5700	8.5399	11.4623	14.5540	16.9866	18.1084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	196.3617	198.3993	193.2646	182.3333	168.5346	155.5657	146.9017	144.8641	149.9988	160.9301	174.7288	187.6977	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	113.7563	111.7394	107.5510	101.8569	98.1602	92.9549	88.5306	94.1993	96.2135	102.1070	108.7617	111.7478	(72)
Total internal gains													
	387.2824	385.3331	373.0877	353.3707	333.4425	314.1466	301.5479	307.1490	317.2202	337.1367	360.0228	377.0995	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	11.2829	0.6300	0.7000	0.7700	48.2750	(75)

Solar gains	48.2750	98.2651	177.0425	290.7547	390.8313	416.6676	389.7840	310.7403	215.7291	120.0878	60.7424	39.4238	(83)
Total gains	435.5574	483.5983	550.1302	644.1253	724.2738	730.8141	691.3319	617.8893	532.9493	457.2244	420.7652	416.5233	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.5099	44.5837	44.6562	45.0001	45.0651	45.3698	45.3698	45.4267	45.2519	45.0651	44.9339	44.7976	
alpha	3.9673	3.9722	3.9771	4.0000	4.0043	4.0247	4.0247	4.0284	4.0168	4.0043	3.9956	3.9865	
util living area													
	0.9973	0.9956	0.9899	0.9686	0.9048	0.7723	0.6248	0.6988	0.9063	0.9832	0.9955	0.9978	(86)
MIT	19.2685	19.4123	19.7122	20.1492	20.5690	20.8518	20.9535	20.9272	20.6797	20.1612	19.6453	19.2430	(87)
Th 2	19.6427	19.6446	19.6464	19.6553	19.6569	19.6646	19.6646	19.6660	19.6616	19.6569	19.6536	19.6501	(88)
util rest of house													
	0.9964	0.9939	0.9859	0.9548	0.8599	0.6654	0.4598	0.5368	0.8416	0.9735	0.9935	0.9970	(89)
MIT 2	17.3769	17.5881	18.0258	18.6590	19.2315	19.5662	19.6487	19.6367	19.3929	18.6860	17.9348	17.3444	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	18.1923	18.3744	18.7527	19.3013	19.8080	20.1204	20.2111	20.1930	19.9475	19.3218	18.6721	18.1628	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1923	18.3744	18.7527	19.3013	19.8080	20.1204	20.2111	20.1930	19.9475	19.3218	18.6721	18.1628	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9917	0.9821	0.9500	0.8660	0.7061	0.5318	0.6070	0.8587	0.9701	0.9913	0.9957	(94)
Useful gains	433.3106	479.5748	540.2795	611.9338	627.2001	515.9916	367.6793	375.0526	457.6243	443.5442	417.0949	414.7284	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1508.5613	1460.7651	1326.1570	1117.1754	869.6036	588.0952	384.7002	403.5682	624.5734	935.4384	1244.7533	1506.4808	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	799.9865	659.3599	584.6928	363.7740	180.3482	0.0000	0.0000	0.0000	0.0000	365.9693	595.9140	812.2638	(98)
Space heating												4362.3086	(98)
Space heating per m2											(98) / (4) =	62.6768	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4665.5706	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	799.9865	659.3599	584.6928	363.7740	180.3482	0.0000	0.0000	0.0000	0.0000	365.9693	595.9140	812.2638	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	855.6005	705.1977	625.3399	389.0631	192.8858	0.0000	0.0000	0.0000	0.0000	391.4111	637.3412	868.7313	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	189.0273	166.6580	175.1423	157.1626	154.1295	137.8860	132.5823	145.2667	144.9421	162.9608	172.1143	184.5331	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.2387	88.1162	87.7868	86.9814	85.2336	79.8000	79.8000	79.8000	79.8000	86.9097	87.8600	88.3080	(217)
Fuel for water heating, kWh/month													
	214.2227	189.1344	199.5087	180.6853	180.8317	172.7895	166.1433	182.0385	181.6317	187.5059	195.8962	208.9654	(219)
Water heating fuel used												2259.3533	(219)
Annual totals kWh/year													
Space heating fuel - main system												4665.5706	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												311.1527	(232)
Total delivered energy for all uses												7311.0766	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4665.5706	0.2160	1007.7633	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2259.3533	0.2160	488.0203	(264)
Space and water heating			1495.7836	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	311.1527	0.5190	161.4882	(268)
Total CO2, kg/m2/year			1696.1968	(272)
Emissions per m2 for space and water heating			21.4911	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3202	(272b)
Emissions per m2 for pumps and fans			0.5593	(272c)
Target Carbon Dioxide Emission Rate (TER) = (21.4911 * 1.00) + 2.3202 + 0.5593, rounded to 2 d.p.			24.3700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1064	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2564	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2779	0.2725	0.2670	0.2398	0.2343	0.2071	0.2071	0.2016	0.2180	0.2343	0.2452	0.2561	(22b)
Effective ac	0.5386	0.5371	0.5356	0.5287	0.5275	0.5214	0.5214	0.5203	0.5238	0.5275	0.5301	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1500	40.8300			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.8605			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	66.2205	(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	33.4015	33.3085	33.2173	32.7892	32.7091	32.3363	32.3363	32.2672	32.4799	32.7091	32.8712	33.0406	(38)
Heat transfer coeff	99.6220	99.5290	99.4379	99.0098	98.9297	98.5568	98.5568	98.4877	98.7004	98.9297	99.0917	99.2611	(39)
Average = Sum(39)m / 12 =												99.0094	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4314	1.4300	1.4287	1.4226	1.4214	1.4160	1.4160	1.4151	1.4181	1.4214	1.4237	1.4262	(40)
HLP (average)												1.4225	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364	(42)
Average daily hot water use (litres/day)	87.3139	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	30.2669	26.4716	27.3163	23.8150	22.8511	19.7188	18.2723	20.9678	21.2182	24.7277	26.9923	29.3119 (65)

---

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	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6188	15.6488	12.7265	9.6348	7.2021	6.0803	6.5700	8.5399	11.4623	14.5540	16.9866	18.1084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	196.3617	198.3993	193.2646	182.3333	168.5346	155.5657	146.9017	144.8641	149.9988	160.9301	174.7288	187.6977	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	40.6813	39.3923	36.7155	33.0764	30.7138	27.3872	24.5596	28.1825	29.4697	33.2362	37.4893	39.3977	(72)
Total internal gains													
	311.2074	309.9860	299.2522	281.5901	262.9961	245.5788	234.5769	238.1321	247.4764	265.2659	285.7504	301.7494	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	11.2829	0.6800	0.8000	0.7700	59.5501	(75)

Solar gains	59.5501	121.2160	218.3926	358.6634	482.1139	513.9845	480.8220	383.3168	266.1148	148.1355	74.9294	48.6316	(83)
Total gains	370.7575	431.2020	517.6448	640.2535	745.1101	759.5633	715.3989	621.4490	513.5912	413.4014	360.6798	350.3810	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.4067	19.4248	19.4426	19.5267	19.5425	19.6164	19.6164	19.6302	19.5879	19.5425	19.5105	19.4772	
alpha	2.2938	2.2950	2.2962	2.3018	2.3028	2.3078	2.3078	2.3087	2.3059	2.3028	2.3007	2.2985	
util living area													
	0.9750	0.9636	0.9368	0.8740	0.7668	0.6307	0.5132	0.5822	0.7885	0.9229	0.9658	0.9780	(86)
MIT	17.9543	18.2227	18.7600	19.5026	20.1819	20.6434	20.8437	20.7855	20.3516	19.4812	18.5874	17.8961	(87)
Th 2	19.7394	19.7404	19.7414	19.7461	19.7470	19.7511	19.7511	19.7518	19.7495	19.7470	19.7452	19.7433	(88)
util rest of house													
	0.9707	0.9573	0.9254	0.8500	0.7199	0.5496	0.3959	0.4653	0.7256	0.9033	0.9587	0.9742	(89)
MIT 2	16.9837	17.2501	17.7806	18.5038	19.1378	19.5390	19.6868	19.6555	19.3151	18.5000	17.6181	16.9285	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	17.4020	17.6694	18.2027	18.9344	19.5878	20.0150	20.1855	20.1425	19.7619	18.9229	18.0359	17.3455	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4020	17.6694	18.2027	18.9344	19.5878	20.0150	20.1855	20.1425	19.7619	18.9229	18.0359	17.3455	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9594	0.9431	0.9072	0.8311	0.7132	0.5683	0.4396	0.5053	0.7264	0.8865	0.9455	0.9639	(94)
Useful gains	355.7220	406.6633	469.5818	532.0982	531.3874	431.6517	314.4826	313.9960	373.0568	366.4624	341.0098	337.7341	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1305.2498	1270.9217	1163.6964	993.4988	780.3388	533.6878	353.3722	368.5950	558.8324	823.3828	1083.6573	1304.8418	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.4487	580.7816	516.4213	332.2084	185.2198	0.0000	0.0000	0.0000	0.0000	339.9488	534.7062	719.5281	(98)
Space heating												3915.2630	(98)
Space heating per m2											(98) / (4) =	56.2538	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	926.4338	729.3202	748.5068	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7139	0.7730	0.7245	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	661.3510	563.8008	542.2605	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	970.9188	917.6227	809.1622	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	222.8888	263.2435	198.5748	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												684.7072	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	55.7222	65.8109	49.6437	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												171.1768 (107)
Space cooling per m2												2.4594 (108)
Energy for space heating												56.2538 (99)
Energy for space cooling												2.4594 (108)
Total												58.7132 (109)
Dwelling Fabric Energy Efficiency (DFEE)												58.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1064	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3564	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3787	0.3711	0.3333	0.3257	0.2878	0.2878	0.2802	0.3030	0.3257	0.3408	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5530	0.5414	0.5414	0.5393	0.5459	0.5530	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			14.0000	1.3258	18.5606			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1800	48.9960			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.5566			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		72.9566	(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	35.6334	35.4537	35.2776	34.4505	34.2957	33.5753	33.5753	33.4419	33.8528	34.2957	34.6088	34.9361	(38)
Heat transfer coeff	108.5900	108.4103	108.2342	107.4071	107.2523	106.5319	106.5319	106.3985	106.8094	107.2523	107.5654	107.8927	(39)
Average = Sum(39)m / 12 =												107.4064	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5602	1.5576	1.5551	1.5432	1.5410	1.5306	1.5306	1.5287	1.5346	1.5410	1.5455	1.5502	(40)
HLP (average)												1.5432	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364	(42)
Average daily hot water use (litres/day)	87.3139	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.2669	26.4716	27.3163	23.8150	22.8511	19.7188	18.2723	20.9678	21.2182	24.7277	26.9923	29.3119	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	111.8187	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.6188	15.6488	12.7265	9.6348	7.2021	6.0803	6.5700	8.5399	11.4623	14.5540	16.9866	18.1084	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	196.3617	198.3993	193.2646	182.3333	168.5346	155.5657	146.9017	144.8641	149.9988	160.9301	174.7288	187.6977	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	34.1819	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	40.6813	39.3923	36.7155	33.0764	30.7138	27.3872	24.5596	28.1825	29.4697	33.2362	37.4893	39.3977	(72)
Total internal gains													
	311.2074	309.9860	299.2522	281.5901	262.9961	245.5788	234.5769	238.1321	247.4764	265.2659	285.7504	301.7494	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	11.2829	0.6300	0.7000	0.7700	48.2750	(75)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	48.2750	98.2651	177.0425	290.7547	390.8313	416.6676	389.7840	310.7403	215.7291	120.0878	60.7424	39.4238	(83)
Total gains	359.4823	408.2512	476.2947	572.3448	653.8275	662.2464	624.3609	548.8724	463.2055	385.3537	346.4928	341.1732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.5099	44.5837	44.6562	45.0001	45.0651	45.3698	45.3698	45.4267	45.2519	45.0651	44.9339	44.7976	
alpha	3.9673	3.9722	3.9771	4.0000	4.0043	4.0247	4.0247	4.0284	4.0168	4.0043	3.9956	3.9865	
util living area	0.9987	0.9976	0.9939	0.9786	0.9278	0.8125	0.6734	0.7528	0.9363	0.9907	0.9978	0.9990	(86)
MIT	19.1739	19.3192	19.6227	20.0688	20.5077	20.8186	20.9391	20.9038	20.6175	20.0758	19.5532	19.1489	(87)
Th 2	19.6427	19.6446	19.6464	19.6553	19.6569	19.6646	19.6646	19.6660	19.6616	19.6569	19.6536	19.6501	(88)
util rest of house	0.9982	0.9967	0.9914	0.9687	0.8907	0.7118	0.5038	0.5922	0.8863	0.9850	0.9968	0.9986	(89)
MIT 2	18.0014	18.1478	18.4517	18.8988	19.3155	19.5786	19.6496	19.6377	19.4302	18.9114	18.3886	17.9820	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	18.5067	18.6527	18.9565	19.4031	19.8294	20.1131	20.2054	20.1834	19.9420	19.4133	18.8906	18.4850	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5067	18.6527	18.9565	19.4031	19.8294	20.1131	20.2054	20.1834	19.9420	19.4133	18.8906	18.4850	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9958	0.9896	0.9662	0.8965	0.7502	0.5785	0.6624	0.8996	0.9835	0.9959	0.9981	(94)
Useful gains	358.6292	406.5208	471.3531	553.0129	586.1524	496.8438	361.1780	363.5736	416.7146	379.0021	345.0796	340.5219	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1542.7106	1490.9366	1348.2165	1128.1055	871.8939	587.3185	384.0885	402.5470	623.9803	945.2493	1268.2599	1541.2490	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	880.9566	728.7275	652.3864	414.0667	212.5917	0.0000	0.0000	0.0000	0.0000	421.2879	664.6898	893.3410	(98)
Space heating												4868.0475	(98)
Space heating per m2											(98) / (4) =	69.9432	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1001.4003	788.3364	808.6289	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7344	0.8123	0.7548	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	735.4149	640.3421	610.3365	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	857.1718	811.2147	724.3325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	87.6649	127.1291	84.8130	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												299.6071	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	21.9162	31.7823	21.2033	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												74.9018	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	1.0762 (108)
Energy for space heating	69.9432 (99)
Energy for space cooling	1.0762 (108)
Total	71.0194 (109)
Target Fabric Energy Efficiency (TFEE)	81.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1500	40.8300			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.8605			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	66.2205	(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	14.4685	14.2709	14.0732	13.6779	13.6779	12.8872	13.2825	12.8872	12.6895	13.0849	13.0849	13.8755	(38)
Heat transfer coeff	80.6891	80.4914	80.2937	79.8984	79.8984	79.1077	79.5031	79.1077	78.9101	79.3054	79.3054	80.0961	(39)
Average = Sum(39)m / 12 =												79.7172	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1593	1.1565	1.1536	1.1480	1.1480	1.1366	1.1423	1.1366	1.1338	1.1394	1.1394	1.1508	(40)
HLP (average)												1.1454	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364 (42)
Average daily hot water use (litres/day)	87.3139 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	21.3649	18.6858	19.2821	16.8106	16.1302	13.9191	12.8981	14.8008	14.9775	17.4549	19.0534	20.6907	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             197.7092   174.4997   183.8242   165.5644   162.8114   146.2878   141.2642   153.9486   153.3440   171.6427   180.5161   193.2150 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             197.7092   174.4997   183.8242   165.5644   162.8114   146.2878   141.2642   153.9486   153.3440   171.6427   180.5161   193.2150 (64)
                                                                                   Total per year (kWh/year) = Sum(64)m =   2024.6274 (64)
RHI water heating demand                                                                                      2025 (64)
Heat gains from water heating, kWh/month
              91.5802    81.3622    86.9635    80.0585    79.9767    73.6490    72.8123    77.0298    75.9952    82.9131    85.0299    90.0859 (65)
```

---

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         134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825   134.1825 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              44.0469    39.1220    31.8162    24.0869    18.0052    15.2008    16.4250    21.3498    28.6557    36.3850    42.4666    45.2711 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             293.0772   296.1184   288.4546   272.1393   251.5442   232.1877   219.2563   216.2151   223.8789   240.1942   260.7893   280.1458 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546    50.6546 (69)
Pumps, fans    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550   -89.4550 (71)
Water heating gains (Table 5)
             123.0917   121.0747   116.8864   111.1923   107.4955   102.2903    97.8659   103.5347   105.5488   111.4423   118.0971   121.0832 (72)
Total internal gains
             555.5978   551.6973   532.5393   502.8006   472.4271   445.0608   428.9294   436.4817   453.4655   483.4036   516.7351   541.8822 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF             Access            Gains
                                          m2           Table 6a       Specific data    Specific data        factor                W
                                                          W/m2        or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------------
Northeast                              14.0000           12.4885           0.6800           0.8000           0.7700          65.9129 (75)
-------------------------------------------------------------------------------------------------------------------------------------

Solar gains   65.9129   118.8658   219.8380   372.1421   484.8618   550.4992   514.2549   424.5781   294.1236   161.9686    85.7964    55.0411 (83)
Total gains  621.5107   670.5630   752.3772   874.9428   957.2888   995.5600   943.1843   861.0598   747.5891   645.3721   602.5316   596.9233 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                   21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           23.9603    24.0191    24.0783    24.1974    24.1974    24.4392    24.3177    24.4392    24.5005    24.3783    24.3783    24.1377
alpha          2.5974     2.6013     2.6052     2.6132     2.6132     2.6293     2.6212     2.6293     2.6334     2.6252     2.6252     2.6092
util living area
               0.9087     0.8878     0.8239     0.7007     0.5256     0.3211     0.1917     0.2173     0.4839     0.7438     0.8693     0.9152 (86)

MIT           19.2864    19.4737    19.9544    20.4610    20.8147    20.9675    20.9948    20.9928    20.8950    20.4797    19.8363    19.2571 (87)
Th 2          19.9527    19.9550    19.9573    19.9619    19.9619    19.9711    19.9664    19.9711    19.9734    19.9687    19.9687    19.9596 (88)
util rest of house
               0.8957     0.8720     0.7988     0.6603     0.4660     0.2469     0.1065     0.1255     0.4021     0.6974     0.8478     0.9028 (89)
MIT 2         17.7290    17.9951    18.6693    19.3514    19.7878    19.9520    19.9655    19.9695    19.8947    19.4022    18.5241    17.6924 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.4310 (91)
MIT           18.4003    18.6324    19.2232    19.8297    20.2305    20.3897    20.4092    20.4106    20.3259    19.8666    19.0897    18.3668 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT  18.4003    18.6324    19.2232    19.8297    20.2305    20.3897    20.4092    20.4106    20.3259    19.8666    19.0897    18.3668 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.8713     0.8475     0.7785     0.6548     0.4820     0.2776     0.1433     0.1651     0.4314     0.6923     0.8258     0.8790 (94)
Useful gains 541.5498   568.2904   585.6951   572.8728   461.4425   276.3964   135.1593   142.1609   322.4807   446.7995   497.5901   524.7026 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
            1024.7738  1000.7047   885.0927   729.4448   513.7840   283.9759   135.8845   143.2312   349.2448   592.1427   823.9597  1014.5606 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             359.5186   290.5825   222.7518   112.7319    38.9420     0.0000     0.0000     0.0000     0.0000   108.1354   234.9861   364.4543 (98)
Space heating                                                                                                1732.1026 (98)
RHI space heating demand                                                                                      1732 (98)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1500	40.8300			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.8605			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	66.2205	(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	16.8406	16.6429	16.4452	15.4569	15.2592	14.2709	14.2709	14.0732	14.6662	15.2592	15.6546	16.0499	(38)
Heat transfer coeff	83.0611	82.8634	82.6658	81.6774	81.4798	80.4914	80.4914	80.2937	80.8868	81.4798	81.8751	82.2704	(39)
Average = Sum(39)m / 12 =												81.6280	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1934	1.1906	1.1877	1.1735	1.1707	1.1565	1.1565	1.1536	1.1622	1.1707	1.1764	1.1820	(40)
HLP (average)												1.1728	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364 (42)
Average daily hot water use (litres/day)	87.3139 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	21.3649	18.6858	19.2821	16.8106	16.1302	13.9191	12.8981	14.8008	14.9775	17.4549	19.0534	20.6907	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (64)
Total per year (kWh/year) = Sum(64)m = 2024.6274 (64)
Heat gains from water heating, kWh/month
91.5802 81.3622 86.9635 80.0585 79.9767 73.6490 72.8123 77.0298 75.9952 82.9131 85.0299 90.0859 (65)

---

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	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	44.0469	39.1220	31.8162	24.0869	18.0052	15.2008	16.4250	21.3498	28.6557	36.3850	42.4666	45.2711	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	293.0772	296.1184	288.4546	272.1393	251.5442	232.1877	219.2563	216.2151	223.8789	240.1942	260.7893	280.1458	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	123.0917	121.0747	116.8864	111.1923	107.4955	102.2903	97.8659	103.5347	105.5488	111.4423	118.0971	121.0832	(72)
Total internal gains													
	555.5978	551.6973	532.5393	502.8006	472.4271	445.0608	428.9294	436.4817	453.4655	483.4036	516.7351	541.8822	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	11.2829	0.6800	0.8000	0.7700	59.5501	(75)

Solar gains	59.5501	121.2160	218.3926	358.6634	482.1139	513.9845	480.8220	383.3168	266.1148	148.1355	74.9294	48.6316	(83)
Total gains	615.1479	672.9132	750.9319	861.4640	954.5410	959.0453	909.7513	819.7986	719.5803	631.5391	591.6646	590.5138	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.2760	23.3316	23.3874	23.6704	23.7278	24.0191	24.0191	24.0783	23.9017	23.7278	23.6132	23.4997	
alpha	2.5517	2.5554	2.5592	2.5780	2.5819	2.6013	2.6013	2.6052	2.5934	2.5819	2.5742	2.5666	
util living area													
	0.9260	0.9055	0.8608	0.7680	0.6336	0.4819	0.3682	0.4177	0.6252	0.8169	0.9013	0.9322	(86)
MIT	18.9326	19.1653	19.6007	20.1682	20.6101	20.8643	20.9507	20.9309	20.7234	20.1551	19.4617	18.8886	(87)
Th 2	19.9253	19.9276	19.9298	19.9412	19.9435	19.9550	19.9550	19.9573	19.9504	19.9435	19.9390	19.9344	(88)
util rest of house													
	0.9158	0.8926	0.8416	0.7368	0.5861	0.4167	0.2879	0.3335	0.5601	0.7844	0.8858	0.9228	(89)
MIT 2	17.2047	17.5377	18.1553	18.9452	19.5247	19.8372	19.9243	19.9114	19.6875	18.9508	17.9752	17.1472	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	17.9495	18.2393	18.7783	19.4724	19.9926	20.2799	20.3668	20.3509	20.1340	19.4699	18.6159	17.8978	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9495	18.2393	18.7783	19.4724	19.9926	20.2799	20.3668	20.3509	20.1340	19.4699	18.6159	17.8978	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8915	0.8672	0.8171	0.7214	0.5885	0.4377	0.3203	0.3663	0.5723	0.7675	0.8616	0.8993	(94)
Useful gains	548.4240	583.5475	613.5817	621.4394	561.7279	419.7624	291.3693	300.2843	411.7913	484.7143	509.7703	531.0698	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1133.7438	1105.3388	1014.9936	863.5239	675.6761	457.1829	303.1918	317.2294	488.0719	722.7184	942.8675	1126.9242	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	435.4779	350.6437	298.6504	174.3008	84.7775	0.0000	0.0000	0.0000	0.0000	177.0751	311.8300	443.3157	(98)
Space heating												2276.0711	(98)
Space heating per m2											(98) / (4) =	32.7022	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	756.6193	595.6365	610.2325	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8269	0.8737	0.8402	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	625.6548	520.3885	512.7057	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1045.8219	990.9290	884.5144	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	302.5204	350.0821	276.6257	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling	929.2282	(104)
Cooled fraction	fC = cooled area / (4) = 0.8621	(105)
Intermittency factor (Table 10b)		

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	65.1984	75.4487	59.6176	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling	200.2647	(107)
Space cooling per m2	2.8774	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	2276.0711	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	836.4561	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	1553.4185	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2024.6274	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	744.0506	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1381.8082	(310b)
Electricity used for heat distribution	45.1573	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	46.3576	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	157.6179	(330a)
Total electricity for the above, kWh/year	157.6179	(331)
Electricity for lighting (calculated in Appendix L)	311.1527	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	5030.8615	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	836.4561	4.2400	35.4657	(340a)
Space heating from Combined Heat and Power	1553.4185	2.9700	46.1365	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	744.0506	4.2400	31.5477	(342a)
Water heating from Combined Heat and Power	1381.8082	2.9700	41.0397	(342b)
Space cooling	46.3576	13.1900	6.1146	(348)
Mechanical ventilation fans	157.6179	13.1900	20.7898	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	311.1527	13.1900	41.0410	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			302.5651	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1089	(357)
SAP value	84.5312	
SAP rating (Section 12)	85	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1663.6912	0.2160	359.3573	(367)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	2824.3973	0.2160	610.0698 (363)
less credit emissions for electricity	-988.5391	0.5190	-513.0518 (364)
Water heating from Combined Heat and Power	2512.3785	0.2160	542.6738 (365)
less credit emissions for electricity	-879.3325	0.5190	-456.3736 (366)
Electrical energy for heat distribution	45.1573	0.5190	23.4367 (372)
Total CO2 associated with community systems			566.1122 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			566.1122 (376)
Space cooling	46.3576	0.5190	24.0596 (377)
Pumps and fans	157.6179	0.5190	81.8037 (378)
Energy for lighting	311.1527	0.5190	161.4882 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			677.7637 (383)
CO2 emissions per m2			9.7400 (384)
EI value			92.0750 (384a)
EI rating			92 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6000 (1b)	x	2.7000 (2b)	=	187.9200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.9200	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.0000	1.1450	16.0305			(27)
External Wall 1	286.2000	14.0000	272.2000	0.1500	40.8300			(29a)
Total net area of external elements Aum(A, m2)			286.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.8605			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	66.2205	(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	14.4685	14.2709	14.0732	13.6779	13.6779	12.8872	13.2825	12.8872	12.6895	13.0849	13.0849	13.8755	(38)
Heat transfer coeff	80.6891	80.4914	80.2937	79.8984	79.8984	79.1077	79.5031	79.1077	78.9101	79.3054	79.3054	80.0961	(39)
Average = Sum(39)m / 12 =												79.7172	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1593	1.1565	1.1536	1.1480	1.1480	1.1366	1.1423	1.1366	1.1338	1.1394	1.1394	1.1508	(40)
HLP (average)												1.1454	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2364 (42)
Average daily hot water use (litres/day)	87.3139 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.0453	92.5527	89.0602	85.5676	82.0751	78.5825	78.5825	82.0751	85.5676	89.0602	92.5527	96.0453	(44)
Energy conte	142.4324	124.5723	128.5474	112.0708	107.5346	92.7942	85.9874	98.6718	99.8503	116.3659	127.0225	137.9382	(45)
Energy content (annual)										Total = Sum(45)m =		1373.7876	(45)
Distribution loss (46)m = 0.15 x (45)m	21.3649	18.6858	19.2821	16.8106	16.1302	13.9191	12.8981	14.8008	14.9775	17.4549	19.0534	20.6907	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
197.7092 174.4997 183.8242 165.5644 162.8114 146.2878 141.2642 153.9486 153.3440 171.6427 180.5161 193.2150 (64)
Total per year (kWh/year) = Sum(64)m = 2024.6274 (64)
Heat gains from water heating, kWh/month
91.5802 81.3622 86.9635 80.0585 79.9767 73.6490 72.8123 77.0298 75.9952 82.9131 85.0299 90.0859 (65)

---

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	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	134.1825	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	44.0469	39.1220	31.8162	24.0869	18.0052	15.2008	16.4250	21.3498	28.6557	36.3850	42.4666	45.2711	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	293.0772	296.1184	288.4546	272.1393	251.5442	232.1877	219.2563	216.2151	223.8789	240.1942	260.7893	280.1458	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	50.6546	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	-89.4550	(71)
Water heating gains (Table 5)													
	123.0917	121.0747	116.8864	111.1923	107.4955	102.2903	97.8659	103.5347	105.5488	111.4423	118.0971	121.0832	(72)
Total internal gains													
	555.5978	551.6973	532.5393	502.8006	472.4271	445.0608	428.9294	436.4817	453.4655	483.4036	516.7351	541.8822	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.0000	12.4885	0.6800	0.8000	0.7700	65.9129	(75)

Solar gains	65.9129	118.8658	219.8380	372.1421	484.8618	550.4992	514.2549	424.5781	294.1236	161.9686	85.7964	55.0411	(83)
Total gains	621.5107	670.5630	752.3772	874.9428	957.2888	995.5600	943.1843	861.0598	747.5891	645.3721	602.5316	596.9233	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.9603	24.0191	24.0783	24.1974	24.1974	24.4392	24.3177	24.4392	24.5005	24.3783	24.3783	24.1377	
alpha	2.5974	2.6013	2.6052	2.6132	2.6132	2.6293	2.6212	2.6293	2.6334	2.6252	2.6252	2.6092	
util living area													
	0.9087	0.8878	0.8239	0.7007	0.5256	0.3211	0.1917	0.2173	0.4839	0.7438	0.8693	0.9152	(86)
MIT	19.2864	19.4737	19.9544	20.4610	20.8147	20.9675	20.9948	20.9928	20.8950	20.4797	19.8363	19.2571	(87)
Th 2	19.9527	19.9550	19.9573	19.9619	19.9619	19.9711	19.9664	19.9711	19.9734	19.9687	19.9687	19.9596	(88)
util rest of house													
	0.8957	0.8720	0.7988	0.6603	0.4660	0.2469	0.1065	0.1255	0.4021	0.6974	0.8478	0.9028	(89)
MIT 2	17.7290	17.9951	18.6693	19.3514	19.7878	19.9520	19.9655	19.9695	19.8947	19.4022	18.5241	17.6924	(90)
Living area fraction									fLA = Living area / (4) =			0.4310	(91)
MIT	18.4003	18.6324	19.2232	19.8297	20.2305	20.3897	20.4092	20.4106	20.3259	19.8666	19.0897	18.3668	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4003	18.6324	19.2232	19.8297	20.2305	20.3897	20.4092	20.4106	20.3259	19.8666	19.0897	18.3668	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8713	0.8475	0.7785	0.6548	0.4820	0.2776	0.1433	0.1651	0.4314	0.6923	0.8258	0.8790	(94)
Useful gains	541.5498	568.2904	585.6951	572.8728	461.4425	276.3964	135.1593	142.1609	322.4807	446.7995	497.5901	524.7026	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	1024.7738	1000.7047	885.0927	729.4448	513.7840	283.9759	135.8845	143.2312	349.2448	592.1427	823.9597	1014.5606	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	359.5186	290.5825	222.7518	112.7319	38.9420	0.0000	0.0000	0.0000	0.0000	108.1354	234.9861	364.4543	(98)
Space heating												1732.1026	(98)
Space heating per m2										(98) / (4) =		24.8865	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	569.5757	421.3663	427.1818	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9040	0.9409	0.9261	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	514.9028	396.4720	395.6166	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1088.5014	1030.0065	932.7418	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	412.9910	471.3497	399.6212	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1283.9619	(104)
Cooled fraction										fC = cooled area / (4) =		0.8621	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	89.0067	101.5840	86.1253	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												276.7159	(107)
Space cooling per m2												3.9758	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1732.1026	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	636.5477	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	1182.1600	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2024.6274	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	744.0506	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1381.8082	(310b)
Electricity used for heat distribution	39.4457	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	64.0546	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	157.6179	(330a)
Total electricity for the above, kWh/year	157.6179	(331)
Electricity for lighting (calculated in Appendix L)	311.1527	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4477.3916	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	636.5477	5.0000	31.8274	(340a)
Space heating from Combined Heat and Power	1182.1600	3.5000	41.3756	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	744.0506	5.0000	37.2025	(342a)
Water heating from Combined Heat and Power	1381.8082	3.5000	48.3633	(342b)
Space cooling	64.0546	15.7000	10.0566	(348)
Mechanical ventilation fans	157.6179	15.7000	24.7460	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	311.1527	15.7000	48.8510	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			284.3224	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1453.2613	0.2160	313.9044	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	2149.3819	0.2160	464.2665	(363)
less credit emissions for electricity	-752.2836	0.5190	-390.4352	(364)
Water heating from Combined Heat and Power	2512.3785	0.2160	542.6738	(365)
less credit emissions for electricity	-879.3325	0.5190	-456.3736	(366)
Electrical energy for heat distribution	39.4457	0.5190	20.4723	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			494.5082	(373)
Space and water heating			494.5082	(376)
Space cooling	64.0546	0.5190	33.2443	(377)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Pumps and fans	157.6179	0.5190	81.8037 (378)
Energy for lighting	311.1527	0.5190	161.4882 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			615.3445 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1453.2613	1.2200	1772.9788	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	2149.3819	1.2200	2622.2459	(363)
less credit emissions for electricity	-752.2836	3.0700	-2309.5108	(364)
Water heating from Combined Heat and Power	2512.3785	1.2200	3065.1018	(365)
less credit emissions for electricity	-879.3325	3.0700	-2699.5507	(366)
Electrical energy for heat distribution	39.4457	3.0700	121.0982	(372)
Total CO2 associated with community systems			2572.3631	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			2572.3631	(376)
Space cooling	64.0546	3.0700	196.6477	(377)
Pumps and fans	157.6179	3.0700	483.8870	(378)
Energy for lighting	311.1527	3.0700	955.2386	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			3287.1364	(383)
Primary energy kWh/m2/year			47.2290	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: A 92

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£84	£84	£0
Community scheme	£248	£248	£0
Space heating	£187	£187	£0
Space cooling	£10	£10	£0
Water heating	£86	£86	£0
Lighting	£49	£49	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£285	£285	£0
Total cost of uses	£285	£285	£0
Delivered energy	64 kWh/m²	64 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	372.08 (P1)
Transmission heat loss coefficient	66.22 (37)
Summer heat loss coefficient	438.30 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	14.0000	98.8453	0.6800	0.8000	0.9000	609.7725
total:						609.7725

	Jun	Jul	Aug	
Solar gains	658	610	499	(P3)
Internal gains	445	429	436	
Total summer gains	1103	1039	935	(P5)
Summer gain/loss ratio	2.52	2.37	2.13	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.82	21.57	21.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007044	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0303
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	6.54	**TER**	13.45
Environmental	94 A	**% DER<TER**	51.38		
CO_2 Emissions (t/year)	0.49	**DFEE**	27.51	**TFEE**	32.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.70		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)       02/05/2018

FullRefNo:                      001

Regs Region:                    England
SAP Region:                     Thames Valley
Postcode:                       SW7 4DN
DwellingOrientation:            South East
Property Type:                  Flat, End-Terrace
Storeys:                        1
Date Built:                     2017
Sheltered Sides:                2
Sunlight Shade:                 Average or unknown
Measurements                    Perimeter, Floor Area, Storey Height
     1st Storey:                19.2, 89.2, 2.7
Living Area:                    30 m2, fraction: 33.6%
Thermal Mass:                   Simple calculation
Thermal Mass Simple:            Low
Thermal MassValue:              100
External Walls                  Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                 28.84, 51.84, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                  Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                  Area, Kappa, Construction, Element
     Party Ceilings 1           73, 80, Concrete floor slab, carpeted
Heat Loss Floors                Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                    Area, Kappa, Construction, Element
     Party Floor 1              73, 40
Description                     Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                     Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                    Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                        Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     under Balcony              Window, External Wall 1, South East, , Light-coloured curtain or roller blind, 1, True, 0, 0, 0, 12.00, 20
     Window                     Window, External Wall 1, South West, , Light-coloured curtain or roller blind, 0, , 0, 0, 0, 8.00, 20
     Window                     Window, External Wall 1, South East, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                   None
Draught Proofing:               100
Draught Lobby:                  Yes
Thermal Bridges
     Bridging:                  Calculate Bridges
     Y                          0.181
     List of Bridges            Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                         External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                         External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                         External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                         External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                         External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                         External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                         External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                         External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                         External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                         External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                        External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                        External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                        External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                        External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                        External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                        External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                        External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                        External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                        External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                        External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                        External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                        External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                        External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                        External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                        External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                        Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                        Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                        Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                        Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                        Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                        Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                        Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                        Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                        External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                        External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                        External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                        External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                        External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                        External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 89 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.45 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.54 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)32.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.5 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls:	Charging system linked to use of community heating, TRVsOK	
Hot water controls:	No cylinder	

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.55	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Oversharing:	Average	
Windows facing South East:	15.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South West:	8.00 m², No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	Light-coloured curtain or roller blind, closed 20% of daylight hours	

10 Key features
Air permeability 3.0 m³/m²h
Community CHP, Mains gas
Photovoltaic array

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	51.8400	23.0000	28.8400	0.1500	4.3260			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.6619			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.0219	(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	21.5830	21.3297	21.0764	19.8097	19.5564	18.2897	18.2897	18.0364	18.7964	19.5564	20.0630	20.5697	(38)
Heat transfer coeff	61.6049	61.3516	61.0982	59.8316	59.5782	58.3116	58.3116	58.0582	58.8182	59.5782	60.0849	60.5916	(39)
Average = Sum(39)m / 12 =												59.7682	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6906	0.6878	0.6850	0.6708	0.6679	0.6537	0.6537	0.6509	0.6594	0.6679	0.6736	0.6793	(40)
HLP (average)												0.6700	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6146 (42)
Average daily hot water use (litres/day)	96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5629	20.6083	21.2659	18.5401	17.7897	15.3512	14.2251	16.3235	16.5185	19.2507	21.0136	22.8194	(46)

Water storage loss:		
Store volume	110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (64)
Total per year (kWh/year) = Sum(64)m = 2165.9668 (64)
Heat gains from water heating, kWh/month
96.4526 85.6237 91.3609 83.8923 83.6553 76.8234 75.7538 80.4053 79.4109 86.8938 89.3752 94.8046 (65)

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	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1821	18.8137	15.3003	11.5833	8.6587	7.3100	7.8987	10.2671	13.7805	17.4975	20.4221	21.7708	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	237.5982	240.0637	233.8507	220.6239	203.9274	188.2350	177.7515	175.2860	181.4990	194.7259	211.4224	227.1148	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)
Water heating gains (Table 5)													
	129.6406	127.4162	122.7969	116.5170	112.4399	106.6991	101.8196	108.0716	110.2929	116.7928	124.1322	127.4255	(72)
Total internal gains													
	450.6401	448.5128	434.1671	410.9434	387.2451	364.4633	349.6890	355.8438	367.7916	391.2353	418.1959	438.5302	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	36.7938	0.6800	0.8000	0.7700	208.0647	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	319.0326	543.4305	743.5453	921.2886	1031.9200	1024.4577	987.6866	905.1506	805.1023	600.6064	382.1275	273.0254	(83)
Total gains	769.6726	991.9433	1177.7124	1332.2320	1419.1652	1388.9210	1337.3756	1260.9944	1172.8939	991.8417	800.3233	711.5556	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.2205	40.3865	40.5540	41.4125	41.5886	42.4920	42.4920	42.6775	42.1260	41.5886	41.2379	40.8931	
alpha	3.6814	3.6924	3.7036	3.7608	3.7726	3.8328	3.8328	3.8452	3.8084	3.7726	3.7492	3.7262	
util living area													
	0.8835	0.7852	0.6642	0.5169	0.3835	0.2674	0.1916	0.2114	0.3420	0.5803	0.8059	0.9029	(86)
MIT	20.1692	20.5019	20.7526	20.9153	20.9764	20.9957	20.9991	20.9987	20.9887	20.8940	20.5438	20.1013	(87)
Th 2	20.3491	20.3516	20.3541	20.3667	20.3693	20.3819	20.3819	20.3844	20.3768	20.3693	20.3642	20.3592	(88)
util rest of house													
	0.8724	0.7687	0.6433	0.4935	0.3588	0.2419	0.1648	0.1832	0.3121	0.5516	0.7878	0.8932	(89)
MIT 2	19.2422	19.7038	20.0434	20.2660	20.3435	20.3779	20.3812	20.3834	20.3658	20.2462	19.7792	19.1549	(90)
Living area fraction									fLA = Living area / (4) =			0.3363	(91)
MIT	19.5540	19.9722	20.2819	20.4843	20.5564	20.5857	20.5890	20.5904	20.5753	20.4641	20.0364	19.4732	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5540	19.9722	20.2819	20.4843	20.5564	20.5857	20.5890	20.5904	20.5753	20.4641	20.0364	19.4732	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8571	0.7584	0.6409	0.4979	0.3662	0.2504	0.1738	0.1927	0.3217	0.5560	0.7778	0.8780	(94)
Useful gains	659.6726	752.3381	754.7583	663.2993	519.6422	347.7204	232.3718	242.9340	377.3033	551.4574	622.4556	624.7124	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	939.7198	924.7043	842.0498	693.1092	527.6458	349.0350	232.6074	243.2851	380.8666	587.6845	777.2803	925.4285	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	208.3551	115.8301	64.9448	21.4631	5.9546	0.0000	0.0000	0.0000	0.0000	26.9530	111.4737	223.7327	(98)
Space heating												778.7074	(98)
Space heating per m2											(98) / (4) =	8.7299	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	548.1287	431.5056	441.2426	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9913	0.9956	0.9944	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.3435	429.6253	438.7685	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1708.9346	1646.9006	1558.9229	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	839.2255	905.6529	833.3949	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2578.2733	(104)
Cooled fraction										fC = cooled area / (4) =		0.6726	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	141.1254	152.2959	140.1449	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												433.5661	(107)
Space cooling per m2												4.8606	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	778.7074	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	286.1750	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	531.4678	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2165.9668	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.9928	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1478.2724	(310b)
Electricity used for heat distribution	30.9191	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	100.3625	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	202.0046	(330a)
Total electricity for the above, kWh/year	202.0046	(331)
Electricity for lighting (calculated in Appendix L)	374.0817	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3768.3567	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1139.1240	0.2160	246.0508	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	966.3051	0.2160	208.7219	(363)
less credit emissions for electricity	-338.2068	0.5190	-175.5293	(364)
Water heating from Combined Heat and Power	2687.7679	0.2160	580.5579	(365)
less credit emissions for electricity	-940.7188	0.5190	-488.2330	(366)
Electrical energy for heat distribution	30.9191	0.5190	16.0470	(372)
Total CO2 associated with community systems			387.6152	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			387.6152	(376)
Space cooling	100.3625	0.5190	52.0882	(377)
Pumps and fans	202.0046	0.5190	104.8404	(378)
Energy for lighting	374.0817	0.5190	194.1484	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			582.9921	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.5400	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.5400	ZC1
Total Floor Area	TFA	89.2000	
Assumed number of occupants	N	2.6146	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.7843	ZC2
CO2 emissions from cooking, equation (L16)		2.0376	ZC3
Total CO2 emissions		24.3618	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.3618	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1246	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3746	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3184	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4059	0.3980	0.3900	0.3502	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3741	(22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5457	0.5457	0.5434	0.5507	0.5586	0.5641	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			22.3000	1.3258	29.5644			(27)
External Wall 1	51.8400	22.3000	29.5400	0.1800	5.3172			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8816			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		40.2816	(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	46.2868	46.0325	45.7833	44.6126	44.3936	43.3740	43.3740	43.1852	43.7667	44.3936	44.8367	45.2999	(38)
Heat transfer coeff	86.5684	86.3141	86.0649	84.8942	84.6752	83.6556	83.6556	83.4668	84.0483	84.6752	85.1183	85.5815	(39)
Average = Sum(39)m / 12 =												84.8932	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9705	0.9676	0.9649	0.9517	0.9493	0.9378	0.9378	0.9357	0.9422	0.9493	0.9542	0.9594	(40)
HLP (average)												0.9517	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6146 (42)
Average daily hot water use (litres/day)		96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5629	20.6083	21.2659	18.5401	17.7897	15.3512	14.2251	16.3235	16.5185	19.2507	21.0136	22.8194	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	203.6812	179.4744	188.3677	168.6928	165.1930	147.4329	141.4290	155.4184	155.2150	174.9329	185.1828	198.7246	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	203.6812	179.4744	188.3677	168.6928	165.1930	147.4329	141.4290	155.4184	155.2150	174.9329	185.1828	198.7246	(64)
								Total per year (kWh/year) = Sum(64)m =				2063.7445	(64)
Heat gains from water heating, kWh/month													
	89.5071	79.3503	84.4154	77.1708	76.7098	70.1019	68.8083	73.4597	72.6894	79.9483	82.6537	87.8590	(65)

---

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	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1821	18.8137	15.3003	11.5833	8.6587	7.3100	7.8987	10.2671	13.7805	17.4975	20.4221	21.7708	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	237.5982	240.0637	233.8507	220.6239	203.9274	188.2350	177.7515	175.2860	181.4990	194.7259	211.4224	227.1148	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)
Water heating gains (Table 5)													
	120.3052	118.0808	113.4615	107.1816	103.1045	97.3637	92.4842	98.7362	100.9575	107.4574	114.7968	118.0901	(72)
Total internal gains													
	444.3047	442.1774	427.8317	404.6080	380.9097	358.1279	343.3536	349.5084	361.4562	384.8999	411.8605	432.1948	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	14.5400	36.7938	0.6300	0.7000	0.7700	163.4976	(77)
Southwest	7.7600	36.7938	0.6300	0.7000	0.7700	87.2587	(79)

Solar gains	250.7562	427.1306	584.4187	724.1231	811.0783	805.2130	776.3112	711.4388	632.8019	472.0703	300.3482	214.5951	(83)
Total gains	695.0609	869.3081	1012.2505	1128.7312	1191.9880	1163.3409	1119.6649	1060.9473	994.2581	856.9702	712.2086	646.7899	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.5555	71.7663	71.9741	72.9666	73.1554	74.0470	74.0470	74.2145	73.7010	73.1554	72.7745	72.3806	
alpha	5.7704	5.7844	5.7983	5.8644	5.8770	5.9365	5.9365	5.9476	5.9134	5.8770	5.8516	5.8254	
util living area													
	0.9924	0.9741	0.9261	0.8112	0.6398	0.4577	0.3284	0.3613	0.5730	0.8660	0.9789	0.9947	(86)
MIT	20.1772	20.4088	20.6616	20.8781	20.9729	20.9968	20.9996	20.9994	20.9888	20.8486	20.4694	20.1335	(87)
Th 2	20.1080	20.1104	20.1127	20.1238	20.1258	20.1355	20.1355	20.1372	20.1317	20.1258	20.1216	20.1173	(88)
util rest of house													
	0.9900	0.9669	0.9075	0.7733	0.5864	0.3970	0.2641	0.2939	0.5052	0.8275	0.9718	0.9931	(89)
MIT 2	19.0234	19.3569	19.7090	19.9958	20.1027	20.1336	20.1353	20.1370	20.1243	19.9698	19.4560	18.9672	(90)
Living area fraction									fLA = Living area / (4) =			0.3363	(91)
MIT	19.4114	19.7107	20.0294	20.2925	20.3954	20.4239	20.4260	20.4270	20.4150	20.2654	19.7968	19.3595	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4114	19.7107	20.0294	20.2925	20.3954	20.4239	20.4260	20.4270	20.4150	20.2654	19.7968	19.3595	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9876	0.9629	0.9055	0.7810	0.6032	0.4174	0.2857	0.3166	0.5277	0.8342	0.9685	0.9912	(94)
Useful gains	686.4677	837.0629	916.6080	881.5680	719.0653	485.5831	319.9321	335.8764	524.6411	714.8894	689.7573	641.1176	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1308.1730	1278.3718	1164.4062	967.1602	736.2808	487.2016	320.0671	336.1231	530.7672	818.4171	1080.7323	1297.3714	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	462.5487	296.5596	184.3618	61.6263	12.8084	0.0000	0.0000	0.0000	0.0000	77.0247	281.5020	488.2528	(98)
Space heating												1864.6843	(98)
Space heating per m2											(98) / (4) =	20.9045	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1994.3148	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	462.5487	296.5596	184.3618	61.6263	12.8084	0.0000	0.0000	0.0000	0.0000	77.0247	281.5020	488.2528	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	494.7045	317.1760	197.1784	65.9105	13.6988	0.0000	0.0000	0.0000	0.0000	82.3793	301.0717	522.1955	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	203.6812	179.4744	188.3677	168.6928	165.1930	147.4329	141.4290	155.4184	155.2150	174.9329	185.1828	198.7246	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.9362	86.1451	84.7566	82.4070	80.4847	79.8000	79.8000	79.8000	79.8000	82.7925	85.9281	87.1208	(217)
Fuel for water heating, kWh/month													
	234.2880	208.3396	222.2454	204.7070	205.2476	184.7531	177.2293	194.7599	194.5050	211.2908	215.5089	228.1023	(219)
Water heating fuel used												2480.9767	(219)
Annual totals kWh/year													
Space heating fuel - main system												1994.3148	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												374.0817	(232)
Total delivered energy for all uses												4924.3732	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1994.3148	0.2160	430.7720	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2480.9767	0.2160	535.8910	(264)
Space and water heating			966.6630	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	374.0817	0.5190	194.1484	(268)
Total CO2, kg/m2/year			1199.7364	(272)
Emissions per m2 for space and water heating			10.8370	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1766	(272b)
Emissions per m2 for pumps and fans			0.4364	(272c)
Target Carbon Dioxide Emission Rate (TER) = (10.8370 * 1.00) + 2.1766 + 0.4364, rounded to 2 d.p.			13.4500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1246	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2746	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2334	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2976	0.2917	0.2859	0.2567	0.2509	0.2217	0.2217	0.2159	0.2334	0.2509	0.2626	0.2742	(22b)
Effective ac	0.5443	0.5426	0.5409	0.5330	0.5315	0.5246	0.5246	0.5233	0.5272	0.5315	0.5345	0.5376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	51.8400	23.0000	28.8400	0.1500	4.3260			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.6619			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		40.0219	(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	43.2571	43.1205	42.9866	42.3575	42.2398	41.6920	41.6920	41.5905	41.9030	42.2398	42.4779	42.7268	(38)
Heat transfer coeff	83.2790	83.1424	83.0084	82.3794	82.2617	81.7138	81.7138	81.6124	81.9249	82.2617	82.4998	82.7487	(39)
Average = Sum(39)m / 12 =												82.3788	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9336	0.9321	0.9306	0.9235	0.9222	0.9161	0.9161	0.9149	0.9184	0.9222	0.9249	0.9277	(40)
HLP (average)												0.9235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6146 (42)
Average daily hot water use (litres/day)		96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	33.3808	29.1951	30.1267	26.2652	25.2021	21.7475	20.1522	23.1250	23.4012	27.2718	29.7693	32.3276 (65)

---

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	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	(66)

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

	21.1821	18.8137	15.3003	11.5833	8.6587	7.3100	7.8987	10.2671	13.7805	17.4975	20.4221	21.7708	(67)

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

	237.5982	240.0637	233.8507	220.6239	203.9274	188.2350	177.7515	175.2860	181.4990	194.7259	211.4224	227.1148	(68)

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

	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)

Water heating gains (Table 5)

	44.8667	43.4451	40.4929	36.4794	33.8738	30.2048	27.0863	31.0820	32.5016	36.6557	41.3463	43.4510	(72)

Total internal gains

	365.8662	364.5417	351.8631	330.9058	308.6790	287.9690	274.9558	278.8542	290.0003	311.0982	335.4100	354.5557	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	36.7938	0.6800	0.8000	0.7700	208.0647	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	319.0326	543.4305	743.5453	921.2886	1031.9200	1024.4577	987.6866	905.1506	805.1023	600.6064	382.1275	273.0254	(83)
Total gains	684.8987	907.9722	1095.4084	1252.1944	1340.5990	1312.4268	1262.6424	1184.0048	1095.1026	911.7046	717.5374	627.5811	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.7527	29.8016	29.8497	30.0776	30.1207	30.3226	30.3226	30.3603	30.2445	30.1207	30.0337	29.9434	
alpha	2.9835	2.9868	2.9900	3.0052	3.0080	3.0215	3.0215	3.0240	3.0163	3.0080	3.0022	2.9962	
util living area	0.9348	0.8718	0.7835	0.6595	0.5200	0.3832	0.2801	0.3103	0.4796	0.7262	0.8918	0.9472	(86)
MIT	19.3750	19.8149	20.2513	20.6283	20.8523	20.9564	20.9873	20.9825	20.9128	20.5793	19.8990	19.2732	(87)
Th 2	20.1390	20.1403	20.1416	20.1475	20.1487	20.1539	20.1539	20.1548	20.1519	20.1487	20.1464	20.1440	(88)
util rest of house	0.9266	0.8575	0.7617	0.6289	0.4811	0.3365	0.2279	0.2556	0.4291	0.6921	0.8771	0.9403	(89)
MIT 2	18.6570	19.0820	19.4955	19.8452	20.0400	20.1273	20.1481	20.1465	20.0954	19.8128	19.1754	18.5616	(90)
Living area fraction										fLA = Living area / (4) =		0.3363	(91)
MIT	18.8985	19.3285	19.7497	20.1086	20.3132	20.4062	20.4303	20.4276	20.3703	20.0706	19.4188	18.8009	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8985	19.3285	19.7497	20.1086	20.3132	20.4062	20.4303	20.4276	20.3703	20.0706	19.4188	18.8009	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9123	0.8422	0.7509	0.6274	0.4888	0.3507	0.2451	0.2734	0.4424	0.6888	0.8625	0.9272	(94)
Useful gains	624.8117	764.7180	822.5233	785.6295	655.3384	460.2049	309.4999	323.7505	484.4933	627.9761	618.8578	581.8732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1215.7474	1199.6183	1099.8394	923.3555	708.5339	474.4442	312.9925	328.7058	513.6948	779.0640	1016.2950	1208.2091	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	439.6561	292.2530	206.3232	99.1627	39.5774	0.0000	0.0000	0.0000	0.0000	112.4094	286.1548	465.9939	(98)
Space heating												1941.5306	(98)
Space heating per m2											(98) / (4) =	21.7660	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	768.1102	604.6825	620.2542	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9430	0.9649	0.9570	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	724.3126	583.4869	593.5564	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1632.4403	1572.1674	1481.9333	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	653.8519	735.5783	660.9524	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2050.3826	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   163.4630   183.8946   165.2381     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          512.5956 (107)
Space cooling per m2                                                                                                                     5.7466 (108)
Energy for space heating                                                                                                                21.7660 (99)
Energy for space cooling                                                                                                                 5.7466 (108)
Total                                                                                                                                   27.5126 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   27.5 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1246	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3746	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3184	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4059	0.3980	0.3900	0.3502	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3741	(22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5457	0.5457	0.5434	0.5507	0.5586	0.5641	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			22.3000	1.3258	29.5644			(27)
External Wall 1	51.8400	22.3000	29.5400	0.1800	5.3172			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8816			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		40.2816	(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	46.2868	46.0325	45.7833	44.6126	44.3936	43.3740	43.3740	43.1852	43.7667	44.3936	44.8367	45.2999	(38)
Heat transfer coeff	86.5684	86.3141	86.0649	84.8942	84.6752	83.6556	83.6556	83.4668	84.0483	84.6752	85.1183	85.5815	(39)
Average = Sum(39)m / 12 =												84.8932	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9705	0.9676	0.9649	0.9517	0.9493	0.9378	0.9378	0.9357	0.9422	0.9493	0.9542	0.9594	(40)
HLP (average)												0.9517	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6146 (42)
Average daily hot water use (litres/day)		96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.3808	29.1951	30.1267	26.2652	25.2021	21.7475	20.1522	23.1250	23.4012	27.2718	29.7693	32.3276	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	130.7306	(66)

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

	21.1821	18.8137	15.3003	11.5833	8.6587	7.3100	7.8987	10.2671	13.7805	17.4975	20.4221	21.7708	(67)

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

	237.5982	240.0637	233.8507	220.6239	203.9274	188.2350	177.7515	175.2860	181.4990	194.7259	211.4224	227.1148	(68)

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

	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	36.0731	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)

Water heating gains (Table 5)

	44.8667	43.4451	40.4929	36.4794	33.8738	30.2048	27.0863	31.0820	32.5016	36.6557	41.3463	43.4510	(72)

Total internal gains

	365.8662	364.5417	351.8631	330.9058	308.6790	287.9690	274.9558	278.8542	290.0003	311.0982	335.4100	354.5557	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	14.5400	36.7938	0.6300	0.7000	0.7700	163.4976	(77)
Southwest	7.7600	36.7938	0.6300	0.7000	0.7700	87.2587	(79)

Solar gains	250.7562	427.1306	584.4187	724.1231	811.0783	805.2130	776.3112	711.4388	632.8019	472.0703	300.3482	214.5951	(83)
Total gains	616.6224	791.6723	936.2818	1055.0290	1119.7572	1093.1820	1051.2670	990.2930	922.8022	783.1685	635.7581	569.1508	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.5555	71.7663	71.9741	72.9666	73.1554	74.0470	74.0470	74.2145	73.7010	73.1554	72.7745	72.3806	
alpha	5.7704	5.7844	5.7983	5.8644	5.8770	5.9365	5.9365	5.9476	5.9134	5.8770	5.8516	5.8254	
util living area	0.9958	0.9830	0.9450	0.8427	0.6743	0.4861	0.3497	0.3869	0.6128	0.8997	0.9876	0.9973	(86)
MIT	20.0948	20.3341	20.6043	20.8491	20.9646	20.9956	20.9995	20.9991	20.9842	20.8076	20.3938	20.0509	(87)
Th 2	20.1080	20.1104	20.1127	20.1238	20.1258	20.1355	20.1355	20.1372	20.1317	20.1258	20.1216	20.1173	(88)
util rest of house	0.9945	0.9780	0.9300	0.8075	0.6200	0.4221	0.2812	0.3148	0.5421	0.8669	0.9831	0.9964	(89)
MIT 2	19.2859	19.5238	19.7849	20.0135	20.1049	20.1337	20.1353	20.1370	20.1244	19.9863	19.5939	19.2500	(90)
Living area fraction										fLA = Living area / (4) =		0.3363	(91)
MIT	19.5579	19.7963	20.0605	20.2945	20.3940	20.4236	20.4260	20.4269	20.4136	20.2625	19.8629	19.5194	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5579	19.7963	20.0605	20.2945	20.3940	20.4236	20.4260	20.4269	20.4136	20.2625	19.8629	19.5194	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9759	0.9290	0.8148	0.6372	0.4436	0.3043	0.3390	0.5656	0.8726	0.9815	0.9956	(94)
Useful gains	612.5454	772.5568	869.8190	859.6362	713.4575	484.9388	319.8719	335.7558	521.9012	683.3874	623.9891	566.6485	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1320.8563	1285.7646	1167.0844	967.3289	736.1673	487.1741	320.0631	336.1152	530.6453	818.1754	1086.3587	1311.0535	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	526.9833	344.8756	221.1655	77.5387	16.8962	0.0000	0.0000	0.0000	0.0000	100.2822	332.9062	553.8373	(98)
Space heating												2174.4850	(98)
Space heating per m2											(98) / (4) =	24.3776	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	786.3624	619.0512	634.3473	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9842	0.9942	0.9914	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	773.9506	615.4339	628.8889	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1376.1802	1325.1053	1255.5169	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	433.6053	527.9955	466.2113	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1427.8121	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	108.4013	131.9989	116.5528	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	356.9530 (107)
Space cooling per m2	4.0017 (108)
Energy for space heating	24.3776 (99)
Energy for space cooling	4.0017 (108)
Total	28.3794 (109)
Target Fabric Energy Efficiency (TFEE)	32.6 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	51.8400	23.0000	28.8400	0.1500	4.3260			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.6619			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.0219	(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	18.5430	18.2897	18.0364	17.5297	17.5297	16.5164	17.0230	16.5164	16.2630	16.7697	16.7697	17.7830	(38)
Heat transfer coeff	58.5649	58.3116	58.0582	57.5516	57.5516	56.5382	57.0449	56.5382	56.2849	56.7916	56.7916	57.8049	(39)
Average = Sum(39)m / 12 =												57.3193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6566	0.6537	0.6509	0.6452	0.6452	0.6338	0.6395	0.6338	0.6310	0.6367	0.6367	0.6480	(40)
HLP (average)												0.6426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6146 (42)
Average daily hot water use (litres/day)	96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5629	20.6083	21.2659	18.5401	17.7897	15.3512	14.2251	16.3235	16.5185	19.2507	21.0136	22.8194	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              212.3631   187.3161   197.0496   177.0946   173.8749   155.8348   150.1109   164.1003   163.6169   183.6148   193.5846   207.4065 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              212.3631   187.3161   197.0496   177.0946   173.8749   155.8348   150.1109   164.1003   163.6169   183.6148   193.5846   207.4065 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   2165.9668 (64)
RHI water heating demand                                                                                    2166 (64)
Heat gains from water heating, kWh/month
               96.4526    85.6237    91.3609    83.8923    83.6553    76.8234    75.7538    80.4053    79.4109    86.8938    89.3752    94.8046 (65)
```

---

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         156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767   156.8767 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               52.9551    47.0343    38.2509    28.9584    21.6467    18.2751    19.7469    25.6677    34.4511    43.7436    51.0553    54.4269 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              354.6242   358.3041   349.0309   329.2893   304.3692   280.9477   265.3008   261.6209   270.8941   290.6356   315.5558   338.9773 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023    53.3023 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845  -104.5845 (71)
Water heating gains (Table 5)
              129.6406   127.4162   122.7969   116.5170   112.4399   106.6991   101.8196   108.0716   110.2929   116.7928   124.1322   127.4255 (72)
Total internal gains
              642.8145   638.3491   615.6732   580.3592   544.0503   511.5164   492.4617   500.9547   521.2327   556.7665   596.3378   626.4242 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g              FF            Access            Gains
                                          m2           Table 6a      Specific data  Specific data      factor              W
                                                          W/m2        or Table 6b    or Table 6c     Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Southeast                               15.0000          39.0225          0.6800         0.8000          0.7700          220.6674 (77)
Southwest                                8.0000          39.0225          0.6800         0.8000          0.7700          117.6893 (79)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    338.3567   507.6524   711.5210   914.7181  1002.5997  1065.4495  1023.4330   963.0582   847.3067   624.5112   418.4274   296.7249 (83)
Total gains    981.1712  1146.0015  1327.1942  1495.0773  1546.6500  1576.9659  1515.8947  1464.0129  1368.5393  1181.2778  1014.7652   923.1490 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           42.3082    42.4920    42.6775    43.0532    43.0532    43.8248    43.4356    43.8248    44.0221    43.6293    43.6293    42.8645
alpha          3.8205     3.8328     3.8452     3.8702     3.8702     3.9217     3.8957     3.9217     3.9348     3.9086     3.9086     3.8576
util living area
               0.7552     0.6690     0.5317     0.3897     0.2667     0.1505     0.0865     0.0927     0.2094     0.4057     0.6290     0.7768 (86)

MIT           20.6253    20.7670    20.9094    20.9755    20.9955    20.9997    21.0000    21.0000    20.9988    20.9776    20.8533    20.5943 (87)
Th 2          20.3794    20.3819    20.3844    20.3895    20.3895    20.3996    20.3946    20.3996    20.4022    20.3971    20.3971    20.3870 (88)
util rest of house
               0.7372     0.6491     0.5098     0.3678     0.2444     0.1290     0.0638     0.0695     0.1850     0.3788     0.6053     0.7596 (89)
MIT 2         19.8970    20.0875    20.2750    20.3619    20.3851    20.3994    20.3946    20.3996    20.4012    20.3731    20.2185    19.8624 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.3363 (91)
MIT           20.1419    20.3160    20.4883    20.5683    20.5904    20.6013    20.5982    20.6015    20.6022    20.5764    20.4320    20.1085 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  20.1419    20.3160    20.4883    20.5683    20.5904    20.6013    20.5982    20.6015    20.6022    20.5764    20.4320    20.1085 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.7301     0.6469     0.5135     0.3743     0.2518     0.1362     0.0714     0.0773     0.1931     0.3868     0.6067     0.7514 (94)
Useful gains 716.3235   741.3775   681.5348   559.5450   389.3716   214.8451   108.2777   113.1590   264.3304   456.9469   615.6708   693.6817 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              845.7889   823.1285   713.4397   567.9357   390.7965   214.9200   108.2812   113.1636   264.6628   464.3509   666.2795   832.8840 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               96.3222    54.9367    23.7373     6.0413     1.0601     0.0000     0.0000     0.0000     0.0000     5.5085    36.4383   103.5665 (98)
Space heating                                                                                                                327.6109 (98)
RHI space heating demand                                                                                                      328 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	51.8400	23.0000	28.8400	0.1500	4.3260			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.6619			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.0219	(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	21.5830	21.3297	21.0764	19.8097	19.5564	18.2897	18.2897	18.0364	18.7964	19.5564	20.0630	20.5697	(38)
Heat transfer coeff	61.6049	61.3516	61.0982	59.8316	59.5782	58.3116	58.3116	58.0582	58.8182	59.5782	60.0849	60.5916	(39)
Average = Sum(39)m / 12 =												59.7682	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6906	0.6878	0.6850	0.6708	0.6679	0.6537	0.6537	0.6509	0.6594	0.6679	0.6736	0.6793	(40)
HLP (average)												0.6700	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6146 (42)
Average daily hot water use (litres/day)	96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5629	20.6083	21.2659	18.5401	17.7897	15.3512	14.2251	16.3235	16.5185	19.2507	21.0136	22.8194	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (64)
Total per year (kWh/year) = Sum(64)m = 2165.9668 (64)
Heat gains from water heating, kWh/month
96.4526 85.6237 91.3609 83.8923 83.6553 76.8234 75.7538 80.4053 79.4109 86.8938 89.3752 94.8046 (65)

---

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	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9551	47.0343	38.2509	28.9584	21.6467	18.2751	19.7469	25.6677	34.4511	43.7436	51.0553	54.4269	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	354.6242	358.3041	349.0309	329.2893	304.3692	280.9477	265.3008	261.6209	270.8941	290.6356	315.5558	338.9773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)
Water heating gains (Table 5)													
	129.6406	127.4162	122.7969	116.5170	112.4399	106.6991	101.8196	108.0716	110.2929	116.7928	124.1322	127.4255	(72)
Total internal gains													
	642.8145	638.3491	615.6732	580.3592	544.0503	511.5164	492.4617	500.9547	521.2327	556.7665	596.3378	626.4242	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	36.7938	0.6800	0.8000	0.7700	208.0647	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	319.0326	543.4305	743.5453	921.2886	1031.9200	1024.4577	987.6866	905.1506	805.1023	600.6064	382.1275	273.0254	(83)
Total gains	961.8470	1181.7795	1359.2184	1501.6479	1575.9704	1535.9742	1480.1483	1406.1053	1326.3349	1157.3730	978.4653	899.4495	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.2205	40.3865	40.5540	41.4125	41.5886	42.4920	42.4920	42.6775	42.1260	41.5886	41.2379	40.8931	
alpha	3.6814	3.6924	3.7036	3.7608	3.7726	3.8328	3.8328	3.8452	3.8084	3.7726	3.7492	3.7262	
util living area													
	0.8120	0.7114	0.5981	0.4655	0.3471	0.2422	0.1732	0.1897	0.3036	0.5106	0.7230	0.8342	(86)
MIT	20.4098	20.6494	20.8258	20.9402	20.9831	20.9970	20.9994	20.9991	20.9925	20.9310	20.6934	20.3596	(87)
Th 2	20.3491	20.3516	20.3541	20.3667	20.3693	20.3819	20.3819	20.3844	20.3768	20.3693	20.3642	20.3592	(88)
util rest of house													
	0.7971	0.6931	0.5772	0.4435	0.3244	0.2190	0.1489	0.1644	0.2768	0.4835	0.7021	0.8205	(89)
MIT 2	19.5745	19.9013	20.1375	20.2962	20.3510	20.3791	20.3814	20.3838	20.3696	20.2901	19.9776	19.5140	(90)
Living area fraction									fLA = Living area / (4) =			0.3363	(91)
MIT	19.8554	20.1529	20.3690	20.5128	20.5636	20.5869	20.5893	20.5907	20.5791	20.5056	20.2184	19.7984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8554	20.1529	20.3690	20.5128	20.5636	20.5869	20.5893	20.5907	20.5791	20.5056	20.2184	19.7984	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7849	0.6872	0.5777	0.4486	0.3315	0.2267	0.1571	0.1729	0.2855	0.4894	0.6971	0.8075	(94)
Useful gains	754.9806	812.1540	785.1872	673.6979	522.3703	348.1831	232.4576	243.0691	378.7324	566.4151	682.0632	726.2969	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	958.2900	935.7906	847.3723	694.8106	528.0774	349.1061	232.6206	243.3058	381.0889	590.1594	788.2156	945.1339	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	151.2623	83.0838	46.2657	15.2012	4.2461	0.0000	0.0000	0.0000	0.0000	17.6657	76.4297	162.8148	(98)
Space heating												556.9693	(98)
Space heating per m2											(98) / (4) =	6.2440	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	548.1287	431.5056	441.2426	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9913	0.9956	0.9944	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.3435	429.6253	438.7685	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1708.9346	1646.9006	1558.9229	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	839.2255	905.6529	833.3949	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2578.2733	(104)
Cooled fraction										fC = cooled area / (4) =		0.6726	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	141.1254	152.2959	140.1449	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												433.5661	(107)
Space cooling per m2												4.8606	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	556.9693	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	204.6862	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	380.1315	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2165.9668	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.9928	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1478.2724	(310b)
Electricity used for heat distribution	28.5908	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	100.3625	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	202.0046	(330a)
Total electricity for the above, kWh/year	202.0046	(331)
Electricity for lighting (calculated in Appendix L)	374.0817	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3535.5317	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	204.6862	4.2400	8.6787	(340a)
Space heating from Combined Heat and Power	380.1315	2.9700	11.2899	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	795.9928	4.2400	33.7501	(342a)
Water heating from Combined Heat and Power	1478.2724	2.9700	43.9047	(342b)
Space cooling	100.3625	13.1900	13.2378	(348)
Mechanical ventilation fans	202.0046	13.1900	26.6444	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	374.0817	13.1900	49.3414	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			267.2770	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8365	(357)
SAP value	88.3310	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1053.3463	0.2160	227.5228 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	691.1482	0.2160	149.2880 (363)
less credit emissions for electricity	-241.9019	0.5190	-125.5471 (364)
Water heating from Combined Heat and Power	2687.7679	0.2160	580.5579 (365)
less credit emissions for electricity	-940.7188	0.5190	-488.2330 (366)
Electrical energy for heat distribution	28.5908	0.5190	14.8386 (372)
Total CO2 associated with community systems			358.4272 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			358.4272 (376)
Space cooling	100.3625	0.5190	52.0882 (377)
Pumps and fans	202.0046	0.5190	104.8404 (378)
Energy for lighting	374.0817	0.5190	194.1484 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			553.8041 (383)
CO2 emissions per m2			6.2100 (384)
EI value			94.4702 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	89.2000 (1b)	x	2.7000 (2b)	=	240.8400	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	240.8400	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	51.8400	23.0000	28.8400	0.1500	4.3260			(29a)
Total net area of external elements Aum(A, m2)			51.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.6619			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	40.0219	(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	18.5430	18.2897	18.0364	17.5297	17.5297	16.5164	17.0230	16.5164	16.2630	16.7697	16.7697	17.7830	(38)
Heat transfer coeff	58.5649	58.3116	58.0582	57.5516	57.5516	56.5382	57.0449	56.5382	56.2849	56.7916	56.7916	57.8049	(39)
Average = Sum(39)m / 12 =												57.3193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6566	0.6537	0.6509	0.6452	0.6452	0.6338	0.6395	0.6338	0.6310	0.6367	0.6367	0.6480	(40)
HLP (average)												0.6426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6146 (42)
Average daily hot water use (litres/day)	96.2970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.9267	102.0748	98.2230	94.3711	90.5192	86.6673	86.6673	90.5192	94.3711	98.2230	102.0748	105.9267	(44)
Energy conte	157.0863	137.3887	141.7728	123.6009	118.5981	102.3411	94.8341	108.8235	110.1232	128.3380	140.0909	152.1297	(45)
Energy content (annual)										Total = Sum(45)m =		1515.1271	(45)
Distribution loss (46)m = 0.15 x (45)m	23.5629	20.6083	21.2659	18.5401	17.7897	15.3512	14.2251	16.3235	16.5185	19.2507	21.0136	22.8194	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
212.3631 187.3161 197.0496 177.0946 173.8749 155.8348 150.1109 164.1003 163.6169 183.6148 193.5846 207.4065 (64)
Total per year (kWh/year) = Sum(64)m = 2165.9668 (64)
Heat gains from water heating, kWh/month
96.4526 85.6237 91.3609 83.8923 83.6553 76.8234 75.7538 80.4053 79.4109 86.8938 89.3752 94.8046 (65)

---

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	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	156.8767	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9551	47.0343	38.2509	28.9584	21.6467	18.2751	19.7469	25.6677	34.4511	43.7436	51.0553	54.4269	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	354.6242	358.3041	349.0309	329.2893	304.3692	280.9477	265.3008	261.6209	270.8941	290.6356	315.5558	338.9773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	53.3023	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	-104.5845	(71)
Water heating gains (Table 5)													
	129.6406	127.4162	122.7969	116.5170	112.4399	106.6991	101.8196	108.0716	110.2929	116.7928	124.1322	127.4255	(72)
Total internal gains													
	642.8145	638.3491	615.6732	580.3592	544.0503	511.5164	492.4617	500.9547	521.2327	556.7665	596.3378	626.4242	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	15.0000	39.0225	0.6800	0.8000	0.7700	220.6674	(77)
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)

Solar gains	338.3567	507.6524	711.5210	914.7181	1002.5997	1065.4495	1023.4330	963.0582	847.3067	624.5112	418.4274	296.7249	(83)
Total gains	981.1712	1146.0015	1327.1942	1495.0773	1546.6500	1576.9659	1515.8947	1464.0129	1368.5393	1181.2778	1014.7652	923.1490	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.3082	42.4920	42.6775	43.0532	43.0532	43.8248	43.4356	43.8248	44.0221	43.6293	43.6293	42.8645	
alpha	3.8205	3.8328	3.8452	3.8702	3.8702	3.9217	3.8957	3.9217	3.9348	3.9086	3.9086	3.8576	
util living area													
	0.7552	0.6690	0.5317	0.3897	0.2667	0.1505	0.0865	0.0927	0.2094	0.4057	0.6290	0.7768	(86)
MIT	20.6253	20.7670	20.9094	20.9755	20.9955	20.9997	21.0000	21.0000	20.9988	20.9776	20.8533	20.5943	(87)
Th 2	20.3794	20.3819	20.3844	20.3895	20.3895	20.3996	20.3946	20.3996	20.4022	20.3971	20.3971	20.3870	(88)
util rest of house													
	0.7372	0.6491	0.5098	0.3678	0.2444	0.1290	0.0638	0.0695	0.1850	0.3788	0.6053	0.7596	(89)
MIT 2	19.8970	20.0875	20.2750	20.3619	20.3851	20.3994	20.3946	20.3996	20.4012	20.3731	20.2185	19.8624	(90)
Living area fraction									fLA = Living area / (4) =			0.3363	(91)
MIT	20.1419	20.3160	20.4883	20.5683	20.5904	20.6013	20.5982	20.6015	20.6022	20.5764	20.4320	20.1085	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1419	20.3160	20.4883	20.5683	20.5904	20.6013	20.5982	20.6015	20.6022	20.5764	20.4320	20.1085	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7301	0.6469	0.5135	0.3743	0.2518	0.1362	0.0714	0.0773	0.1931	0.3868	0.6067	0.7514	(94)
Useful gains	716.3235	741.3775	681.5348	559.5450	389.3716	214.8451	108.2777	113.1590	264.3304	456.9469	615.6708	693.6817	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	845.7889	823.1285	713.4397	567.9357	390.7965	214.9200	108.2812	113.1636	264.6628	464.3509	666.2795	832.8840	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	96.3222	54.9367	23.7373	6.0413	1.0601	0.0000	0.0000	0.0000	0.0000	5.5085	36.4383	103.5665	(98)
Space heating												327.6109	(98)
Space heating per m2											(98) / (4) =	3.6728	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	407.0753	302.3380	305.3065	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9975	0.9990	0.9989	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	406.0636	302.0328	304.9555	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1756.8470	1688.6821	1626.6072	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	972.5640	1031.6671	983.3089	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2987.5400	(104)
Cooled fraction										fC = cooled area / (4) =		0.6726	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	163.5478	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												163.5478	(107)
Space cooling per m2												1.8335	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	327.6109	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	120.3970	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	223.5944	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2165.9668	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	795.9928	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1478.2724	(310b)
Electricity used for heat distribution	26.1826	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	37.8583	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	202.0046	(330a)
Total electricity for the above, kWh/year	202.0046	(331)
Electricity for lighting (calculated in Appendix L)	374.0817	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3232.2011	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	120.3970	5.0000	6.0198	(340a)
Space heating from Combined Heat and Power	223.5944	3.5000	7.8258	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	795.9928	5.0000	39.7996	(342a)
Water heating from Combined Heat and Power	1478.2724	3.5000	51.7395	(342b)
Space cooling	37.8583	15.7000	5.9437	(348)
Mechanical ventilation fans	202.0046	15.7000	31.7147	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	374.0817	15.7000	58.7308	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			243.6741	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	964.6209	0.2160	208.3581	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	406.5353	0.2160	87.8116	(363)
less credit emissions for electricity	-142.2874	0.5190	-73.8471	(364)
Water heating from Combined Heat and Power	2687.7679	0.2160	580.5579	(365)
less credit emissions for electricity	-940.7188	0.5190	-488.2330	(366)
Electrical energy for heat distribution	26.1826	0.5190	13.5888	(372)
Total CO2 associated with community systems			328.2362	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			328.2362	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	37.8583	0.5190	19.6484 (377)
Pumps and fans	202.0046	0.5190	104.8404 (378)
Energy for lighting	374.0817	0.5190	194.1484 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			491.1734 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	964.6209	1.2200	1176.8374	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	406.5353	1.2200	495.9731	(363)
less credit emissions for electricity	-142.2874	3.0700	-436.8222	(364)
Water heating from Combined Heat and Power	2687.7679	1.2200	3279.0769	(365)
less credit emissions for electricity	-940.7188	3.0700	-2888.0067	(366)
Electrical energy for heat distribution	26.1826	3.0700	80.3805	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1707.4391	(373)
Space and water heating			1707.4391	(376)
Space cooling	37.8583	3.0700	116.2249	(377)
Pumps and fans	202.0046	3.0700	620.1540	(378)
Energy for lighting	374.0817	3.0700	1148.4308	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2671.2488	(383)
Primary energy kWh/m2/year			29.9467	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£96	£96	£0
Community scheme	£194	£194	£0
Space heating	£135	£135	£0
Space cooling	£6	£6	£0
Water heating	£92	£92	£0
Lighting	£59	£59	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£243	£243	£0
Total cost of uses	£245	£245	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	30 kWh/m²	30 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversha ding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	476.86 (P1)
Transmission heat loss coefficient	40.02 (37)
Summer heat loss coefficient	516.89 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	1.000	0.360	Wide overhang
South West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	0.920	0.90	0.360	0.239 (P8)
South East	1.000	0.90	0.360	0.260 (P8)
South West	0.920	0.90	1.000	0.828 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	15.0000	119.9223	0.6800	0.8000	0.2392	210.6658
South West	8.0000	119.9223	0.6800	0.8000	0.8280	388.9214
total:						599.5872

	Jun	Jul	Aug	
Solar gains	629	600	559	(P3)
Internal gains	512	492	501	
Total summer gains	1141	1092	1060	(P5)
Summer gain/loss ratio	2.21	2.11	2.05	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.51	21.31	21.15	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007045	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0306
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	7.27	**TER**	15.38
Environmental	94 A	**% DER<TER**	52.72		
CO_2 Emissions (t/year)	0.50	**DFEE**	33.11	**TFEE**	39.48
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.14		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               22.6, 79.7, 2.7
Living Area:                   30 m2, fraction: 37.6%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                38.02, 61.02, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 8.00,
     Window                    Window, External Wall 1, North East, , None, 1, True, 0, 0, 0, 3.00,
     SE                        Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.153
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.38 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.27 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.1 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

---

4 Heating efficiency

Main heating system:	Community heating scheme	-
Secondary heating system:	None	

---

5 Cylinder insulation

Hot water storage	No cylinder	

---

6 Controls

Space heating controls:	Charging system linked to use of community heating, TRVsOK	
Hot water controls:	No cylinder	

---

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

---

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.55	
Maximum	1.5	OK
MVHR efficiency:	92%	
Minimum:	70%	OK

---

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
Based on:		
Overshading:	Average	
Windows facing North East:	11.00 m², No overhang	
Windows facing South East:	12.00 m², No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

---

10 Key features

Air permeability	3.0 m³/m²h
Community CHP, Mains gas	
Photovoltaic array	

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	61.0200	23.0000	38.0200	0.1500	5.7030			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0389			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	41.3989	(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	19.2844	19.0580	18.8317	17.6999	17.4736	16.3418	16.3418	16.1154	16.7945	17.4736	17.9263	18.3790	(38)
Heat transfer coeff	60.6833	60.4569	60.2306	59.0988	58.8724	57.7407	57.7407	57.5143	58.1934	58.8724	59.3251	59.7779	(39)
Average = Sum(39)m / 12 =												59.0422	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7614	0.7586	0.7557	0.7415	0.7387	0.7245	0.7245	0.7216	0.7302	0.7387	0.7444	0.7500	(40)
HLP (average)												0.7408	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4571 (42)
Average daily hot water use (litres/day)	92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6478	19.8079	20.4400	17.8201	17.0988	14.7550	13.6727	15.6896	15.8770	18.5031	20.1975	21.9332	(46)
Water storage loss:													
Store volume												110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
206.2624 181.9804 191.5436 172.2944 169.2689 151.8602 146.4279 159.8740 159.3401 178.6306 188.1439 201.4983 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
206.2624 181.9804 191.5436 172.2944 169.2689 151.8602 146.4279 159.8740 159.3401 178.6306 188.1439 201.4983 (64)
Total per year (kWh/year) = Sum(64)m = 2107.1246 (64)
Heat gains from water heating, kWh/month
94.4241 83.8496 89.5302 82.2962 82.1238 75.5018 74.5292 79.0000 77.9889 85.2366 87.5662 92.8401 (65)

---

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	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5073	17.3262	14.0906	10.6675	7.9741	6.7321	7.2742	9.4553	12.6909	16.1140	18.8074	20.0495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	218.8124	221.0830	215.3612	203.1801	187.8037	173.3521	163.6975	161.4269	167.1487	179.3298	194.7062	209.1578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	(71)
Water heating gains (Table 5)													
	126.9142	124.7761	120.3362	114.3003	110.3815	104.8636	100.1736	106.1828	108.3179	114.5653	121.6197	124.7851	(72)
Total internal gains													
	425.0910	423.0425	409.6452	388.0050	366.0165	344.8049	331.0025	336.9222	348.0147	369.8662	394.9904	413.8495	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.0000	11.2829	0.6800	0.8000	0.7700	46.7894	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)

Solar gains	213.2411	378.7700	559.5308	762.4793	917.1969	938.3447	893.1034	773.4300	629.1436	429.7521	258.2440	180.6586	(83)
Total gains	638.3322	801.8125	969.1760	1150.4843	1283.2133	1283.1496	1224.1059	1110.3522	977.1582	799.6183	653.2344	594.5081	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4827	36.6193	36.7569	37.4608	37.6048	38.3419	38.3419	38.4928	38.0437	37.6048	37.3179	37.0353	
alpha	3.4322	3.4413	3.4505	3.4974	3.5070	3.5561	3.5561	3.5662	3.5362	3.5070	3.4879	3.4690	
util living area													
	0.9130	0.8433	0.7334	0.5710	0.4141	0.2855	0.2069	0.2372	0.4003	0.6652	0.8578	0.9268	(86)
MIT	19.8846	20.2294	20.5779	20.8482	20.9577	20.9917	20.9980	20.9968	20.9728	20.7899	20.3107	19.8204	(87)
Th 2	20.2869	20.2894	20.2919	20.3043	20.3068	20.3193	20.3193	20.3218	20.3143	20.3068	20.3018	20.2968	(88)
util rest of house													
	0.9036	0.8287	0.7122	0.5447	0.3855	0.2558	0.1751	0.2026	0.3631	0.6342	0.8418	0.9186	(89)
MIT 2	18.7946	19.2791	19.7579	20.1235	20.2610	20.3117	20.3179	20.3194	20.2879	20.0604	19.4106	18.7109	(90)
Living area fraction									fLA = Living area / (4) =			0.3764	(91)
MIT	19.2049	19.6368	20.0665	20.3963	20.5232	20.5676	20.5739	20.5744	20.5457	20.3350	19.7494	19.1285	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2049	19.6368	20.0665	20.3963	20.5232	20.5676	20.5739	20.5744	20.5457	20.3350	19.7494	19.1285	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8869	0.8138	0.7051	0.5483	0.3945	0.2667	0.1871	0.2155	0.3758	0.6355	0.8277	0.9026	(94)
Useful gains	566.1305	652.5189	683.4141	630.7736	506.2553	342.2207	228.9706	239.2870	367.1729	508.1506	540.6872	536.5797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	904.4776	890.9423	817.1197	679.4147	519.4450	344.5760	229.4548	240.0870	375.0990	573.1211	750.4275	892.3967	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	251.7303	160.2205	99.4770	35.0216	9.8132	0.0000	0.0000	0.0000	0.0000	48.3380	151.0130	264.7278	(98)
Space heating												1020.3414	(98)
Space heating per m2										(98) / (4) =		12.8023	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	542.7623	427.2810	437.1089	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9852	0.9919	0.9885	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	534.7048	423.8149	432.0885	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1578.5376	1507.9138	1376.1088	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	751.5596	806.5696	702.3511	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2260.4803	(104)
Cooled fraction										fC = cooled area / (4) =		0.7528	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	141.4479	151.8011	132.1865	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												425.4354	(107)
Space cooling per m2												5.3380	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1020.3414	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	374.9755	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	696.3830	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2107.1246	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	774.3683	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1438.1125	(310b)
Electricity used for heat distribution	32.8384	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	98.4804	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	180.4906	(330a)
Total electricity for the above, kWh/year	180.4906	(331)
Electricity for lighting (calculated in Appendix L)	344.5048	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3907.3150	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1209.8355	0.2160	261.3245	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1266.1509	0.2160	273.4886	(363)
less credit emissions for electricity	-443.1528	0.5190	-229.9963	(364)
Water heating from Combined Heat and Power	2614.7500	0.2160	564.7860	(365)
less credit emissions for electricity	-915.1625	0.5190	-474.9693	(366)
Electrical energy for heat distribution	32.8384	0.5190	17.0431	(372)
Total CO2 associated with community systems			411.6765	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			411.6765	(376)
Space cooling	98.4804	0.5190	51.1113	(377)
Pumps and fans	180.4906	0.5190	93.6746	(378)
Energy for lighting	344.5048	0.5190	178.7980	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			579.5605	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.2700	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.2700	ZC1
Total Floor Area	TFA	79.7000	
Assumed number of occupants	N	2.4571	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2690	ZC2
CO2 emissions from cooking, equation (L16)		2.2330	ZC3
Total CO2 emissions		25.7720	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.7720	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1394	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3894	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3310	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4220	0.4137	0.4055	0.3641	0.3558	0.3144	0.3144	0.3062	0.3310	0.3558	0.3724	0.3889	(22b)
Effective ac	0.5891	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.9300	1.3258	26.4223			(27)
External Wall 1	61.0200	19.9300	41.0900	0.1800	7.3962			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8185			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.4000 (36)
Total fabric heat loss	(33) + (36) =	39.2185 (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	41.8302	41.5846	41.3439	40.2134	40.0019	39.0172	39.0172	38.8348	39.3965	40.0019	40.4298	40.8771	(38)
Heat transfer coeff	81.0488	80.8032	80.5625	79.4319	79.2204	78.2357	78.2357	78.0534	78.6150	79.2204	79.6483	80.0957	(39)
Average = Sum(39)m / 12 =												79.4309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0169	1.0138	1.0108	0.9966	0.9940	0.9816	0.9816	0.9793	0.9864	0.9940	0.9994	1.0050	(40)
HLP (average)												0.9966	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4571 (42)
Average daily hot water use (litres/day)	92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6478	19.8079	20.4400	17.8201	17.0988	14.7550	13.6727	15.6896	15.8770	18.5031	20.1975	21.9332	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	197.5805	174.1387	182.8617	163.8926	160.5870	143.4584	137.7460	151.1921	150.9382	169.9487	179.7421	192.8164	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	197.5805	174.1387	182.8617	163.8926	160.5870	143.4584	137.7460	151.1921	150.9382	169.9487	179.7421	192.8164	(64)
								Total per year (kWh/year) = Sum(64)m =				2004.9022	(64)
Heat gains from water heating, kWh/month													
	87.4786	77.5762	82.5846	75.5747	75.1783	68.7803	67.5836	72.0545	71.2674	78.2910	80.8447	85.8946	(65)

---

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	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5073	17.3262	14.0906	10.6675	7.9741	6.7321	7.2742	9.4553	12.6909	16.1140	18.8074	20.0495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	218.8124	221.0830	215.3612	203.1801	187.8037	173.3521	163.6975	161.4269	167.1487	179.3298	194.7062	209.1578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	(71)
Water heating gains (Table 5)													
	117.5788	115.4407	111.0009	104.9649	101.0461	95.5283	90.8382	96.8474	98.9825	105.2299	112.2843	115.4497	(72)
Total internal gains													
	418.7557	416.7071	403.3098	381.6697	359.6811	338.4696	324.6671	330.5868	341.6793	363.5309	388.6551	407.5141	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.5300	11.2829	0.6300	0.7000	0.7700	32.8615	(75)
Southeast	10.4000	36.7938	0.6300	0.7000	0.7700	116.9446	(77)

Solar gains	149.8061	266.0904	393.0694	535.6285	644.3052	659.1569	627.3780	543.3175	441.9682	301.9038	181.4209	126.9165	(83)
Total gains	568.5617	682.7975	796.3792	917.2982	1003.9863	997.6265	952.0452	873.9043	783.6475	665.4347	570.0760	534.4307	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.2888	68.4963	68.7010	69.6788	69.8649	70.7442	70.7442	70.9095	70.4029	69.8649	69.4895	69.1014	
alpha	5.5526	5.5664	5.5801	5.6453	5.6577	5.7163	5.7163	5.7273	5.6935	5.6577	5.6326	5.6068	
util living area													
	0.9953	0.9867	0.9592	0.8686	0.6950	0.4970	0.3609	0.4094	0.6635	0.9243	0.9883	0.9966	(86)
MIT	20.0488	20.2421	20.5112	20.8008	20.9527	20.9940	20.9992	20.9984	20.9727	20.7467	20.3413	20.0160	(87)
Th 2	20.0693	20.0718	20.0743	20.0861	20.0884	20.0987	20.0987	20.1006	20.0947	20.0884	20.0839	20.0792	(88)
util rest of house													
	0.9938	0.9826	0.9471	0.8357	0.6387	0.4292	0.2873	0.3301	0.5877	0.8964	0.9840	0.9955	(89)
MIT 2	18.8080	19.0895	19.4735	19.8695	20.0471	20.0951	20.0984	20.1000	20.0756	19.8127	19.2442	18.7677	(90)
Living area fraction									fLA = Living area / (4) =			0.3764	(91)
MIT	19.2751	19.5234	19.8641	20.2201	20.3879	20.4335	20.4375	20.4382	20.4133	20.1643	19.6571	19.2376	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2751	19.5234	19.8641	20.2201	20.3879	20.4335	20.4375	20.4382	20.4133	20.1643	19.6571	19.2376	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9921	0.9795	0.9439	0.8409	0.6578	0.4546	0.3151	0.3600	0.6153	0.8991	0.9814	0.9941	(94)
Useful gains	564.0466	668.8036	751.6968	771.3664	660.4461	453.5380	299.9465	314.6057	482.1415	598.2681	559.4869	531.2929	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1213.7119	1181.6151	1076.6456	899.1749	688.2622	456.3863	300.2271	315.1921	496.3178	757.6855	1000.1543	1204.4437	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	483.3510	344.6094	241.7619	92.0221	20.6952	0.0000	0.0000	0.0000	0.0000	118.6066	317.2805	500.8242	(98)
Space heating												2119.1508	(98)
Space heating per m2											(98) / (4) =	26.5891	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2266.4714	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	483.3510	344.6094	241.7619	92.0221	20.6952	0.0000	0.0000	0.0000	0.0000	118.6066	317.2805	500.8242	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	516.9530	368.5662	258.5689	98.4194	22.1339	0.0000	0.0000	0.0000	0.0000	126.8520	339.3374	535.6408	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	197.5805	174.1387	182.8617	163.8926	160.5870	143.4584	137.7460	151.1921	150.9382	169.9487	179.7421	192.8164	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.1108	86.6020	85.5595	83.3433	80.8918	79.8000	79.8000	79.8000	79.8000	83.8762	86.3146	87.2480	(217)
Fuel for water heating, kWh/month													
	226.8151	201.0794	213.7245	196.6476	198.5207	179.7724	172.6140	189.4637	189.1456	202.6185	208.2407	220.9980	(219)
Water heating fuel used												2399.6403	(219)
Annual totals kWh/year													
Space heating fuel - main system												2266.4714	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												344.5048	(232)
Total delivered energy for all uses												5085.6164	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2266.4714	0.2160	489.5578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2399.6403	0.2160	518.3223	(264)
Space and water heating			1007.8801	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	344.5048	0.5190	178.7980	(268)
Total CO2, kg/m2/year			1225.6031	(272)
Emissions per m2 for space and water heating			12.6459	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2434	(272b)
Emissions per m2 for pumps and fans			0.4884	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.6459 * 1.00) + 2.2434 + 0.4884, rounded to 2 d.p.			15.3800	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1394	(8)
Pressure test			Yes	
Measured/design q50			3.0000	
Infiltration rate			0.2894	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3136	0.3075	0.3013	0.2706	0.2644	0.2337	0.2337	0.2275	0.2460	0.2644	0.2767	0.2890	(22b)
Effective ac	0.5492	0.5473	0.5454	0.5366	0.5350	0.5273	0.5273	0.5259	0.5303	0.5350	0.5383	0.5418	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	61.0200	23.0000	38.0200	0.1500	5.7030			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0389			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		41.3989	(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	38.9993	38.8637	38.7307	38.1063	37.9894	37.4456	37.4456	37.3448	37.6551	37.9894	38.2258	38.4729	(38)
Heat transfer coeff	80.3982	80.2626	80.1296	79.5052	79.3883	78.8444	78.8444	78.7437	79.0539	79.3883	79.6247	79.8718	(39)
Average = Sum(39)m / 12 =												79.5046	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0088	1.0071	1.0054	0.9976	0.9961	0.9893	0.9893	0.9880	0.9919	0.9961	0.9991	1.0022	(40)
HLP (average)												0.9975	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4571 (42)
Average daily hot water use (litres/day)		92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	32.0844	28.0613	28.9567	25.2452	24.2233	20.9029	19.3696	22.2269	22.4924	26.2127	28.6132	31.0721 (65)

---

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	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	(66)

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

	19.5073	17.3262	14.0906	10.6675	7.9741	6.7321	7.2742	9.4553	12.6909	16.1140	18.8074	20.0495	(67)

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

	218.8124	221.0830	215.3612	203.1801	187.8037	173.3521	163.6975	161.4269	167.1487	179.3298	194.7062	209.1578	(68)

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

	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	(71)

Water heating gains (Table 5)

	43.1242	41.7578	38.9203	35.0627	32.5582	29.0318	26.0344	29.8749	31.2394	35.2321	39.7405	41.7635	(72)

Total internal gains

	341.3011	340.0242	328.2293	308.7675	288.1932	268.9731	256.8633	260.6143	270.9362	290.5330	313.1113	330.8280	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.0000	11.2829	0.6800	0.8000	0.7700	46.7894	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)

Solar gains	213.2411	378.7700	559.5308	762.4793	917.1969	938.3447	893.1034	773.4300	629.1436	429.7521	258.2440	180.6586	(83)
Total gains	554.5422	718.7942	887.7601	1071.2468	1205.3901	1207.3178	1149.9667	1034.0443	900.0797	720.2851	571.3553	511.4865	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.5365	27.5831	27.6288	27.8459	27.8868	28.0792	28.0792	28.1151	28.0048	27.8868	27.8041	27.7180	
alpha	2.8358	2.8389	2.8419	2.8564	2.8591	2.8719	2.8719	2.8743	2.8670	2.8591	2.8536	2.8479	
util living area	0.9505	0.9062	0.8296	0.6996	0.5437	0.3974	0.2949	0.3389	0.5397	0.7891	0.9205	0.9593	(86)
MIT	19.0778	19.4886	19.9961	20.4971	20.8036	20.9411	20.9814	20.9721	20.8583	20.3908	19.6260	18.9890	(87)
Th 2	20.0760	20.0775	20.0788	20.0854	20.0866	20.0923	20.0923	20.0933	20.0901	20.0866	20.0841	20.0815	(88)
util rest of house	0.9438	0.8944	0.8096	0.6684	0.5019	0.3463	0.2364	0.2759	0.4830	0.7572	0.9083	0.9537	(89)
MIT 2	18.3201	18.7206	19.2073	19.6753	19.9427	20.0569	20.0841	20.0803	19.9980	19.5946	18.8662	18.2370	(90)
Living area fraction										fLA = Living area / (4) =		0.3764	(91)
MIT	18.6053	19.0097	19.5042	19.9846	20.2668	20.3897	20.4218	20.4160	20.3218	19.8943	19.1522	18.5201	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6053	19.0097	19.5042	19.9846	20.2668	20.3897	20.4218	20.4160	20.3218	19.8943	19.1522	18.5201	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9303	0.8782	0.7957	0.6647	0.5104	0.3634	0.2579	0.2987	0.4979	0.7497	0.8934	0.9415	(94)
Useful gains	515.9025	631.2703	706.4154	712.1053	615.2774	438.6958	296.5543	308.8720	448.1905	540.0242	510.4625	481.5533	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1150.1195	1132.4793	1042.0211	881.2835	680.1011	456.4882	301.3304	316.2336	491.8606	737.8616	959.6559	1143.7694	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	471.8574	336.8125	249.6907	121.8083	48.2289	0.0000	0.0000	0.0000	0.0000	147.1910	323.4193	492.6887	(98)
Space heating												2191.6968	(98)
Space heating per m2											(98) / (4) =	27.4993	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	741.1376	583.4488	598.4522	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9288	0.9537	0.9389	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	688.3902	556.4561	561.8980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1502.7058	1433.7746	1299.8008	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	586.3072	652.7250	548.9997	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1788.0320	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	146.5768	163.1813	137.2499	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	447.0080 (107)
Space cooling per m2	5.6086 (108)
Energy for space heating	27.4993 (99)
Energy for space cooling	5.6086 (108)
Total	33.1080 (109)
Dwelling Fabric Energy Efficiency (DFEE)	33.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1394	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3894	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3310	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4220	0.4137	0.4055	0.3641	0.3558	0.3144	0.3144	0.3062	0.3310	0.3558	0.3724	0.3889	(22b)
Effective ac	0.5891	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.9300	1.3258	26.4223			(27)
External Wall 1	61.0200	19.9300	41.0900	0.1800	7.3962			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8185			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		39.2185	(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	41.8302	41.5846	41.3439	40.2134	40.0019	39.0172	39.0172	38.8348	39.3965	40.0019	40.4298	40.8771	(38)
Heat transfer coeff	81.0488	80.8032	80.5625	79.4319	79.2204	78.2357	78.2357	78.0534	78.6150	79.2204	79.6483	80.0957	(39)
Average = Sum(39)m / 12 =												79.4309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0169	1.0138	1.0108	0.9966	0.9940	0.9816	0.9816	0.9793	0.9864	0.9940	0.9994	1.0050	(40)
HLP (average)												0.9966	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4571 (42)
Average daily hot water use (litres/day)		92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	32.0844	28.0613	28.9567	25.2452	24.2233	20.9029	19.3696	22.2269	22.4924	26.2127	28.6132	31.0721	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	122.8572	(66)

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

	19.5073	17.3262	14.0906	10.6675	7.9741	6.7321	7.2742	9.4553	12.6909	16.1140	18.8074	20.0495	(67)

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

	218.8124	221.0830	215.3612	203.1801	187.8037	173.3521	163.6975	161.4269	167.1487	179.3298	194.7062	209.1578	(68)

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

	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	35.2857	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	(71)

Water heating gains (Table 5)

	43.1242	41.7578	38.9203	35.0627	32.5582	29.0318	26.0344	29.8749	31.2394	35.2321	39.7405	41.7635	(72)

Total internal gains

	341.3011	340.0242	328.2293	308.7675	288.1932	268.9731	256.8633	260.6143	270.9362	290.5330	313.1113	330.8280	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.5300	11.2829	0.6300	0.7000	0.7700	32.8615	(75)
Southeast	10.4000	36.7938	0.6300	0.7000	0.7700	116.9446	(77)

Solar gains	149.8061	266.0904	393.0694	535.6285	644.3052	659.1569	627.3780	543.3175	441.9682	301.9038	181.4209	126.9165	(83)
Total gains	491.1072	606.1146	721.2987	844.3960	932.4984	928.1300	884.2413	803.9317	712.9044	592.4369	494.5322	457.7445	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.2888	68.4963	68.7010	69.6788	69.8649	70.7442	70.7442	70.9095	70.4029	69.8649	69.4895	69.1014	
alpha	5.5526	5.5664	5.5801	5.6453	5.6577	5.7163	5.7163	5.7273	5.6935	5.6577	5.6326	5.6068	
util living area	0.9977	0.9923	0.9729	0.8987	0.7348	0.5321	0.3882	0.4442	0.7152	0.9511	0.9941	0.9984	(86)
MIT	19.9572	20.1548	20.4361	20.7548	20.9375	20.9916	20.9988	20.9976	20.9604	20.6841	20.2542	19.9245	(87)
Th 2	20.0693	20.0718	20.0743	20.0861	20.0884	20.0987	20.0987	20.1006	20.0947	20.0884	20.0839	20.0792	(88)
util rest of house	0.9970	0.9899	0.9643	0.8703	0.6790	0.4604	0.3093	0.3586	0.6384	0.9307	0.9918	0.9979	(89)
MIT 2	19.1171	19.3155	19.5931	19.8998	20.0503	20.0952	20.0984	20.0999	20.0751	19.8454	19.4251	19.0927	(90)
Living area fraction										fLA = Living area / (4) =		0.3764	(91)
MIT	19.4333	19.6314	19.9104	20.2217	20.3843	20.4326	20.4373	20.4378	20.4083	20.1611	19.7372	19.4058	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4333	19.6314	19.9104	20.2217	20.3843	20.4326	20.4373	20.4378	20.4083	20.1611	19.7372	19.4058	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9884	0.9625	0.8749	0.6979	0.4873	0.3391	0.3909	0.6662	0.9326	0.9906	0.9974	(94)
Useful gains	489.2751	599.0832	694.2470	738.7833	650.7751	452.2777	299.8032	314.2669	474.9645	552.5177	489.8963	456.5594	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1226.5344	1190.3443	1080.3771	899.3007	687.9707	456.3195	300.2161	315.1665	495.9293	757.4366	1006.5329	1217.9189	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	548.5209	397.3275	287.2808	115.5725	27.6735	0.0000	0.0000	0.0000	0.0000	152.4597	371.9784	566.4515	(98)
Space heating												2467.2648	(98)
Space heating per m2											(98) / (4) =	30.9569	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	735.4158	578.9443	593.2056	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9733	0.9889	0.9816	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	715.7775	572.5198	582.3078	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1176.3824	1123.1865	1030.8381	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	331.6355	409.6960	333.7066	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1075.0381	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.9089	102.4240	83.4266	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	268.7595 (107)
Space cooling per m2	3.3721 (108)
Energy for space heating	30.9569 (99)
Energy for space cooling	3.3721 (108)
Total	34.3290 (109)
Target Fabric Energy Efficiency (TFEE)	39.5 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	61.0200	23.0000	38.0200	0.1500	5.7030			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0389			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	41.3989	(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	16.5682	16.3418	16.1154	15.6627	15.6627	14.7573	15.2100	14.7573	14.5310	14.9837	14.9837	15.8891	(38)
Heat transfer coeff	57.9670	57.7407	57.5143	57.0616	57.0616	56.1562	56.6089	56.1562	55.9299	56.3826	56.3826	57.2880	(39)
Average = Sum(39)m / 12 =												56.8541	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7273	0.7245	0.7216	0.7160	0.7160	0.7046	0.7103	0.7046	0.7018	0.7074	0.7074	0.7188	(40)
HLP (average)												0.7134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4571 (42)
Average daily hot water use (litres/day)	92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6478	19.8079	20.4400	17.8201	17.0988	14.7550	13.6727	15.6896	15.8770	18.5031	20.1975	21.9332	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             206.2624   181.9804   191.5436   172.2944   169.2689   151.8602   146.4279   159.8740   159.3401   178.6306   188.1439   201.4983 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             206.2624   181.9804   191.5436   172.2944   169.2689   151.8602   146.4279   159.8740   159.3401   178.6306   188.1439   201.4983 (64)
                                                                                   Total per year (kWh/year) = Sum(64)m =   2107.1246 (64)
RHI water heating demand                                                                                    2107 (64)
Heat gains from water heating, kWh/month
              94.4241    83.8496    89.5302    82.2962    82.1238    75.5018    74.5292    79.0000    77.9889    85.2366    87.5662    92.8401 (65)


-------------------------------------------------------------------------------------------------------------
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         147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287   147.4287 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               48.7682    43.3155    35.2265    26.6687    19.9352    16.8301    18.1856    23.6383    31.7272    40.2850    47.0186    50.1236 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              326.5857   329.9746   321.4346   303.2539   280.3041   258.7345   244.3246   240.9357   249.4757   267.6564   290.6062   312.1759 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000    52.2000 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858   -98.2858 (71)
Water heating gains (Table 5)
              126.9142   124.7761   120.3362   114.3003   110.3815   104.8636   100.1736   106.1828   108.3179   114.5653   121.6197   124.7851 (72)
Total internal gains
              603.6110   599.4091   578.3403   545.5658   511.9637   481.7711   464.0267   472.0997   490.8637   523.8496   560.5874   588.4274 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g              FF           Access          Gains
                                         m2             Table 6a      Specific data  Specific data      factor              W
                                                          W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------
Northeast                              11.0000           12.4885           0.6800         0.8000         0.7700        51.7887 (75)
Southeast                              12.0000           39.0225           0.6800         0.8000         0.7700       176.5339 (77)
-------------------------------------------------------------------------------------------------------------

Solar gains   228.3226   358.2566   543.9582   769.6416   904.0583   988.4217   938.0225   836.0622   673.1702   453.0929   285.7215   198.0596 (83)
Total gains   831.9336   957.6658  1122.2985  1315.2074  1416.0220  1470.1929  1402.0492  1308.1619  1164.0339   976.9425   846.3088   786.4870 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           38.1922    38.3419    38.4928    38.7982    38.7982    39.4238    39.1085    39.4238    39.5833    39.2655    39.2655    38.6449
alpha          3.5461     3.5561     3.5662     3.5865     3.5865     3.6283     3.6072     3.6283     3.6389     3.6177     3.6177     3.5763
util living area
               0.8043     0.7341     0.5972     0.4328     0.2877     0.1602     0.0928     0.1030     0.2439     0.4757     0.6997     0.8217 (86)

MIT           20.4280    20.6015    20.8265    20.9511    20.9909    20.9993    20.9999    20.9999    20.9966    20.9466    20.7317    20.3933 (87)
Th 2          20.3168    20.3193    20.3218    20.3268    20.3268    20.3368    20.3318    20.3368    20.3393    20.3343    20.3343    20.3243 (88)
util rest of house
               0.7871     0.7139     0.5726     0.4069     0.2614     0.1350     0.0659     0.0745     0.2127     0.4428     0.6748     0.8055 (89)
MIT 2         19.5764    19.8126    20.1114    20.2718    20.3179    20.3363    20.3317    20.3367    20.3365    20.2770    20.0052    19.5357 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.3764 (91)
MIT           19.8970    20.1096    20.3806    20.5275    20.5712    20.5859    20.5833    20.5864    20.5850    20.5290    20.2787    19.8585 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  19.8970    20.1096    20.3806    20.5275    20.5712    20.5859    20.5833    20.5864    20.5850    20.5290    20.2787    19.8585 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.7758     0.7074     0.5748     0.4146     0.2710     0.1445     0.0760     0.0853     0.2243     0.4525     0.6727     0.7934 (94)
Useful gains 645.4001   677.4538   645.0715   545.3389   383.7060   212.4370   106.6004   111.5336   261.1361   442.1007   569.2741   623.9734 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
             822.9573   803.1475   700.5584   560.7715   386.3774   212.6002   106.6095   111.5471   262.0303   458.3358   652.8344   811.1116 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             132.1026    84.4661    41.2823    11.1115     1.9875     0.0000     0.0000     0.0000     0.0000    12.0789    60.1635   139.2308 (98)
Space heating                                                                                                               482.4231 (98)
RHI space heating demand                                                                                                     482 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	61.0200	23.0000	38.0200	0.1500	5.7030			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0389			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	41.3989	(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	19.2844	19.0580	18.8317	17.6999	17.4736	16.3418	16.3418	16.1154	16.7945	17.4736	17.9263	18.3790	(38)
Heat transfer coeff	60.6833	60.4569	60.2306	59.0988	58.8724	57.7407	57.7407	57.5143	58.1934	58.8724	59.3251	59.7779	(39)
Average = Sum(39)m / 12 =												59.0422	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7614	0.7586	0.7557	0.7415	0.7387	0.7245	0.7245	0.7216	0.7302	0.7387	0.7444	0.7500	(40)
HLP (average)												0.7408	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4571 (42)
Average daily hot water use (litres/day)	92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6478	19.8079	20.4400	17.8201	17.0988	14.7550	13.6727	15.6896	15.8770	18.5031	20.1975	21.9332	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
206.2624 181.9804 191.5436 172.2944 169.2689 151.8602 146.4279 159.8740 159.3401 178.6306 188.1439 201.4983 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
206.2624 181.9804 191.5436 172.2944 169.2689 151.8602 146.4279 159.8740 159.3401 178.6306 188.1439 201.4983 (64)
Total per year (kWh/year) = Sum(64)m = 2107.1246 (64)
Heat gains from water heating, kWh/month
94.4241 83.8496 89.5302 82.2962 82.1238 75.5018 74.5292 79.0000 77.9889 85.2366 87.5662 92.8401 (65)

---

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	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7682	43.3155	35.2265	26.6687	19.9352	16.8301	18.1856	23.6383	31.7272	40.2850	47.0186	50.1236	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	326.5857	329.9746	321.4346	303.2539	280.3041	258.7345	244.3246	240.9357	249.4757	267.6564	290.6062	312.1759	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	(71)
Water heating gains (Table 5)													
	126.9142	124.7761	120.3362	114.3003	110.3815	104.8636	100.1736	106.1828	108.3179	114.5653	121.6197	124.7851	(72)
Total internal gains													
	603.6110	599.4091	578.3403	545.5658	511.9637	481.7711	464.0267	472.0997	490.8637	523.8496	560.5874	588.4274	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.0000	11.2829	0.6800	0.8000	0.7700	46.7894	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)

Solar gains	213.2411	378.7700	559.5308	762.4793	917.1969	938.3447	893.1034	773.4300	629.1436	429.7521	258.2440	180.6586	(83)
Total gains	816.8521	978.1792	1137.8711	1308.0451	1429.1605	1420.1158	1357.1301	1245.5297	1120.0073	953.6017	818.8313	769.0860	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4827	36.6193	36.7569	37.4608	37.6048	38.3419	38.3419	38.4928	38.0437	37.6048	37.3179	37.0353	
alpha	3.4322	3.4413	3.4505	3.4974	3.5070	3.5561	3.5561	3.5662	3.5362	3.5070	3.4879	3.4690	
util living area													
	0.8496	0.7729	0.6640	0.5146	0.3748	0.2586	0.1868	0.2117	0.3523	0.5858	0.7799	0.8668	(86)
MIT	20.1727	20.4365	20.6943	20.8903	20.9691	20.9940	20.9986	20.9978	20.9819	20.8598	20.5149	20.1213	(87)
Th 2	20.2869	20.2894	20.2919	20.3043	20.3068	20.3193	20.3193	20.3218	20.3143	20.3068	20.3018	20.2968	(88)
util rest of house													
	0.8358	0.7551	0.6417	0.4894	0.3485	0.2315	0.1581	0.1808	0.3188	0.5550	0.7596	0.8541	(89)
MIT 2	19.1966	19.5608	19.9097	20.1748	20.2735	20.3138	20.3183	20.3202	20.2969	20.1452	19.6859	19.1331	(90)
Living area fraction									fLA = Living area / (4) =			0.3764	(91)
MIT	19.5640	19.8904	20.2050	20.4442	20.5353	20.5698	20.5744	20.5752	20.5547	20.4142	19.9979	19.5051	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5640	19.8904	20.2050	20.4442	20.5353	20.5698	20.5744	20.5752	20.5547	20.4142	19.9979	19.5051	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8204	0.7444	0.6389	0.4945	0.3572	0.2415	0.1688	0.1924	0.3307	0.5599	0.7501	0.8383	(94)
Useful gains	670.1211	728.1499	726.9818	646.8458	510.4999	343.0010	229.1387	239.5883	370.3433	533.9107	614.2343	644.7252	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	926.2686	906.2742	825.4618	682.2457	520.1565	344.7024	229.4820	240.1356	375.6224	577.7842	765.1711	914.9061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	190.5737	119.6995	73.2691	25.4879	7.1845	0.0000	0.0000	0.0000	0.0000	32.6419	108.6746	201.0146	(98)
Space heating												758.5459	(98)
Space heating per m2											(98) / (4) =	9.5175	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	542.7623	427.2810	437.1089	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9852	0.9919	0.9885	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	534.7048	423.8149	432.0885	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1578.5376	1507.9138	1376.1088	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	751.5596	806.5696	702.3511	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2260.4803	(104)
Cooled fraction										fC = cooled area / (4) =		0.7528	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	141.4479	151.8011	132.1865	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												425.4354	(107)
Space cooling per m2												5.3380	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	758.5459	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	278.7656	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	517.7076	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2107.1246	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	774.3683	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1438.1125	(310b)
Electricity used for heat distribution	30.0895	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	98.4804	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	180.4906	(330a)
Total electricity for the above, kWh/year	180.4906	(331)
Electricity for lighting (calculated in Appendix L)	344.5048	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3632.4298	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	278.7656	4.2400	11.8197	(340a)
Space heating from Combined Heat and Power	517.7076	2.9700	15.3759	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	774.3683	4.2400	32.8332	(342a)
Water heating from Combined Heat and Power	1438.1125	2.9700	42.7119	(342b)
Space cooling	98.4804	13.1900	12.9896	(348)
Mechanical ventilation fans	180.4906	13.1900	23.8067	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	344.5048	13.1900	45.4402	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			265.4072	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8939	(357)
SAP value	87.5299	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1108.5620	0.2160	239.4494 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	941.2866	0.2160	203.3179 (363)
less credit emissions for electricity	-329.4503	0.5190	-170.9847 (364)
Water heating from Combined Heat and Power	2614.7500	0.2160	564.7860 (365)
less credit emissions for electricity	-915.1625	0.5190	-474.9693 (366)
Electrical energy for heat distribution	30.0895	0.5190	15.6165 (372)
Total CO2 associated with community systems			377.2157 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			377.2157 (376)
Space cooling	98.4804	0.5190	51.1113 (377)
Pumps and fans	180.4906	0.5190	93.6746 (378)
Energy for lighting	344.5048	0.5190	178.7980 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			545.0997 (383)
CO2 emissions per m2			6.8400 (384)
EI value			94.1425 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.7000 (1b)	x	2.7000 (2b)	=	215.1900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	215.1900	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			23.0000	1.1450	26.3359			(27)
External Wall 1	61.0200	23.0000	38.0200	0.1500	5.7030			(29a)
Total net area of external elements Aum(A, m2)			61.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0389			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	41.3989	(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	16.5682	16.3418	16.1154	15.6627	15.6627	14.7573	15.2100	14.7573	14.5310	14.9837	14.9837	15.8891	(38)
Heat transfer coeff	57.9670	57.7407	57.5143	57.0616	57.0616	56.1562	56.6089	56.1562	55.9299	56.3826	56.3826	57.2880	(39)
Average = Sum(39)m / 12 =												56.8541	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7273	0.7245	0.7216	0.7160	0.7160	0.7046	0.7103	0.7046	0.7018	0.7074	0.7074	0.7188	(40)
HLP (average)												0.7134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4571 (42)
Average daily hot water use (litres/day)	92.5572 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.8129	98.1106	94.4083	90.7060	87.0037	83.3015	83.3015	87.0037	90.7060	94.4083	98.1106	101.8129	(44)
Energy conte	150.9856	132.0530	136.2668	118.8007	113.9921	98.3665	91.1510	104.5972	105.8464	123.3538	134.6503	146.2215	(45)
Energy content (annual)										Total = Sum(45)m =		1456.2848	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6478	19.8079	20.4400	17.8201	17.0988	14.7550	13.6727	15.6896	15.8770	18.5031	20.1975	21.9332	(46)
Water storage loss:													
Store volume												110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	206.2624	181.9804	191.5436	172.2944	169.2689	151.8602	146.4279	159.8740	159.3401	178.6306	188.1439	201.4983 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	206.2624	181.9804	191.5436	172.2944	169.2689	151.8602	146.4279	159.8740	159.3401	178.6306	188.1439	201.4983 (64)

Total per year (kWh/year) = Sum(64)m = 2107.1246 (64)

Heat gains from water heating, kWh/month

	94.4241	83.8496	89.5302	82.2962	82.1238	75.5018	74.5292	79.0000	77.9889	85.2366	87.5662	92.8401 (65)

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	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	147.4287	(66)

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

	48.7682	43.3155	35.2265	26.6687	19.9352	16.8301	18.1856	23.6383	31.7272	40.2850	47.0186	50.1236 (67)

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

	326.5857	329.9746	321.4346	303.2539	280.3041	258.7345	244.3246	240.9357	249.4757	267.6564	290.6062	312.1759 (68)

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

	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000	52.2000 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858	-98.2858 (71)

Water heating gains (Table 5)

	126.9142	124.7761	120.3362	114.3003	110.3815	104.8636	100.1736	106.1828	108.3179	114.5653	121.6197	124.7851 (72)

Total internal gains

	603.6110	599.4091	578.3403	545.5658	511.9637	481.7711	464.0267	472.0997	490.8637	523.8496	560.5874	588.4274 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.0000	12.4885	0.6800	0.8000	0.7700	51.7887	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)

Solar gains	228.3226	358.2566	543.9582	769.6416	904.0583	988.4217	938.0225	836.0622	673.1702	453.0929	285.7215	198.0596 (83)
Total gains	831.9336	957.6658	1122.2985	1315.2074	1416.0220	1470.1929	1402.0492	1308.1619	1164.0339	976.9425	846.3088	786.4870 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.1922	38.3419	38.4928	38.7982	38.7982	39.4238	39.1085	39.4238	39.5833	39.2655	39.2655	38.6449	
alpha	3.5461	3.5561	3.5662	3.5865	3.5865	3.6283	3.6072	3.6283	3.6389	3.6177	3.6177	3.5763	
util living area													
	0.8043	0.7341	0.5972	0.4328	0.2877	0.1602	0.0928	0.1030	0.2439	0.4757	0.6997	0.8217	(86)
MIT	20.4280	20.6015	20.8265	20.9511	20.9909	20.9993	20.9999	20.9999	20.9966	20.9466	20.7317	20.3933	(87)
Th 2	20.3168	20.3193	20.3218	20.3268	20.3268	20.3368	20.3318	20.3368	20.3393	20.3343	20.3343	20.3243	(88)
util rest of house													
	0.7871	0.7139	0.5726	0.4069	0.2614	0.1350	0.0659	0.0745	0.2127	0.4428	0.6748	0.8055	(89)
MIT 2	19.5764	19.8126	20.1114	20.2718	20.3179	20.3363	20.3317	20.3367	20.3365	20.2770	20.0052	19.5357	(90)
Living area fraction									fLA = Living area / (4) =			0.3764	(91)
MIT	19.8970	20.1096	20.3806	20.5275	20.5712	20.5859	20.5833	20.5864	20.5850	20.5290	20.2787	19.8585	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8970	20.1096	20.3806	20.5275	20.5712	20.5859	20.5833	20.5864	20.5850	20.5290	20.2787	19.8585	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7758	0.7074	0.5748	0.4146	0.2710	0.1445	0.0760	0.0853	0.2243	0.4525	0.6727	0.7934	(94)
Useful gains	645.4001	677.4538	645.0715	545.3389	383.7060	212.4370	106.6004	111.5336	261.1361	442.1007	569.2741	623.9734	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	822.9573	803.1475	700.5584	560.7715	386.3774	212.6002	106.6095	111.5471	262.0303	458.3358	652.8344	811.1116	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	132.1026	84.4661	41.2823	11.1115	1.9875	0.0000	0.0000	0.0000	0.0000	12.0789	60.1635	139.2308	(98)
Space heating												482.4231	(98)
Space heating per m2											(98) / (4) =	6.0530	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	404.3247	300.0272	303.2435	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9953	0.9979	0.9973	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	402.4164	299.3940	302.4208	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1637.0693	1560.4166	1449.3153	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	888.9501	938.2009	853.2895	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2680.4404	(104)
Cooled fraction										fC = cooled area / (4) =		0.7528	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	167.3055	0.0000	160.5940	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												327.8995	(107)
Space cooling per m2												4.1142	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	482.4231	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	177.2905	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	329.2538	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2107.1246	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	774.3683	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1438.1125	(310b)
Electricity used for heat distribution	27.1903	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	75.9027	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	180.4906	(330a)
Total electricity for the above, kWh/year	180.4906	(331)
Electricity for lighting (calculated in Appendix L)	344.5048	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3319.9231	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	177.2905	5.0000	8.8645	(340a)
Space heating from Combined Heat and Power	329.2538	3.5000	11.5239	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	774.3683	5.0000	38.7184	(342a)
Water heating from Combined Heat and Power	1438.1125	3.5000	50.3339	(342b)
Space cooling	75.9027	15.7000	11.9167	(348)
Mechanical ventilation fans	180.4906	15.7000	28.3370	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	344.5048	15.7000	54.0872	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			245.6817	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1001.7461	0.2160	216.3772	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	598.6432	0.2160	129.3069	(363)
less credit emissions for electricity	-209.5251	0.5190	-108.7435	(364)
Water heating from Combined Heat and Power	2614.7500	0.2160	564.7860	(365)
less credit emissions for electricity	-915.1625	0.5190	-474.9693	(366)
Electrical energy for heat distribution	27.1903	0.5190	14.1117	(372)
Total CO2 associated with community systems			340.8690	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			340.8690	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	75.9027	0.5190	39.3935 (377)
Pumps and fans	180.4906	0.5190	93.6746 (378)
Energy for lighting	344.5048	0.5190	178.7980 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			497.0350 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1001.7461	1.2200	1222.1302	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	598.6432	1.2200	730.3447	(363)
less credit emissions for electricity	-209.5251	3.0700	-643.2421	(364)
Water heating from Combined Heat and Power	2614.7500	1.2200	3189.9950	(365)
less credit emissions for electricity	-915.1625	3.0700	-2809.5489	(366)
Electrical energy for heat distribution	27.1903	3.0700	83.4741	(372)
Total CO2 associated with community systems			1773.1530	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1773.1530	(376)
Space cooling	75.9027	3.0700	233.0212	(377)
Pumps and fans	180.4906	3.0700	554.1062	(378)
Energy for lighting	344.5048	3.0700	1057.6296	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2696.9100	(383)
Primary energy kWh/m2/year			33.8383	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£94	£94	£0
Community scheme	£198	£198	£0
Space heating	£138	£138	£0
Space cooling	£12	£12	£0
Water heating	£89	£89	£0
Lighting	£54	£54	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£245	£245	£0
Total cost of uses	£246	£246	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	34 kWh/m²	34 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	426.08 (P1)
Transmission heat loss coefficient	41.40 (37)
Summer heat loss coefficient	467.48 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
North East	1.000	0.590	Wide overhang
South East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
North East	1.000	0.90	0.590	0.490 (P8)
South East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	11.0000	98.8453	0.6800	0.8000	0.9000	479.1070
South East	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
total:						1113.2180

	Jun	Jul	Aug	
Solar gains	1183	1113	984	(P3)
Internal gains	482	464	472	
Total summer gains	1665	1577	1456	(P5)
Summer gain/loss ratio	3.56	3.37	3.11	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.86	22.57	22.21	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007046	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0307
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	89 B	**DER**	6.16	**TER**	13.57
Environmental	95 A	**% DER<TER**	54.60		
CO_2 Emissions (t/year)	0.61	**DFEE**	30.40	**TFEE**	39.11
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.28		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               24.5, 120, 2.7
Living Area:                   30 m2, fraction: 25.0%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                47.15, 66.15, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                 Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 16.00,
     Window                    Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.141
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System  None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.57 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.16 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)39.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.4 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing North East:		16.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1500	7.0725			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8282			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	38.1882	(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	29.0355	28.6947	28.3538	26.6498	26.3090	24.6050	24.6050	24.2642	25.2866	26.3090	26.9906	27.6722	(38)
Heat transfer coeff	67.2237	66.8829	66.5421	64.8380	64.4972	62.7932	62.7932	62.4524	63.4748	64.4972	65.1788	65.8605	(39)
Average = Sum(39)m / 12 =												64.7528	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5602	0.5574	0.5545	0.5403	0.5375	0.5233	0.5233	0.5204	0.5290	0.5375	0.5432	0.5488	(40)
HLP (average)												0.5396	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633 (42)
Average daily hot water use (litres/day)	102.2037 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0083	21.8724	22.5703	19.6774	18.8809	16.2928	15.0977	17.3248	17.5317	20.4315	22.3026	24.2192	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (64)
Total per year (kWh/year) = Sum(64)m = 2258.9022 (64)
Heat gains from water heating, kWh/month
99.6564 88.4257 94.2523 86.4131 86.0741 78.9106 77.6879 82.6247 81.6569 89.5113 92.2323 97.9072 (65)

---

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	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
26.5826 23.6105 19.2013 14.5366 10.8663 9.1738 9.9126 12.8848 17.2939 21.9586 25.6289 27.3214 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
285.2132 288.1728 280.7146 264.8371 244.7946 225.9575 213.3731 210.4135 217.8717 233.7492 253.7917 272.6288 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 37.3166 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 -114.5326 (71)
Water heating gains (Table 5)
133.9468 131.5859 126.6833 120.0182 115.6910 109.5981 104.4192 111.0547 113.4123 120.3108 128.1005 131.5958 (72)
Total internal gains
511.6923 509.3189 492.5489 465.3417 437.3016 410.6791 393.6547 400.3027 414.5276 441.9683 473.4708 497.4957 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	11.2829	0.6800	0.8000	0.7700	68.0573	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	80.8180	164.5074	296.3899	486.7574	654.2975	697.5504	652.5441	520.2157	361.1558	201.0410	101.6899	66.0000	(83)
Total gains	592.5103	673.8262	788.9389	952.0991	1091.5991	1108.2294	1046.1988	920.5184	775.6834	643.0094	575.1607	563.4958	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.5857	49.8384	50.0936	51.4102	51.6818	53.0843	53.0843	53.3740	52.5143	51.6818	51.1413	50.6121	
alpha	4.3057	4.3226	4.3396	4.4273	4.4455	4.5390	4.5390	4.5583	4.5010	4.4455	4.4094	4.3741	
util living area	0.9688	0.9462	0.8844	0.7294	0.5315	0.3603	0.2636	0.3110	0.5450	0.8332	0.9461	0.9737	(86)
MIT	19.9734	20.1771	20.4990	20.8299	20.9629	20.9951	20.9991	20.9981	20.9711	20.7448	20.3179	19.9510	(87)
Th 2	20.4660	20.4685	20.4711	20.4840	20.4866	20.4995	20.4995	20.5021	20.4944	20.4866	20.4814	20.4763	(88)
util rest of house	0.9652	0.9403	0.8728	0.7084	0.5052	0.3327	0.2338	0.2777	0.5093	0.8129	0.9393	0.9706	(89)
MIT 2	19.0550	19.3499	19.8087	20.2721	20.4445	20.4948	20.4988	20.5006	20.4644	20.1685	19.5649	19.0302	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2846	19.5567	19.9813	20.4115	20.5741	20.6199	20.6239	20.6250	20.5911	20.3125	19.7532	19.2604	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2846	19.5567	19.9813	20.4115	20.5741	20.6199	20.6239	20.6250	20.5911	20.3125	19.7532	19.2604	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9554	0.9284	0.8609	0.7053	0.5098	0.3394	0.2412	0.2860	0.5163	0.8055	0.9280	0.9618	(94)
Useful gains	566.0957	625.5969	679.2115	671.5199	556.4480	376.1132	252.3695	263.2280	400.4632	517.9712	533.7424	541.9469	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1007.3197	980.2844	897.0735	746.3855	572.3548	378.0063	252.6728	263.8612	412.0191	626.4321	824.7188	991.8840	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	328.2707	238.3500	162.0893	53.9032	11.8347	0.0000	0.0000	0.0000	0.0000	80.6949	209.5030	334.7532	(98)
Space heating												1419.3990	(98)
Space heating per m2											(98) / (4) =	11.8283	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	590.2560	464.6696	474.6381	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9883	0.9944	0.9905	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	583.3774	462.0490	470.1077	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1397.4106	1322.6915	1177.6705	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	586.1040	640.3180	526.4267	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1752.8486	(104)
Cooled fraction										fC = cooled area / (4) =		0.5000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	73.2630	80.0397	65.8033	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												219.1061	(107)
Space cooling per m2												1.8259	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1419.3990	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	521.6291	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	968.7398	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2258.9022	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	830.1466	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1541.7008	(310b)
Electricity used for heat distribution	38.6222	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	50.7190	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	271.7550	(330a)
Total electricity for the above, kWh/year	271.7550	(331)
Electricity for lighting (calculated in Appendix L)	469.4575	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4654.1479	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1422.9218	0.2160	307.3511	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1761.3452	0.2160	380.4506	(363)
less credit emissions for electricity	-616.4708	0.5190	-319.9483	(364)
Water heating from Combined Heat and Power	2803.0923	0.2160	605.4679	(365)
less credit emissions for electricity	-981.0823	0.5190	-509.1817	(366)
Electrical energy for heat distribution	38.6222	0.5190	20.0449	(372)
Total CO2 associated with community systems			484.1844	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			484.1844	(376)
Space cooling	50.7190	0.5190	26.3232	(377)
Pumps and fans	271.7550	0.5190	141.0408	(378)
Energy for lighting	469.4575	0.5190	243.6485	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			739.4969	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.1600	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.1600	ZC1
Total Floor Area	TFA	120.0000	
Assumed number of occupants	N	2.8633	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0843	ZC2
CO2 emissions from cooking, equation (L16)		1.5643	ZC3
Total CO2 emissions		21.8086	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		21.8086	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1235	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3889	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.0000	1.3258	25.1894			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1800	8.4870			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.6764			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		39.0764	(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	62.2173	61.8772	61.5439	59.9783	59.6854	58.3218	58.3218	58.0693	58.8470	59.6854	60.2779	60.8974	(38)
Heat transfer coeff	101.2936	100.9536	100.6203	99.0547	98.7618	97.3982	97.3982	97.1457	97.9234	98.7618	99.3543	99.9738	(39)
Average = Sum(39)m / 12 =												99.0533	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8441	0.8413	0.8385	0.8255	0.8230	0.8117	0.8117	0.8095	0.8160	0.8230	0.8280	0.8331	(40)
HLP (average)												0.8254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8633	(42)
Average daily hot water use (litres/day)												102.2037	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0083	21.8724	22.5703	19.6774	18.8809	16.2928	15.0977	17.3248	17.5317	20.4315	22.3026	24.2192	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	213.3166	187.9016	197.0638	176.2743	172.4676	153.7104	147.2459	162.0934	161.9698	182.8049	193.7757	208.0559	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.3166	187.9016	197.0638	176.2743	172.4676	153.7104	147.2459	162.0934	161.9698	182.8049	193.7757	208.0559	(64)
								Total per year (kWh/year) = Sum(64)m =				2156.6799	(64)
Heat gains from water heating, kWh/month													
	92.7109	82.1523	87.3068	79.6916	79.1286	72.1891	70.7424	75.6792	74.9354	82.5657	85.5109	90.9617	(65)

---

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	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.5826	23.6105	19.2013	14.5366	10.8663	9.1738	9.9126	12.8848	17.2939	21.9586	25.6289	27.3214	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.2132	288.1728	280.7146	264.8371	244.7946	225.9575	213.3731	210.4135	217.8717	233.7492	253.7917	272.6288	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)													
	124.6114	122.2505	117.3479	110.6828	106.3556	100.2627	95.0839	101.7193	104.0769	110.9755	118.7651	122.2604	(72)
Total internal gains													
	505.3569	502.9835	486.2136	459.0063	430.9663	404.3437	387.3193	393.9673	408.1922	435.6330	467.1354	491.1603	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	11.2829	0.6300	0.7000	0.7700	55.1714	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	65.5161	133.3598	240.2720	394.5956	530.4140	565.4774	528.9925	421.7190	292.7752	162.9763	82.4362	53.5037	(83)
Total gains	570.8730	636.3433	726.4856	853.6019	961.3802	969.8211	916.3118	815.6863	700.9674	598.6092	549.5716	544.6641	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2691	82.5462	82.8196	84.1286	84.3781	85.5594	85.5594	85.7818	85.1005	84.3781	83.8749	83.3551	
alpha	6.4846	6.5031	6.5213	6.6086	6.6252	6.7040	6.7040	6.7188	6.6734	6.6252	6.5917	6.5570	
util living area													
	0.9994	0.9986	0.9947	0.9670	0.8482	0.6305	0.4662	0.5435	0.8532	0.9881	0.9986	0.9996	(86)
MIT	20.0709	20.1791	20.3890	20.6896	20.9143	20.9901	20.9988	20.9970	20.9353	20.6375	20.3081	20.0572	(87)
Th 2	20.2153	20.2177	20.2201	20.2313	20.2334	20.2432	20.2432	20.2451	20.2395	20.2334	20.2292	20.2247	(88)
util rest of house													
	0.9992	0.9982	0.9927	0.9552	0.8053	0.5612	0.3868	0.4566	0.7944	0.9823	0.9981	0.9994	(89)
MIT 2	18.9508	19.1110	19.4189	19.8572	20.1498	20.2367	20.2428	20.2438	20.1853	19.7905	19.3087	18.9380	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	19.2308	19.3780	19.6614	20.0653	20.3409	20.4250	20.4318	20.4321	20.3728	20.0022	19.5585	19.2178	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2308	19.3780	19.6614	20.0653	20.3409	20.4250	20.4318	20.4321	20.3728	20.0022	19.5585	19.2178	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9975	0.9909	0.9521	0.8118	0.5782	0.4067	0.4784	0.8058	0.9799	0.9974	0.9992	(94)
Useful gains	570.2315	634.7297	719.8774	812.7394	780.4638	560.7725	372.6730	390.2198	564.8349	586.5845	548.1207	544.2141	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1512.3929	1461.6077	1324.3049	1105.9774	853.3938	567.3487	373.2101	391.6985	614.2542	928.5797	1237.8078	1501.3904	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.9681	555.6620	449.6940	211.1314	54.2599	0.0000	0.0000	0.0000	0.0000	254.4445	496.5747	712.1392	(98)
Space heating												3434.8738	(98)
Space heating per m2											(98) / (4) =	28.6239	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3673.6618	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.9681	555.6620	449.6940	211.1314	54.2599	0.0000	0.0000	0.0000	0.0000	254.4445	496.5747	712.1392	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	749.6985	594.2909	480.9562	225.8089	58.0320	0.0000	0.0000	0.0000	0.0000	272.1332	531.0959	761.6462	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.3166	187.9016	197.0638	176.2743	172.4676	153.7104	147.2459	162.0934	161.9698	182.8049	193.7757	208.0559	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.7547	87.5340	86.9477	85.2961	82.1237	79.8000	79.8000	79.8000	79.8000	85.6960	87.2174	87.8371	(217)
Fuel for water heating, kWh/month													
	243.0829	214.6612	226.6462	206.6617	210.0095	192.6195	184.5187	203.1246	202.9697	213.3178	222.1754	236.8657	(219)
Water heating fuel used												2556.6530	(219)
Annual totals kWh/year													
Space heating fuel - main system												3673.6618	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.4575	(232)
Total delivered energy for all uses												6774.7724	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3673.6618	0.2160	793.5110	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2556.6530	0.2160	552.2371	(264)
Space and water heating			1345.7480	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	469.4575	0.5190	243.6485	(268)
Total CO2, kg/m2/year			1628.3215	(272)
Emissions per m2 for space and water heating			11.2146	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0304	(272b)
Emissions per m2 for pumps and fans			0.3244	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.2146 * 1.00) + 2.0304 + 0.3244, rounded to 2 d.p.			13.5700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1235	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2324	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2964	0.2905	0.2847	0.2557	0.2499	0.2208	0.2208	0.2150	0.2324	0.2499	0.2615	0.2731	(22b)
Effective ac	0.5439	0.5422	0.5405	0.5327	0.5312	0.5244	0.5244	0.5231	0.5270	0.5312	0.5342	0.5373	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1500	7.0725			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8282			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	38.1882	(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	58.1553	57.9730	57.7943	56.9549	56.7978	56.0667	56.0667	55.9313	56.3483	56.7978	57.1155	57.4477	(38)
Heat transfer coeff	96.3435	96.1612	95.9825	95.1431	94.9860	94.2549	94.2549	94.1195	94.5365	94.9860	95.3037	95.6359	(39)
Average = Sum(39)m / 12 =												95.1423	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8029	0.8013	0.7999	0.7929	0.7916	0.7855	0.7855	0.7843	0.7878	0.7916	0.7942	0.7970	(40)
HLP (average)												0.7929	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633	(42)
Average daily hot water use (litres/day)	102.2037	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	35.4284	30.9859	31.9746	27.8763	26.7479	23.0814	21.3883	24.5434	24.8366	28.9446	31.5953	34.3105 (65)

---

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	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	(66)

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

	26.5826	23.6105	19.2013	14.5366	10.8663	9.1738	9.9126	12.8848	17.2939	21.9586	25.6289	27.3214	(67)

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

	285.2132	288.1728	280.7146	264.8371	244.7946	225.9575	213.3731	210.4135	217.8717	233.7492	253.7917	272.6288	(68)

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

	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)

Water heating gains (Table 5)

	47.6188	46.1099	42.9767	38.7170	35.9515	32.0576	28.7478	32.9885	34.4952	38.9041	43.8824	46.1162	(72)

Total internal gains

	425.3643	423.8429	408.8423	384.0405	357.5622	333.1386	317.9832	322.2365	335.6105	360.5616	389.2527	412.0162	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	11.2829	0.6800	0.8000	0.7700	68.0573	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	80.8180	164.5074	296.3899	486.7574	654.2975	697.5504	652.5441	520.2157	361.1558	201.0410	101.6899	66.0000	(83)
Total gains	506.1823	588.3503	705.2323	870.7979	1011.8597	1030.6889	970.5273	842.4522	696.7663	561.6026	490.9427	478.0162	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.5984	34.6640	34.7286	35.0350	35.0929	35.3651	35.3651	35.4160	35.2597	35.0929	34.9759	34.8544	
alpha	3.3066	3.3109	3.3152	3.3357	3.3395	3.3577	3.3577	3.3611	3.3506	3.3395	3.3317	3.3236	
util living area	0.9849	0.9744	0.9453	0.8632	0.7148	0.5408	0.4129	0.4857	0.7441	0.9284	0.9766	0.9874	(86)
MIT	19.1208	19.3491	19.7714	20.3212	20.7279	20.9219	20.9761	20.9595	20.7722	20.2070	19.5646	19.0752	(87)
Th 2	20.2509	20.2522	20.2535	20.2595	20.2607	20.2660	20.2660	20.2669	20.2639	20.2607	20.2584	20.2560	(88)
util rest of house	0.9828	0.9708	0.9375	0.8446	0.6795	0.4890	0.3488	0.4170	0.6972	0.9146	0.9728	0.9857	(89)
MIT 2	18.4920	18.7195	19.1370	19.6728	20.0472	20.2148	20.2540	20.2454	20.0989	19.5739	18.9398	18.4505	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	18.6492	18.8769	19.2956	19.8349	20.2174	20.3916	20.4345	20.4239	20.2672	19.7322	19.0960	18.6067	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6492	18.8769	19.2956	19.8349	20.2174	20.3916	20.4345	20.4239	20.2672	19.7322	19.0960	18.6067	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9768	0.9625	0.9255	0.8325	0.6773	0.4982	0.3638	0.4322	0.6974	0.9027	0.9650	0.9804	(94)
Useful gains	494.4529	566.2601	652.7062	724.9708	685.3572	513.4627	353.0823	364.0897	485.9267	506.9579	473.7431	468.6649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1382.4536	1344.0375	1228.1559	1040.3785	809.0323	545.8854	361.4228	378.7292	583.0253	867.4281	1143.2649	1377.7950	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	660.6725	522.6664	428.1346	227.0935	92.0143	0.0000	0.0000	0.0000	0.0000	268.1899	482.0557	676.3928	(98)
Space heating												3357.2197	(98)
Space heating per m2											(98) / (4) =	27.9768	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	885.9963	697.4865	715.3085	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8954	0.9319	0.9027	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	793.2783	650.0220	645.7182	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1319.8701	1247.0200	1099.6043	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	379.1461	444.1665	337.6912	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1161.0038	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	94.7865	111.0416	84.4228	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	290.2510 (107)
Space cooling per m2	2.4188 (108)
Energy for space heating	27.9768 (99)
Energy for space cooling	2.4188 (108)
Total	30.3956 (109)
Dwelling Fabric Energy Efficiency (DFEE)	30.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1235	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3889	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.0000	1.3258	25.1894			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1800	8.4870			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.6764			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		39.0764	(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	62.2173	61.8772	61.5439	59.9783	59.6854	58.3218	58.3218	58.0693	58.8470	59.6854	60.2779	60.8974	(38)
Heat transfer coeff	101.2936	100.9536	100.6203	99.0547	98.7618	97.3982	97.3982	97.1457	97.9234	98.7618	99.3543	99.9738	(39)
Average = Sum(39)m / 12 =												99.0533	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8441	0.8413	0.8385	0.8255	0.8230	0.8117	0.8117	0.8095	0.8160	0.8230	0.8280	0.8331	(40)
HLP (average)												0.8254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8633 (42)
Average daily hot water use (litres/day)		102.2037 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.4284	30.9859	31.9746	27.8763	26.7479	23.0814	21.3883	24.5434	24.8366	28.9446	31.5953	34.3105	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	143.1657	(66)

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

	26.5826	23.6105	19.2013	14.5366	10.8663	9.1738	9.9126	12.8848	17.2939	21.9586	25.6289	27.3214	(67)

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

	285.2132	288.1728	280.7146	264.8371	244.7946	225.9575	213.3731	210.4135	217.8717	233.7492	253.7917	272.6288	(68)

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

	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	37.3166	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)

Water heating gains (Table 5)

	47.6188	46.1099	42.9767	38.7170	35.9515	32.0576	28.7478	32.9885	34.4952	38.9041	43.8824	46.1162	(72)

Total internal gains

	425.3643	423.8429	408.8423	384.0405	357.5622	333.1386	317.9832	322.2365	335.6105	360.5616	389.2527	412.0162	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	11.2829	0.6300	0.7000	0.7700	55.1714	(75)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446	(81)

Solar gains	65.5161	133.3598	240.2720	394.5956	530.4140	565.4774	528.9925	421.7190	292.7752	162.9763	82.4362	53.5037	(83)
Total gains	490.8803	557.2027	649.1143	778.6362	887.9761	898.6160	846.9758	743.9555	628.3857	523.5378	471.6889	465.5199	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2691	82.5462	82.8196	84.1286	84.3781	85.5594	85.5594	85.7818	85.1005	84.3781	83.8749	83.3551	
alpha	6.4846	6.5031	6.5213	6.6086	6.6252	6.7040	6.7040	6.7188	6.6734	6.6252	6.5917	6.5570	
util living area	0.9998	0.9994	0.9972	0.9790	0.8831	0.6742	0.5034	0.5927	0.8990	0.9943	0.9994	0.9998	(86)
MIT	20.0047	20.1139	20.3265	20.6371	20.8882	20.9854	20.9982	20.9951	20.9077	20.5784	20.2438	19.9916	(87)
Th 2	20.2153	20.2177	20.2201	20.2313	20.2334	20.2432	20.2432	20.2451	20.2395	20.2334	20.2292	20.2247	(88)
util rest of house	0.9997	0.9992	0.9961	0.9709	0.8451	0.6027	0.4182	0.4996	0.8497	0.9913	0.9992	0.9998	(89)
MIT 2	19.2858	19.3970	19.6111	19.9265	20.1566	20.2365	20.2427	20.2435	20.1834	19.8736	19.5365	19.2807	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	19.4656	19.5763	19.7900	20.1041	20.3395	20.4237	20.4316	20.4314	20.3645	20.0498	19.7133	19.4584	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4656	19.5763	19.7900	20.1041	20.3395	20.4237	20.4316	20.4314	20.3645	20.0498	19.7133	19.4584	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9996	0.9989	0.9954	0.9692	0.8509	0.6202	0.4396	0.5231	0.8590	0.9904	0.9990	0.9997	(94)
Useful gains	490.6757	556.6010	646.1033	754.6870	755.5736	557.3655	372.3310	389.1287	539.7682	518.4863	471.2194	465.3850	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1536.1757	1481.6205	1337.2423	1109.8227	853.2498	567.2204	373.1904	391.6351	613.4385	933.2777	1253.1885	1525.4406	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	777.8520	621.6131	514.2074	255.6977	72.6711	0.0000	0.0000	0.0000	0.0000	308.6048	563.0177	788.6814	(98)
Space heating												3902.3453	(98)
Space heating per m2											(98) / (4) =	32.5195	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	915.5428	720.7464	738.3070	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9496	0.9792	0.9594	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	869.4376	705.7430	708.3498	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1165.4991	1102.6091	984.4782	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	213.1643	295.2684	205.4396	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												713.8723	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	53.2911	73.8171	51.3599	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	178.4681 (107)
Space cooling per m2	1.4872 (108)
Energy for space heating	32.5195 (99)
Energy for space cooling	1.4872 (108)
Total	34.0068 (109)
Target Fabric Energy Efficiency (TFEE)	39.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1500	7.0725			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8282			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	38.1882	(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	24.9458	24.6050	24.2642	23.5825	23.5825	22.2193	22.9009	22.2193	21.8785	22.5601	22.5601	23.9234	(38)
Heat transfer coeff	63.1340	62.7932	62.4524	61.7708	61.7708	60.4075	61.0892	60.4075	60.0667	60.7483	60.7483	62.1116	(39)
Average = Sum(39)m / 12 =												61.4584	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5261	0.5233	0.5204	0.5148	0.5148	0.5034	0.5091	0.5034	0.5006	0.5062	0.5062	0.5176	(40)
HLP (average)												0.5122	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633 (42)
Average daily hot water use (litres/day)	102.2037 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0083	21.8724	22.5703	19.6774	18.8809	16.2928	15.0977	17.3248	17.5317	20.4315	22.3026	24.2192	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (64)
Total per year (kWh/year) = Sum(64)m = 2258.9022 (64)
RHI water heating demand 2259 (64)
Heat gains from water heating, kWh/month
99.6564 88.4257 94.2523 86.4131 86.0741 78.9106 77.6879 82.6247 81.6569 89.5113 92.2323 97.9072 (65)

---

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	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.4566	59.0261	48.0033	36.3416	27.1658	22.9345	24.7815	32.2119	43.2348	54.8965	64.0723	68.3036	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)													
	133.9468	131.5859	126.6833	120.0182	115.6910	109.5981	104.4192	111.0547	113.4123	120.3108	128.1005	131.5958	(72)
Total internal gains													
	738.4041	733.0302	705.9731	663.9486	620.5313	582.0920	559.9776	569.6262	594.1382	636.3962	683.2758	719.1175	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	12.4885	0.6800	0.8000	0.7700	75.3290	(75)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	89.4532	161.3178	298.3516	505.0500	658.0267	747.1060	697.9174	576.2131	399.1677	219.8145	116.4380	74.6987	(83)
Total gains	827.8574	894.3480	1004.3247	1168.9986	1278.5580	1329.1980	1257.8950	1145.8393	993.3059	856.2107	799.7139	793.8162	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7978	53.0843	53.3740	53.9630	53.9630	55.1808	54.5651	55.1808	55.4938	54.8712	54.8712	53.6669	
alpha	4.5199	4.5390	4.5583	4.5975	4.5975	4.6787	4.6377	4.6787	4.6996	4.6581	4.6581	4.5778	
util living area													
	0.8758	0.8348	0.7161	0.5286	0.3461	0.1908	0.1117	0.1265	0.3076	0.5848	0.7942	0.8859	(86)
MIT	20.5424	20.6525	20.8473	20.9651	20.9957	20.9998	21.0000	21.0000	20.9984	20.9584	20.7852	20.5290	(87)
Th 2	20.4969	20.4995	20.5021	20.5073	20.5073	20.5177	20.5125	20.5177	20.5203	20.5151	20.5151	20.5047	(88)
util rest of house													
	0.8646	0.8211	0.6965	0.5058	0.3228	0.1689	0.0880	0.1011	0.2789	0.5562	0.7760	0.8754	(89)
MIT 2	19.8892	20.0439	20.3104	20.4666	20.5029	20.5176	20.5125	20.5177	20.5189	20.4682	20.2425	19.8773	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	20.0525	20.1961	20.4446	20.5912	20.6261	20.6382	20.6344	20.6383	20.6388	20.5907	20.3782	20.0402	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0525	20.1961	20.4446	20.5912	20.6261	20.6382	20.6344	20.6383	20.6388	20.5907	20.3782	20.0402	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8538	0.8122	0.6942	0.5097	0.3284	0.1744	0.0939	0.1075	0.2860	0.5608	0.7707	0.8645	(94)
Useful gains	706.7938	726.4149	697.2019	595.8154	419.9274	231.7992	118.1681	123.1244	284.0715	480.1344	616.3086	686.2707	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	906.1330	878.8572	764.7048	610.9862	421.6537	231.8533	118.1700	123.1276	284.6432	497.5740	709.4302	890.6955	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	148.3084	102.4412	50.2222	10.9229	1.2844	0.0000	0.0000	0.0000	0.0000	12.9751	67.0476	152.0920	(98)
Space heating												545.2937	(98)
RHI space heating demand												545	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1500	7.0725			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8282			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	38.1882	(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	29.0355	28.6947	28.3538	26.6498	26.3090	24.6050	24.6050	24.2642	25.2866	26.3090	26.9906	27.6722	(38)
Heat transfer coeff	67.2237	66.8829	66.5421	64.8380	64.4972	62.7932	62.7932	62.4524	63.4748	64.4972	65.1788	65.8605	(39)
Average = Sum(39)m / 12 =												64.7528	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5602	0.5574	0.5545	0.5403	0.5375	0.5233	0.5233	0.5204	0.5290	0.5375	0.5432	0.5488	(40)
HLP (average)												0.5396	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633 (42)
Average daily hot water use (litres/day)	102.2037 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0083	21.8724	22.5703	19.6774	18.8809	16.2928	15.0977	17.3248	17.5317	20.4315	22.3026	24.2192	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	221.9985	195.7433	205.7457	184.6761	181.1495	162.1122	155.9278	170.7753	170.3716	191.4868	202.1775	216.7378 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	221.9985	195.7433	205.7457	184.6761	181.1495	162.1122	155.9278	170.7753	170.3716	191.4868	202.1775	216.7378 (64)

Total per year (kWh/year) = Sum(64)m = 2258.9022 (64)
Heat gains from water heating, kWh/month

	99.6564	88.4257	94.2523	86.4131	86.0741	78.9106	77.6879	82.6247	81.6569	89.5113	92.2323	97.9072 (65)

---

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	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)

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

	66.4566	59.0261	48.0033	36.3416	27.1658	22.9345	24.7815	32.2119	43.2348	54.8965	64.0723	68.3036 (67)

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

	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087 (68)

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

	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326 (71)

Water heating gains (Table 5)

	133.9468	131.5859	126.6833	120.0182	115.6910	109.5981	104.4192	111.0547	113.4123	120.3108	128.1005	131.5958 (72)

Total internal gains

	738.4041	733.0302	705.9731	663.9486	620.5313	582.0920	559.9776	569.6262	594.1382	636.3962	683.2758	719.1175 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	11.2829	0.6800	0.8000	0.7700	68.0573	(75)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	80.8180	164.5074	296.3899	486.7574	654.2975	697.5504	652.5441	520.2157	361.1558	201.0410	101.6899	66.0000 (83)
Total gains	819.2221	897.5375	1002.3631	1150.7060	1274.8288	1279.6424	1212.5217	1089.8419	955.2940	837.4372	784.9658	785.1176 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.5857	49.8384	50.0936	51.4102	51.6818	53.0843	53.0843	53.3740	52.5143	51.6818	51.1413	50.6121	
alpha	4.3057	4.3226	4.3396	4.4273	4.4455	4.5390	4.5390	4.5583	4.5010	4.4455	4.4094	4.3741	
util living area	0.9143	0.8779	0.7969	0.6363	0.4616	0.3129	0.2277	0.2632	0.4509	0.7162	0.8684	0.9231	(86)
MIT	20.3009	20.4588	20.6885	20.9012	20.9786	20.9973	20.9995	20.9991	20.9864	20.8659	20.5772	20.2821	(87)
Th 2	20.4660	20.4685	20.4711	20.4840	20.4866	20.4995	20.4995	20.5021	20.4944	20.4866	20.4814	20.4763	(88)
util rest of house	0.9061	0.8671	0.7809	0.6147	0.4377	0.2888	0.2018	0.2348	0.4196	0.6915	0.8554	0.9156	(89)
MIT 2	19.5220	19.7467	20.0675	20.3630	20.4626	20.4969	20.4992	20.5014	20.4805	20.3245	19.9271	19.5038	(90)

Living area fraction fLA = Living area / (4) = 0.2500 (91)

MIT	19.7167	19.9248	20.2227	20.4975	20.5916	20.6220	20.6242	20.6258	20.6069	20.4598	20.0896	19.6984	(92)

Temperature adjustment 0.0000

adjusted MIT	19.7167	19.9248	20.2227	20.4975	20.5916	20.6220	20.6242	20.6258	20.6069	20.4598	20.0896	19.6984	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8932	0.8549	0.7730	0.6153	0.4427	0.2947	0.2083	0.2419	0.4267	0.6902	0.8446	0.9031	(94)
Useful gains	731.7201	767.3456	774.8261	707.9733	564.3134	377.0857	252.5332	263.6003	407.5903	577.9729	662.9691	709.0535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1036.3695	1004.8996	913.1385	751.9617	573.4836	378.1400	252.6953	263.9120	413.0269	635.9315	846.6481	1020.7308	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	226.6592	159.6363	102.9044	31.6717	6.8226	0.0000	0.0000	0.0000	0.0000	43.1212	132.2489	231.8880	(98)

Space heating 934.9523 (98)
Space heating per m2 (98) / (4) = 7.7913 (99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	590.2560	464.6696	474.6381	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9883	0.9944	0.9905	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	583.3774	462.0490	470.1077	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1397.4106	1322.6915	1177.6705	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	586.1040	640.3180	526.4267	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1752.8486	(104)
Cooled fraction										fC = cooled area / (4) =		0.5000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.2630	80.0397	65.8033	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												219.1061	(107)
Space cooling per m2												1.8259	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	934.9523	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	343.5950	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	638.1049	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2258.9022	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	830.1466	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1541.7008	(310b)
Electricity used for heat distribution	33.5355	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	50.7190	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	271.7550	(330a)
Total electricity for the above, kWh/year	271.7550	(331)
Electricity for lighting (calculated in Appendix L)	469.4575	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4145.4788	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	343.5950	4.2400	14.5684	(340a)
Space heating from Combined Heat and Power	638.1049	2.9700	18.9517	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	830.1466	4.2400	35.1982	(342a)
Water heating from Combined Heat and Power	1541.7008	2.9700	45.7885	(342b)
Space cooling	50.7190	13.1900	6.6898	(348)
Mechanical ventilation fans	271.7550	13.1900	35.8445	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	469.4575	13.1900	61.9214	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			299.3926	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.4200 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7621 (357)
SAP value		89.3688
SAP rating (Section 12)		89 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	1235.5174	0.2160	266.8718 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	1160.1908	0.2160	250.6012 (363)
less credit emissions for electricity	-406.0668	0.5190	-210.7487 (364)
Water heating from Combined Heat and Power	2803.0923	0.2160	605.4679 (365)
less credit emissions for electricity	-981.0823	0.5190	-509.1817 (366)
Electrical energy for heat distribution	33.5355	0.5190	17.4049 (372)
Total CO2 associated with community systems			420.4154 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			420.4154 (376)
Space cooling	50.7190	0.5190	26.3232 (377)
Pumps and fans	271.7550	0.5190	141.0408 (378)
Energy for lighting	469.4575	0.5190	243.6485 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			675.7279 (383)
CO2 emissions per m2			5.6300 (384)
EI value			94.5123 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	120.0000 (1b)	x	2.7000 (2b)	=	324.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			19.0000	1.1450	21.7557			(27)
External Wall 1	66.1500	19.0000	47.1500	0.1500	7.0725			(29a)
Total net area of external elements Aum(A, m2)			66.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.8282			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	38.1882	(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	24.9458	24.6050	24.2642	23.5825	23.5825	22.2193	22.9009	22.2193	21.8785	22.5601	22.5601	23.9234	(38)
Heat transfer coeff	63.1340	62.7932	62.4524	61.7708	61.7708	60.4075	61.0892	60.4075	60.0667	60.7483	60.7483	62.1116	(39)
Average = Sum(39)m / 12 =												61.4584	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5261	0.5233	0.5204	0.5148	0.5148	0.5034	0.5091	0.5034	0.5006	0.5062	0.5062	0.5176	(40)
HLP (average)												0.5122	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8633 (42)
Average daily hot water use (litres/day)	102.2037 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4241	108.3359	104.2478	100.1596	96.0715	91.9833	91.9833	96.0715	100.1596	104.2478	108.3359	112.4241	(44)
Energy conte	166.7217	145.8158	150.4689	131.1824	125.8727	108.6185	100.6510	115.4985	116.8780	136.2100	148.6839	161.4610	(45)
Energy content (annual)										Total = Sum(45)m =		1608.0625	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0083	21.8724	22.5703	19.6774	18.8809	16.2928	15.0977	17.3248	17.5317	20.4315	22.3026	24.2192	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
221.9985 195.7433 205.7457 184.6761 181.1495 162.1122 155.9278 170.7753 170.3716 191.4868 202.1775 216.7378 (64)
Total per year (kWh/year) = Sum(64)m = 2258.9022 (64)
Heat gains from water heating, kWh/month
99.6564 88.4257 94.2523 86.4131 86.0741 78.9106 77.6879 82.6247 81.6569 89.5113 92.2323 97.9072 (65)

---

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	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	171.7989	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.4566	59.0261	48.0033	36.3416	27.1658	22.9345	24.7815	32.2119	43.2348	54.8965	64.0723	68.3036	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	425.6913	430.1086	418.9771	395.2793	365.3651	337.2500	318.4674	314.0500	325.1816	348.8794	378.7936	406.9087	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	55.0432	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	-114.5326	(71)
Water heating gains (Table 5)													
	133.9468	131.5859	126.6833	120.0182	115.6910	109.5981	104.4192	111.0547	113.4123	120.3108	128.1005	131.5958	(72)
Total internal gains													
	738.4041	733.0302	705.9731	663.9486	620.5313	582.0920	559.9776	569.6262	594.1382	636.3962	683.2758	719.1175	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.0000	12.4885	0.6800	0.8000	0.7700	75.3290	(75)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	89.4532	161.3178	298.3516	505.0500	658.0267	747.1060	697.9174	576.2131	399.1677	219.8145	116.4380	74.6987	(83)
Total gains	827.8574	894.3480	1004.3247	1168.9986	1278.5580	1329.1980	1257.8950	1145.8393	993.3059	856.2107	799.7139	793.8162	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7978	53.0843	53.3740	53.9630	53.9630	55.1808	54.5651	55.1808	55.4938	54.8712	54.8712	53.6669	
alpha	4.5199	4.5390	4.5583	4.5975	4.5975	4.6787	4.6377	4.6787	4.6996	4.6581	4.6581	4.5778	
util living area													
	0.8758	0.8348	0.7161	0.5286	0.3461	0.1908	0.1117	0.1265	0.3076	0.5848	0.7942	0.8859	(86)
MIT	20.5424	20.6525	20.8473	20.9651	20.9957	20.9998	21.0000	21.0000	20.9984	20.9584	20.7852	20.5290	(87)
Th 2	20.4969	20.4995	20.5021	20.5073	20.5073	20.5177	20.5125	20.5177	20.5203	20.5151	20.5151	20.5047	(88)
util rest of house													
	0.8646	0.8211	0.6965	0.5058	0.3228	0.1689	0.0880	0.1011	0.2789	0.5562	0.7760	0.8754	(89)
MIT 2	19.8892	20.0439	20.3104	20.4666	20.5029	20.5176	20.5125	20.5177	20.5189	20.4682	20.2425	19.8773	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	20.0525	20.1961	20.4446	20.5912	20.6261	20.6382	20.6344	20.6383	20.6388	20.5907	20.3782	20.0402	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0525	20.1961	20.4446	20.5912	20.6261	20.6382	20.6344	20.6383	20.6388	20.5907	20.3782	20.0402	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8538	0.8122	0.6942	0.5097	0.3284	0.1744	0.0939	0.1075	0.2860	0.5608	0.7707	0.8645	(94)
Useful gains	706.7938	726.4149	697.2019	595.8154	419.9274	231.7992	118.1681	123.1244	284.0715	480.1344	616.3086	686.2707	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	906.1330	878.8572	764.7048	610.9862	421.6537	231.8533	118.1700	123.1276	284.6432	497.5740	709.4302	890.6955	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	148.3084	102.4412	50.2222	10.9229	1.2844	0.0000	0.0000	0.0000	0.0000	12.9751	67.0476	152.0920	(98)
Space heating												545.2937	(98)
Space heating per m2											(98) / (4) =	4.5441	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	434.9343	323.7725	326.2007	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9975	0.9991	0.9986	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	433.8615	323.4705	325.7404	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1455.3328	1375.7252	1243.1220	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	735.4594	782.8775	682.5319	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2200.8688	(104)
Cooled fraction										fC = cooled area / (4) =		0.5000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	91.9324	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												91.9324	(107)
Space cooling per m2												0.7661	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	545.2937	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	200.3954	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	372.1629	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2258.9022	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	830.1466	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1541.7008	(310b)
Electricity used for heat distribution	29.4441	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	21.2807	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	271.7550	(330a)
Total electricity for the above, kWh/year	271.7550	(331)
Electricity for lighting (calculated in Appendix L)	469.4575	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3706.8989	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	200.3954	5.0000	10.0198	(340a)
Space heating from Combined Heat and Power	372.1629	3.5000	13.0257	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	830.1466	5.0000	41.5073	(342a)
Water heating from Combined Heat and Power	1541.7008	3.5000	53.9595	(342b)
Space cooling	21.2807	15.7000	3.3411	(348)
Mechanical ventilation fans	271.7550	15.7000	42.6655	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	469.4575	15.7000	73.7048	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			280.1238	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1084.7811	0.2160	234.3127	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	676.6599	0.2160	146.1585	(363)
less credit emissions for electricity	-236.8310	0.5190	-122.9153	(364)
Water heating from Combined Heat and Power	2803.0923	0.2160	605.4679	(365)
less credit emissions for electricity	-981.0823	0.5190	-509.1817	(366)
Electrical energy for heat distribution	29.4441	0.5190	15.2815	(372)
Total CO2 associated with community systems			369.1237	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			369.1237	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	21.2807	0.5190	11.0447 (377)
Pumps and fans	271.7550	0.5190	141.0408 (378)
Energy for lighting	469.4575	0.5190	243.6485 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			609.1576 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1084.7811	1.2200	1323.4329	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	676.6599	1.2200	825.5251	(363)
less credit emissions for electricity	-236.8310	3.0700	-727.0711	(364)
Water heating from Combined Heat and Power	2803.0923	1.2200	3419.7726	(365)
less credit emissions for electricity	-981.0823	3.0700	-3011.9227	(366)
Electrical energy for heat distribution	29.4441	3.0700	90.3933	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1920.1301	(373)
Space and water heating			1920.1301	(376)
Space cooling	21.2807	3.0700	65.3316	(377)
Pumps and fans	271.7550	3.0700	834.2879	(378)
Energy for lighting	469.4575	3.0700	1441.2347	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			3339.9842	(383)
Primary energy kWh/m2/year			27.8332	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£120	£120	£0
Community scheme	£208	£208	£0
Space heating	£155	£155	£0
Space cooling	£3	£3	£0
Water heating	£95	£95	£0
Lighting	£74	£74	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£281	£281	£0
Total cost of uses	£280	£280	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	28 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversha ding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	641.52 (P1)
Transmission heat loss coefficient	38.19 (37)
Summer heat loss coefficient	679.71 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	16.0000	98.8453	0.6800	0.8000	0.9000	696.8829
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						768.0230

	Jun	Jul	Aug	
Solar gains	829	768	628	(P3)
Internal gains	582	560	570	
Total summer gains	1411	1328	1198	(P5)
Summer gain/loss ratio	2.08	1.95	1.76	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.38	21.15	20.86	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007047	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0503
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	88 B	**DER**	7.09	**TER**	14.82
Environmental	94 A	**% DER<TER**	52.16		
CO_2 Emissions (t/year)	0.43	**DFEE**	29.59	**TFEE**	34.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.42		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)      02/05/2018

FullRefNo:                     001

Regs Region:                   England
SAP Region:                    Thames Valley
Postcode:                      SW7 4DN
DwellingOrientation:           South East
Property Type:                 Flat, End-Terrace
Storeys:                       1
Date Built:                    2017
Sheltered Sides:               2
Sunlight Shade:                Average or unknown
Measurements                   Perimeter, Floor Area, Storey Height
     1st Storey:               17.6, 72.5, 2.7
Living Area:                   30 m2, fraction: 41.4%
Thermal Mass:                  Simple calculation
Thermal Mass Simple:           Low
Thermal MassValue:             100
External Walls                 Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                27.52, 47.52, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                 Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                 Area, Kappa, Construction, Element
     Party Ceilings 1          73, 80, Concrete floor slab, carpeted
Heat Loss Floors               Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                   Area, Kappa, Construction, Element
     Party Floor 1             73, 40
Description                    Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                    Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                   Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                       Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     under Balcony             Window, External Wall 1, South East, , Light-coloured curtain or roller blind, 1, True, 0, 0, 0, 12.00, 20
     Window                    Window, External Wall 1, South West, , Light-coloured curtain or roller blind, 0, , 0, 0, 0, 8.00, 20
Conservatory:                  None
Draught Proofing:              100
Draught Lobby:                 Yes
Thermal Bridges
     Bridging:                 Calculate Bridges
     Y                         0.197
     List of Bridges           Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                        External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                        External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                        External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                        External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                        External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                        External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                        External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                        External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                        External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                        External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                       External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                       External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                       External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                       External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                       External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                       External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                       External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                       External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                       External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                       External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                       External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                       External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                       External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                       External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                       External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                       Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                       Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                       Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                       Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                       Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                       Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                       Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                       Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                       External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                       External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                       External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                       External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                       External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                       External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                       External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     40.                       External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System  None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 73 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  7.09 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)34.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)29.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                Highest
External wall   0.15 (max. 0.30)       0.15 (max. 0.70)          OK
Floor           (no floor)
```

SAP2012 - 9.92 input data (DesignData) -

Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing South East:		12.00 m², Overhang twice as wide as window, ratio 1.00	
Windows facing South West:		8.00 m², No overhang	
Air change rate:		6.00 ach	
Blinds/curtains:		Light-coloured curtain or roller blind, closed 20% of daylight hours	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			20.0000	1.1450	22.9008			(27)
External Wall 1	47.5200	20.0000	27.5200	0.1500	4.1280			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0288			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	36.3888	(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	17.5423	17.3364	17.1304	16.1009	15.8950	14.8655	14.8655	14.6596	15.2773	15.8950	16.3068	16.7186	(38)
Heat transfer coeff	53.9310	53.7251	53.5192	52.4897	52.2838	51.2543	51.2543	51.0484	51.6661	52.2838	52.6956	53.1074	(39)
Average = Sum(39)m / 12 =												52.4382	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7439	0.7410	0.7382	0.7240	0.7212	0.7070	0.7070	0.7041	0.7126	0.7212	0.7268	0.7325	(40)
HLP (average)												0.7233	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3053 (42)
Average daily hot water use (litres/day)	88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7652	19.0359	19.6434	17.1256	16.4324	14.1799	13.1398	15.0781	15.2582	17.7819	19.4104	21.0784	(46)
Water storage loss:													
Store volume												110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (64)
Total per year (kWh/year) = Sum(64)m = 2050.3673 (64)
Heat gains from water heating, kWh/month
92.4675 82.1383 87.7643 80.7567 80.6466 74.2271 73.3480 77.6445 76.6172 83.6380 85.8212 90.9452 (65)

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	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.1030	16.0789	13.0762	9.8995	7.4000	6.2474	6.7506	8.7746	11.7773	14.9540	17.4535	18.6061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.0602	205.1673	199.8574	188.5532	174.2838	160.8725	151.9130	149.8058	155.1157	166.4199	180.6893	194.1006	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	(71)
Water heating gains (Table 5)													
	124.2843	122.2296	117.9628	112.1620	108.3960	103.0932	98.5860	104.3609	106.4128	112.4167	119.1962	122.2382	(72)
Total internal gains													
	403.0263	401.0546	388.4752	368.1937	347.6587	327.7920	314.8283	320.5203	330.8847	351.3694	374.9178	392.5237	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	277.4196	472.5482	646.5611	801.1205	897.3218	890.8328	858.8579	787.0875	700.0889	522.2665	332.2848	237.4134	(83)
Total gains	680.4459	873.6029	1035.0363	1169.3142	1244.9804	1218.6248	1173.6862	1107.6077	1030.9736	873.6359	707.2026	629.9371	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.3419	37.4851	37.6293	38.3673	38.5184	39.2921	39.2921	39.4506	38.9789	38.5184	38.2174	37.9211	
alpha	3.4895	3.4990	3.5086	3.5578	3.5679	3.6195	3.6195	3.6300	3.5986	3.5679	3.5478	3.5281	
util living area													
	0.8716	0.7739	0.6558	0.5130	0.3821	0.2675	0.1917	0.2114	0.3408	0.5735	0.7936	0.8915	(86)
MIT	20.1180	20.4576	20.7205	20.8981	20.9696	20.9939	20.9986	20.9981	20.9851	20.8764	20.5055	20.0474	(87)
Th 2	20.3022	20.3047	20.3072	20.3197	20.3222	20.3347	20.3347	20.3372	20.3297	20.3222	20.3172	20.3122	(88)
util rest of house													
	0.8593	0.7562	0.6338	0.4883	0.3559	0.2401	0.1629	0.1812	0.3089	0.5434	0.7741	0.8806	(89)
MIT 2	19.1332	19.6026	19.9579	20.1992	20.2894	20.3292	20.3337	20.3358	20.3153	20.1797	19.6869	19.0424	(90)
Living area fraction									fLA = Living area / (4) =			0.4138	(91)
MIT	19.5407	19.9564	20.2735	20.4884	20.5709	20.6042	20.6089	20.6098	20.5925	20.4680	20.0256	19.4583	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5407	19.9564	20.2735	20.4884	20.5709	20.6042	20.6089	20.6098	20.5925	20.4680	20.0256	19.4583	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8443	0.7469	0.6327	0.4945	0.3656	0.2512	0.1748	0.1936	0.3215	0.5500	0.7652	0.8654	(94)
Useful gains	574.4846	652.4975	654.8407	578.2093	455.1181	306.1609	205.1624	214.4540	331.4372	480.4755	541.1741	545.1494	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	821.9478	808.9067	737.1458	608.2697	463.8017	307.7430	205.4715	214.9045	335.4402	515.9347	681.1247	810.3269	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	184.1126	105.1070	61.2350	21.6435	6.4606	0.0000	0.0000	0.0000	0.0000	26.3817	100.7644	197.2921	(98)
Space heating												702.9969	(98)
Space heating per m2											(98) / (4) =	9.6965	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	481.7901	379.2815	387.9675	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9887	0.9941	0.9926	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	476.3684	377.0596	385.0871	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1497.2951	1443.2999	1367.1026	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	735.0672	793.2828	730.6196	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2258.9696	(104)
Cooled fraction										fC = cooled area / (4) =		0.8276	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0829	164.1275	151.1627	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												467.3730	(107)
Space cooling per m2												6.4465	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	702.9969	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	258.3514	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	479.7954	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2050.3673	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	753.5100	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1399.3757	(310b)
Electricity used for heat distribution	28.9103	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	108.1882	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	164.1853	(330a)
Total electricity for the above, kWh/year	164.1853	(331)
Electricity for lighting (calculated in Appendix L)	319.7039	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3483.1099	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1065.1172	0.2160	230.0653	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	872.3553	0.2160	188.4287	(363)
less credit emissions for electricity	-305.3243	0.5190	-158.4633	(364)
Water heating from Combined Heat and Power	2544.3195	0.2160	549.5730	(365)
less credit emissions for electricity	-890.5118	0.5190	-462.1756	(366)
Electrical energy for heat distribution	28.9103	0.5190	15.0045	(372)
Total CO2 associated with community systems			362.4326	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			362.4326	(376)
Space cooling	108.1882	0.5190	56.1497	(377)
Pumps and fans	164.1853	0.5190	85.2122	(378)
Energy for lighting	319.7039	0.5190	165.9263	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			514.0208	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.0900	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.0900	ZC1
Total Floor Area	TFA	72.5000	
Assumed number of occupants	N	2.3053	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5971	ZC2
CO2 emissions from cooking, equation (L16)		2.4045	ZC3
Total CO2 emissions		26.0916	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.0916	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4033	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3428	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4370	0.4285	0.4199	0.3770	0.3685	0.3256	0.3256	0.3171	0.3428	0.3685	0.3856	0.4028	(22b)
Effective ac	0.5955	0.5918	0.5882	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			18.1300	1.3258	24.0360			(27)
External Wall 1	47.5200	18.1300	29.3900	0.1800	5.2902			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3262			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		34.7262	(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	38.4676	38.2281	37.9933	36.8904	36.6841	35.7235	35.7235	35.5457	36.0935	36.6841	37.1015	37.5379	(38)
Heat transfer coeff	73.1938	72.9543	72.7195	71.6166	71.4103	70.4497	70.4497	70.2718	70.8197	71.4103	71.8277	72.2641	(39)
Average = Sum(39)m / 12 =												71.6156	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0096	1.0063	1.0030	0.9878	0.9850	0.9717	0.9717	0.9693	0.9768	0.9850	0.9907	0.9967	(40)
HLP (average)												0.9878	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3053 (42)
Average daily hot water use (litres/day)		88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7652	19.0359	19.6434	17.1256	16.4324	14.1799	13.1398	15.0781	15.2582	17.7819	19.4104	21.0784	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3938 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7527 (55)

Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	191.6960	168.9920	177.5509	159.2624	156.1443	139.6246	134.1934	147.1155	146.8130	165.1411	174.4942	187.1175	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	191.6960	168.9920	177.5509	159.2624	156.1443	139.6246	134.1934	147.1155	146.8130	165.1411	174.4942	187.1175	(64)
								Total per year (kWh/year) = Sum(64)m =				1948.1450	(64)
Heat gains from water heating, kWh/month													
	85.5220	75.8649	80.8188	74.0352	73.7011	67.5056	66.4024	70.6990	69.8957	76.6925	79.0998	83.9997	(65)

---

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	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.1030	16.0789	13.0762	9.8995	7.4000	6.2474	6.7506	8.7746	11.7773	14.9540	17.4535	18.6061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.0602	205.1673	199.8574	188.5532	174.2838	160.8725	151.9130	149.8058	155.1157	166.4199	180.6893	194.1006	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	(71)
Water heating gains (Table 5)													
	114.9490	112.8942	108.6274	102.8267	99.0606	93.7578	89.2506	95.0256	97.0774	103.0813	109.8608	112.9028	(72)
Total internal gains													
	396.6909	394.7193	382.1399	361.8583	341.3233	321.4566	308.4930	314.1849	324.5493	345.0340	368.5825	386.1884	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.8800	36.7938	0.6300	0.7000	0.7700	122.3420	(77)
Southwest	7.2500	36.7938	0.6300	0.7000	0.7700	81.5239	(79)

Solar gains	203.8659	347.2591	475.1350	588.7154	659.4103	654.6418	631.1445	578.4029	514.4708	383.7953	244.1844	174.4668	(83)
Total gains	600.5569	741.9784	857.2749	950.5737	1000.7336	976.0984	939.6375	892.5878	839.0201	728.8293	612.7669	560.6551	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.7862	69.0120	69.2349	70.3010	70.5042	71.4655	71.4655	71.6464	71.0921	70.5042	70.0944	69.6711	
alpha	5.5857	5.6008	5.6157	5.6867	5.7003	5.7644	5.7644	5.7764	5.7395	5.7003	5.6730	5.6447	
util living area													
	0.9903	0.9705	0.9216	0.8084	0.6406	0.4590	0.3295	0.3615	0.5712	0.8586	0.9748	0.9931	(86)
MIT	20.1657	20.3954	20.6481	20.8691	20.9692	20.9962	20.9995	20.9992	20.9874	20.8439	20.4649	20.1241	(87)
Th 2	20.0754	20.0781	20.0808	20.0935	20.0959	20.1070	20.1070	20.1090	20.1027	20.0959	20.0911	20.0860	(88)
util rest of house													
	0.9874	0.9623	0.9019	0.7696	0.5857	0.3963	0.2628	0.2918	0.5016	0.8184	0.9664	0.9910	(89)
MIT 2	18.9817	19.3118	19.6629	19.9565	20.0697	20.1047	20.1068	20.1087	20.0943	19.9362	19.4248	18.9298	(90)
Living area fraction									fLA = Living area / (4) =			0.4138	(91)
MIT	19.4716	19.7602	20.0706	20.3341	20.4419	20.4736	20.4762	20.4772	20.4639	20.3118	19.8552	19.4240	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4716	19.7602	20.0706	20.3341	20.4419	20.4736	20.4762	20.4772	20.4639	20.3118	19.8552	19.4240	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9589	0.9017	0.7805	0.6072	0.4222	0.2905	0.3207	0.5300	0.8288	0.9637	0.9890	(94)
Useful gains	591.4982	711.4831	773.0019	741.8899	607.6164	412.0950	272.9217	286.2383	444.7047	604.0801	590.5295	554.4657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1110.4693	1084.1149	986.8444	818.8723	624.2615	413.7937	273.0779	286.5128	450.6872	693.5239	916.1788	1100.1503	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	386.1144	250.4086	159.0988	55.4274	12.3840	0.0000	0.0000	0.0000	0.0000	66.5463	234.4675	405.9893	(98)
Space heating												1570.4363	(98)
Space heating per m2											(98) / (4) =	21.6612	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1679.6110	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	386.1144	250.4086	159.0988	55.4274	12.3840	0.0000	0.0000	0.0000	0.0000	66.5463	234.4675	405.9893	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	412.9566	267.8167	170.1592	59.2806	13.2449	0.0000	0.0000	0.0000	0.0000	71.1725	250.7674	434.2132	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	191.6960	168.9920	177.5509	159.2624	156.1443	139.6246	134.1934	147.1155	146.8130	165.1411	174.4942	187.1175	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6456	85.8611	84.5228	82.3125	80.4994	79.8000	79.8000	79.8000	79.8000	82.6052	85.6026	86.8270	(217)
Fuel for water heating, kWh/month													
	221.2414	196.8202	210.0627	193.4850	193.9695	174.9682	168.1622	184.3553	183.9761	199.9161	203.8422	215.5061	(219)
Water heating fuel used												2346.3051	(219)
Annual totals kWh/year													
Space heating fuel - main system												1679.6110	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												319.7039	(232)
Total delivered energy for all uses												4420.6201	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1679.6110	0.2160	362.7960	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2346.3051	0.2160	506.8019	(264)
Space and water heating			869.5979	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	319.7039	0.5190	165.9263	(268)
Total CO2, kg/m2/year			1074.4492	(272)
Emissions per m2 for space and water heating			11.9945	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2886	(272b)
Emissions per m2 for pumps and fans			0.5369	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.9945 * 1.00) + 2.2886 + 0.5369, rounded to 2 d.p.			14.8200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.3033	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2578	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3287	0.3222	0.3158	0.2835	0.2771	0.2449	0.2449	0.2384	0.2578	0.2771	0.2900	0.3029	(22b)
Effective ac	0.5540	0.5519	0.5499	0.5402	0.5384	0.5300	0.5300	0.5284	0.5332	0.5384	0.5420	0.5459	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			20.0000	1.1450	22.9008			(27)
External Wall 1	47.5200	20.0000	27.5200	0.1500	4.1280			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.0288			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		36.3888	(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	35.7875	35.6520	35.5192	34.8955	34.7788	34.2356	34.2356	34.1350	34.4448	34.7788	35.0149	35.2617	(38)
Heat transfer coeff	72.1762	72.0408	71.9080	71.2843	71.1676	70.6243	70.6243	70.5237	70.8336	71.1676	71.4036	71.6504	(39)
Average = Sum(39)m / 12 =												71.2837	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9955	0.9937	0.9918	0.9832	0.9816	0.9741	0.9741	0.9727	0.9770	0.9816	0.9849	0.9883	(40)
HLP (average)												0.9832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3053 (42)
Average daily hot water use (litres/day)		88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	30.8340	26.9676	27.8281	24.2612	23.2792	20.0882	18.6147	21.3606	21.6157	25.1911	27.4980	29.8611 (65)

---

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	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	(66)

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

	18.1030	16.0789	13.0762	9.8995	7.4000	6.2474	6.7506	8.7746	11.7773	14.9540	17.4535	18.6061	(67)

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

	203.0602	205.1673	199.8574	188.5532	174.2838	160.8725	151.9130	149.8058	155.1157	166.4199	180.6893	194.1006	(68)

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

	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	(71)

Water heating gains (Table 5)

	41.4435	40.1303	37.4034	33.6962	31.2893	27.9003	25.0197	28.7105	30.0219	33.8590	38.1917	40.1358	(72)

Total internal gains

	320.1855	318.9554	307.9159	289.7278	270.5520	252.5991	241.2621	244.8698	254.4937	272.8117	293.9134	310.4214	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	277.4196	472.5482	646.5611	801.1205	897.3218	890.8328	858.8579	787.0875	700.0889	522.2665	332.2848	237.4134	(83)
Total gains	597.6051	791.5036	954.4770	1090.8484	1167.8738	1143.4319	1100.1200	1031.9573	954.5827	795.0781	626.1981	547.8348	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.9024	27.9549	28.0065	28.2515	28.2978	28.5155	28.5155	28.5562	28.4313	28.2978	28.2043	28.1071	
alpha	2.8602	2.8637	2.8671	2.8834	2.8865	2.9010	2.9010	2.9037	2.8954	2.8865	2.8803	2.8738	
util living area	0.9274	0.8622	0.7732	0.6502	0.5132	0.3787	0.2773	0.3068	0.4732	0.7155	0.8824	0.9404	(86)
MIT	19.3047	19.7561	20.2057	20.5990	20.8363	20.9501	20.9849	20.9795	20.9028	20.5519	19.8500	19.2026	(87)
Th 2	20.0871	20.0886	20.0901	20.0973	20.0987	20.1049	20.1049	20.1061	20.1025	20.0987	20.0960	20.0931	(88)
util rest of house	0.9181	0.8467	0.7501	0.6182	0.4728	0.3301	0.2227	0.2498	0.4206	0.6798	0.8662	0.9327	(89)
MIT 2	18.5490	18.9838	19.4089	19.7735	19.9794	20.0751	20.0983	20.0966	20.0404	19.7440	19.0882	18.4542	(90)
Living area fraction										fLA = Living area / (4) =		0.4138	(91)
MIT	18.8617	19.3034	19.7386	20.1151	20.3340	20.4371	20.4652	20.4619	20.3973	20.0783	19.4034	18.7639	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8617	19.3034	19.7386	20.1151	20.3340	20.4371	20.4652	20.4619	20.3973	20.0783	19.4034	18.7639	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9032	0.8316	0.7404	0.6189	0.4836	0.3484	0.2448	0.2727	0.4383	0.6789	0.8519	0.9188	(94)
Useful gains	539.7770	658.2177	706.7227	675.0955	564.7490	398.3176	269.3606	281.4199	418.3770	539.7975	533.4344	503.3236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1051.0068	1037.6325	951.9619	799.4605	614.4591	412.2443	272.9756	286.4615	446.0595	674.5501	878.5075	1043.5108	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	380.3550	254.9667	182.4580	89.5428	36.9843	0.0000	0.0000	0.0000	0.0000	100.2560	248.4527	401.8993	(98)
Space heating												1694.9147	(98)
Space heating per m2											(98) / (4) =	23.3781	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	663.8688	522.6201	535.9805	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9384	0.9613	0.9530	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	622.9445	502.3993	510.7737	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1422.1022	1369.7337	1291.4522	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	575.3935	645.2968	580.8248	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1801.5151	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000   143.8484   161.3242   145.2062     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          450.3788 (107)
Space cooling per m2                                                                                                                     6.2121 (108)
Energy for space heating                                                                                                                23.3781 (99)
Energy for space cooling                                                                                                                 6.2121 (108)
Total                                                                                                                                   29.5903 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   29.6 (109)


------------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.4033	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3428	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4370	0.4285	0.4199	0.3770	0.3685	0.3256	0.3256	0.3171	0.3428	0.3685	0.3856	0.4028	(22b)
Effective ac	0.5955	0.5918	0.5882	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			18.1300	1.3258	24.0360			(27)
External Wall 1	47.5200	18.1300	29.3900	0.1800	5.2902			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.3262			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		34.7262	(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	38.4676	38.2281	37.9933	36.8904	36.6841	35.7235	35.7235	35.5457	36.0935	36.6841	37.1015	37.5379	(38)
Heat transfer coeff	73.1938	72.9543	72.7195	71.6166	71.4103	70.4497	70.4497	70.2718	70.8197	71.4103	71.8277	72.2641	(39)
Average = Sum(39)m / 12 =												71.6156	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0096	1.0063	1.0030	0.9878	0.9850	0.9717	0.9717	0.9693	0.9768	0.9850	0.9907	0.9967	(40)
HLP (average)												0.9878	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3053	(42)
Average daily hot water use (litres/day)	88.9499	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.8340	26.9676	27.8281	24.2612	23.2792	20.0882	18.6147	21.3606	21.6157	25.1911	27.4980	29.8611	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	115.2628	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.1030	16.0789	13.0762	9.8995	7.4000	6.2474	6.7506	8.7746	11.7773	14.9540	17.4535	18.6061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	203.0602	205.1673	199.8574	188.5532	174.2838	160.8725	151.9130	149.8058	155.1157	166.4199	180.6893	194.1006	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	34.5263	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	(71)
Water heating gains (Table 5)													
	41.4435	40.1303	37.4034	33.6962	31.2893	27.9003	25.0197	28.7105	30.0219	33.8590	38.1917	40.1358	(72)
Total internal gains													
	320.1855	318.9554	307.9159	289.7278	270.5520	252.5991	241.2621	244.8698	254.4937	272.8117	293.9134	310.4214	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.8800	36.7938	0.6300	0.7000	0.7700	122.3420	(77)
Southwest	7.2500	36.7938	0.6300	0.7000	0.7700	81.5239	(79)

Solar gains	203.8659	347.2591	475.1350	588.7154	659.4103	654.6418	631.1445	578.4029	514.4708	383.7953	244.1844	174.4668	(83)
Total gains	524.0514	666.2145	783.0509	878.4432	929.9623	907.2409	872.4066	823.2728	768.9645	656.6069	538.0978	484.8881	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.7862	69.0120	69.2349	70.3010	70.5042	71.4655	71.4655	71.6464	71.0921	70.5042	70.0944	69.6711	
alpha	5.5857	5.6008	5.6157	5.6867	5.7003	5.7644	5.7644	5.7764	5.7395	5.7003	5.6730	5.6447	
util living area													
	0.9949	0.9815	0.9437	0.8446	0.6807	0.4925	0.3547	0.3916	0.6175	0.8978	0.9859	0.9966	(86)
MIT	20.0682	20.3074	20.5801	20.8336	20.9584	20.9946	20.9993	20.9988	20.9815	20.7954	20.3758	20.0262	(87)
Th 2	20.0754	20.0781	20.0808	20.0935	20.0959	20.1070	20.1070	20.1090	20.1027	20.0959	20.0911	20.0860	(88)
util rest of house													
	0.9933	0.9760	0.9283	0.8089	0.6249	0.4258	0.2831	0.3163	0.5444	0.8641	0.9809	0.9955	(89)
MIT 2	19.2324	19.4701	19.7338	19.9720	20.0713	20.1047	20.1068	20.1087	20.0941	19.9480	19.5503	19.1995	(90)
Living area fraction										fLA = Living area / (4) =		0.4138	(91)
MIT	19.5782	19.8166	20.0840	20.3285	20.4384	20.4729	20.4761	20.4770	20.4613	20.2987	19.8919	19.5416	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5782	19.8166	20.0840	20.3285	20.4384	20.4729	20.4761	20.4770	20.4613	20.2987	19.8919	19.5416	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9922	0.9742	0.9284	0.8188	0.6466	0.4534	0.3127	0.3475	0.5743	0.8725	0.9795	0.9947	(94)
Useful gains	519.9865	648.9947	726.9483	719.2700	601.3254	411.2986	272.8393	286.0799	441.5888	572.8684	527.0715	482.3157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1118.2728	1088.2274	987.8235	818.4731	624.0102	413.7470	273.0713	286.5003	450.5030	692.5842	918.8141	1108.6450	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	445.1250	295.1644	194.0912	71.4262	16.8775	0.0000	0.0000	0.0000	0.0000	89.0685	282.0547	465.9889	(98)
Space heating												1859.7964	(98)
Space heating per m2											(98) / (4) =	25.6524	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	662.2274	521.3280	534.0660	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9817	0.9930	0.9899	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	650.0872	517.6573	528.6653	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1146.0347	1103.5752	1047.5352	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	357.0822	435.9229	386.0393	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1179.0444	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	89.2706	108.9807	96.5098	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	294.7611 (107)
Space cooling per m2	4.0657 (108)
Energy for space heating	25.6524 (99)
Energy for space cooling	4.0657 (108)
Total	29.7180 (109)
Target Fabric Energy Efficiency (TFEE)	34.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			20.0000	1.1450	22.9008			(27)
External Wall 1	47.5200	20.0000	27.5200	0.1500	4.1280			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0288			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	36.3888	(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	15.0714	14.8655	14.6596	14.2478	14.2478	13.4242	13.8360	13.4242	13.2183	13.6301	13.6301	14.4537	(38)
Heat transfer coeff	51.4602	51.2543	51.0484	50.6365	50.6365	49.8129	50.2247	49.8129	49.6070	50.0188	50.0188	50.8425	(39)
Average = Sum(39)m / 12 =												50.4478	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7098	0.7070	0.7041	0.6984	0.6984	0.6871	0.6928	0.6871	0.6842	0.6899	0.6899	0.7013	(40)
HLP (average)												0.6958	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3053 (42)
Average daily hot water use (litres/day)	88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7652	19.0359	19.6434	17.1256	16.4324	14.1799	13.1398	15.0781	15.2582	17.7819	19.4104	21.0784	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                0.0152 (51)
  Volume factor from Table 2a                                                                               1.0294 (52)
  Temperature factor from Table 2b                                                                          0.6000 (53)
Enter (49) or (54) in (55)                                                                                  1.0327 (55)
Total storage loss
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
               32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss   23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
              200.3779   176.8338   186.2328   167.6643   164.8262   148.0265   142.8753   155.7974   155.2148   173.8230   182.8961   195.7994 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              200.3779   176.8338   186.2328   167.6643   164.8262   148.0265   142.8753   155.7974   155.2148   173.8230   182.8961   195.7994 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   2050.3673 (64)
RHI water heating demand                                                                                    2050 (64)
Heat gains from water heating, kWh/month
               92.4675    82.1383    87.7643    80.7567    80.6466    74.2271    73.3480    77.6445    76.6172    83.6380    85.8212    90.9452 (65)


-------------------------------------------------------------------------------------------------------------
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         138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154   138.3154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               45.2574    40.1972    32.6906    24.7489    18.5001    15.6185    16.8764    21.9366    29.4432    37.3849    43.6337    46.5152 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              303.0749   306.2198   298.2946   281.4227   260.1251   240.1082   226.7358   223.5908   231.5160   248.3879   269.6856   289.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368    51.1368 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103   -92.2103 (71)
Water heating gains (Table 5)
              124.2843   122.2296   117.9628   112.1620   108.3960   103.0932    98.5860   104.3609   106.4128   112.4167   119.1962   122.2382 (72)
Total internal gains
              569.8585   565.8886   546.1899   515.5756   484.2631   456.0619   439.4401   447.1302   464.6140   495.4315   529.7574   555.6978 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                          W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------
Southeast                              12.0000            39.0225            0.6800           0.8000           0.7700          176.5339 (77)
Southwest                               8.0000            39.0225            0.6800           0.8000           0.7700          117.6893 (79)
-------------------------------------------------------------------------------------------------------------

Solar gains    294.2232   441.4369   618.7139   795.4070   871.8258   926.4778   889.9418   837.4419   736.7884   543.0532   363.8499   258.0216 (83)
Total gains    864.0817  1007.3254  1164.9038  1310.9826  1356.0889  1382.5397  1329.3818  1284.5722  1201.4024  1038.4847   893.6073   813.7194 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           39.1349    39.2921    39.4506    39.7714    39.7714    40.4290    40.0975    40.4290    40.5968    40.2626    40.2626    39.6104
alpha          3.6090     3.6195     3.6300     3.6514     3.6514     3.6953     3.6732     3.6953     3.7065     3.6842     3.6842     3.6407
util living area
               0.7452     0.6618     0.5285     0.3894     0.2672     0.1512     0.0869     0.0931     0.2101     0.4046     0.6228     0.7665 (86)

MIT           20.5831    20.7325    20.8899    20.9679    20.9936    20.9995    21.0000    21.0000    20.9982    20.9708    20.8280    20.5502 (87)
Th 2          20.3322    20.3347    20.3372    20.3422    20.3422    20.3523    20.3472    20.3523    20.3548    20.3498    20.3498    20.3397 (88)
util rest of house
               0.7263     0.6409     0.5053     0.3660     0.2432     0.1279     0.0622     0.0679     0.1837     0.3759     0.5978     0.7483 (89)
MIT 2         19.7980    19.9982    20.2049    20.3063    20.3360    20.3519    20.3472    20.3522    20.3533    20.3187    20.1415    19.7609 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.4138 (91)
MIT           20.1229    20.3021    20.4884    20.5800    20.6081    20.6199    20.6173    20.6203    20.6202    20.5886    20.4256    20.0875 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  20.1229    20.3021    20.4884    20.5800    20.6081    20.6199    20.6173    20.6203    20.6202    20.5886    20.4256    20.0875 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.7200     0.6398     0.5106     0.3745     0.2529     0.1376     0.0724     0.0783     0.1945     0.3865     0.6008     0.7409 (94)
Useful gains 622.1620   644.4868   594.8449   491.0061   343.0037   190.1725    96.2912   100.6276   233.7131   401.4257   536.8743   602.9053 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
              742.2030   722.7905   627.3013   500.2907   344.7374   190.2802    96.2970   100.6352   234.1529   409.5821   586.5002   731.4945 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               89.3105    52.6201    24.1476     6.6849     1.2899     0.0000     0.0000     0.0000     0.0000     6.0683    35.7306    95.6704 (98)
Space heating                                                                                                                 311.5223 (98)
RHI space heating demand                                                                                                      312 (98)
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			20.0000	1.1450	22.9008			(27)
External Wall 1	47.5200	20.0000	27.5200	0.1500	4.1280			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0288			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	36.3888	(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	17.5423	17.3364	17.1304	16.1009	15.8950	14.8655	14.8655	14.6596	15.2773	15.8950	16.3068	16.7186	(38)
Heat transfer coeff	53.9310	53.7251	53.5192	52.4897	52.2838	51.2543	51.2543	51.0484	51.6661	52.2838	52.6956	53.1074	(39)
Average = Sum(39)m / 12 =												52.4382	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7439	0.7410	0.7382	0.7240	0.7212	0.7070	0.7070	0.7041	0.7126	0.7212	0.7268	0.7325	(40)
HLP (average)												0.7233	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3053 (42)
Average daily hot water use (litres/day)	88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7652	19.0359	19.6434	17.1256	16.4324	14.1799	13.1398	15.0781	15.2582	17.7819	19.4104	21.0784	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (64)
Total per year (kWh/year) = Sum(64)m = 2050.3673 (64)
Heat gains from water heating, kWh/month
92.4675 82.1383 87.7643 80.7567 80.6466 74.2271 73.3480 77.6445 76.6172 83.6380 85.8212 90.9452 (65)

---

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	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.2574	40.1972	32.6906	24.7489	18.5001	15.6185	16.8764	21.9366	29.4432	37.3849	43.6337	46.5152	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	303.0749	306.2198	298.2946	281.4227	260.1251	240.1082	226.7358	223.5908	231.5160	248.3879	269.6856	289.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	51.1368	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	-92.2103	(71)
Water heating gains (Table 5)													
	124.2843	122.2296	117.9628	112.1620	108.3960	103.0932	98.5860	104.3609	106.4128	112.4167	119.1962	122.2382	(72)
Total internal gains													
	569.8585	565.8886	546.1899	515.5756	484.2631	456.0619	439.4401	447.1302	464.6140	495.4315	529.7574	555.6978	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Southwest	8.0000	36.7938	0.6800	0.8000	0.7700	110.9678	(79)

Solar gains	277.4196	472.5482	646.5611	801.1205	897.3218	890.8328	858.8579	787.0875	700.0889	522.2665	332.2848	237.4134	(83)
Total gains	847.2781	1038.4368	1192.7510	1316.6961	1381.5848	1346.8947	1298.2980	1234.2177	1164.7029	1017.6979	862.0421	793.1111	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.3419	37.4851	37.6293	38.3673	38.5184	39.2921	39.2921	39.4506	38.9789	38.5184	38.2174	37.9211	
alpha	3.4895	3.4990	3.5086	3.5578	3.5679	3.6195	3.6195	3.6300	3.5986	3.5679	3.5478	3.5281	
util living area													
	0.8004	0.7020	0.5918	0.4630	0.3464	0.2424	0.1734	0.1899	0.3031	0.5061	0.7127	0.8226	(86)
MIT	20.3619	20.6096	20.7985	20.9263	20.9778	20.9956	20.9990	20.9987	20.9898	20.9170	20.6591	20.3091	(87)
Th 2	20.3022	20.3047	20.3072	20.3197	20.3222	20.3347	20.3347	20.3372	20.3297	20.3222	20.3172	20.3122	(88)
util rest of house													
	0.7844	0.6827	0.5699	0.4397	0.3222	0.2175	0.1473	0.1627	0.2744	0.4776	0.6907	0.8077	(89)
MIT 2	19.4687	19.8055	20.0578	20.2332	20.2984	20.3307	20.3340	20.3362	20.3200	20.2276	19.8896	19.4048	(90)
Living area fraction									fLA = Living area / (4) =			0.4138	(91)
MIT	19.8383	20.1382	20.3643	20.5200	20.5795	20.6059	20.6092	20.6103	20.5972	20.5129	20.2080	19.7790	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8383	20.1382	20.3643	20.5200	20.5795	20.6059	20.6092	20.6103	20.5972	20.5129	20.2080	19.7790	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7730	0.6778	0.5717	0.4466	0.3314	0.2277	0.1581	0.1739	0.2859	0.4857	0.6870	0.7953	(94)
Useful gains	654.9083	703.9038	681.9063	588.0907	457.9156	306.6887	205.2694	214.6185	332.9568	494.2815	592.2208	630.7799	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	837.9955	818.6754	742.0059	609.9303	464.2552	307.8261	205.4884	214.9303	335.6822	518.2815	690.7344	827.3595	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	136.2169	77.1265	44.7141	15.7245	4.7167	0.0000	0.0000	0.0000	0.0000	17.8560	70.9298	146.2553	(98)
Space heating												513.5397	(98)
Space heating per m2										(98) / (4) =		7.0833	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	481.7901	379.2815	387.9675	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9887	0.9941	0.9926	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	476.3684	377.0596	385.0871	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1497.2951	1443.2999	1367.1026	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	735.0672	793.2828	730.6196	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2258.9696	(104)
Cooled fraction										fC = cooled area / (4) =		0.8276	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	152.0829	164.1275	151.1627	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												467.3730	(107)
Space cooling per m2												6.4465	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	513.5397	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	188.7258	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	350.4908	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2050.3673	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	753.5100	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1399.3757	(310b)
Electricity used for heat distribution	26.9210	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	108.1882	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	164.1853	(330a)
Total electricity for the above, kWh/year	164.1853	(331)
Electricity for lighting (calculated in Appendix L)	319.7039	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3284.1798	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	188.7258	4.2400	8.0020	(340a)
Space heating from Combined Heat and Power	350.4908	2.9700	10.4096	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	753.5100	4.2400	31.9488	(342a)
Water heating from Combined Heat and Power	1399.3757	2.9700	41.5615	(342b)
Space cooling	108.1882	13.1900	14.2700	(348)
Mechanical ventilation fans	164.1853	13.1900	21.6560	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	319.7039	13.1900	42.1689	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			250.4469	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8952	(357)
SAP value	87.5118	
SAP rating (Section 12)	88	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating from Boilers	991.8272	0.2160	214.2347 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	637.2561	0.2160	137.6473 (363)
less credit emissions for electricity	-223.0396	0.5190	-115.7576 (364)
Water heating from Combined Heat and Power	2544.3195	0.2160	549.5730 (365)
less credit emissions for electricity	-890.5118	0.5190	-462.1756 (366)
Electrical energy for heat distribution	26.9210	0.5190	13.9720 (372)
Total CO2 associated with community systems			337.4938 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			337.4938 (376)
Space cooling	108.1882	0.5190	56.1497 (377)
Pumps and fans	164.1853	0.5190	85.2122 (378)
Energy for lighting	319.7039	0.5190	165.9263 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			489.0820 (383)
CO2 emissions per m2			6.7500 (384)
EI value			94.4224 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.5000 (1b)	x	2.7000 (2b)	=	195.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			20.0000	1.1450	22.9008			(27)
External Wall 1	47.5200	20.0000	27.5200	0.1500	4.1280			(29a)
Total net area of external elements Aum(A, m2)			47.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.0288			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	36.3888	(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	15.0714	14.8655	14.6596	14.2478	14.2478	13.4242	13.8360	13.4242	13.2183	13.6301	13.6301	14.4537	(38)
Heat transfer coeff	51.4602	51.2543	51.0484	50.6365	50.6365	49.8129	50.2247	49.8129	49.6070	50.0188	50.0188	50.8425	(39)
Average = Sum(39)m / 12 =												50.4478	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7098	0.7070	0.7041	0.6984	0.6984	0.6871	0.6928	0.6871	0.6842	0.6899	0.6899	0.7013	(40)
HLP (average)												0.6958	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3053 (42)
Average daily hot water use (litres/day)	88.9499 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.8448	94.2868	90.7289	87.1709	83.6129	80.0549	80.0549	83.6129	87.1709	90.7289	94.2868	97.8448	(44)
Energy conte	145.1011	126.9063	130.9560	114.1706	109.5494	94.5328	87.5985	100.5206	101.7211	118.5462	129.4024	140.5226	(45)
Energy content (annual)										Total = Sum(45)m =		1399.5276	(45)
Distribution loss (46)m = 0.15 x (45)m	21.7652	19.0359	19.6434	17.1256	16.4324	14.1799	13.1398	15.0781	15.2582	17.7819	19.4104	21.0784	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
200.3779 176.8338 186.2328 167.6643 164.8262 148.0265 142.8753 155.7974 155.2148 173.8230 182.8961 195.7994 (64)
Total per year (kWh/year) = Sum(64)m = 2050.3673 (64)
Heat gains from water heating, kWh/month
92.4675 82.1383 87.7643 80.7567 80.6466 74.2271 73.3480 77.6445 76.6172 83.6380 85.8212 90.9452 (65)

---

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	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	138.3154	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
45.2574 40.1972 32.6906 24.7489 18.5001 15.6185 16.8764 21.9366 29.4432 37.3849 43.6337 46.5152 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
303.0749 306.2198 298.2946 281.4227 260.1251 240.1082 226.7358 223.5908 231.5160 248.3879 269.6856 289.7024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 51.1368 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 -92.2103 (71)
Water heating gains (Table 5)
124.2843 122.2296 117.9628 112.1620 108.3960 103.0932 98.5860 104.3609 106.4128 112.4167 119.1962 122.2382 (72)
Total internal gains
569.8585 565.8886 546.1899 515.5756 484.2631 456.0619 439.4401 447.1302 464.6140 495.4315 529.7574 555.6978 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Southwest	8.0000	39.0225	0.6800	0.8000	0.7700	117.6893	(79)

Solar gains	294.2232	441.4369	618.7139	795.4070	871.8258	926.4778	889.9418	837.4419	736.7884	543.0532	363.8499	258.0216	(83)
Total gains	864.0817	1007.3254	1164.9038	1310.9826	1356.0889	1382.5397	1329.3818	1284.5722	1201.4024	1038.4847	893.6073	813.7194	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1349	39.2921	39.4506	39.7714	39.7714	40.4290	40.0975	40.4290	40.5968	40.2626	40.2626	39.6104	
alpha	3.6090	3.6195	3.6300	3.6514	3.6514	3.6953	3.6732	3.6953	3.7065	3.6842	3.6842	3.6407	
util living area	0.7452	0.6618	0.5285	0.3894	0.2672	0.1512	0.0869	0.0931	0.2101	0.4046	0.6228	0.7665	(86)
MIT	20.5831	20.7325	20.8899	20.9679	20.9936	20.9995	21.0000	21.0000	20.9982	20.9708	20.8280	20.5502	(87)
Th 2	20.3322	20.3347	20.3372	20.3422	20.3422	20.3523	20.3472	20.3523	20.3548	20.3498	20.3498	20.3397	(88)
util rest of house	0.7263	0.6409	0.5053	0.3660	0.2432	0.1279	0.0622	0.0679	0.1837	0.3759	0.5978	0.7483	(89)
MIT 2	19.7980	19.9982	20.2049	20.3063	20.3360	20.3519	20.3472	20.3522	20.3533	20.3187	20.1415	19.7609	(90)
Living area fraction									fLA = Living area / (4) =			0.4138	(91)
MIT	20.1229	20.3021	20.4884	20.5800	20.6081	20.6199	20.6173	20.6203	20.6202	20.5886	20.4256	20.0875	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1229	20.3021	20.4884	20.5800	20.6081	20.6199	20.6173	20.6203	20.6202	20.5886	20.4256	20.0875	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7200	0.6398	0.5106	0.3745	0.2529	0.1376	0.0724	0.0783	0.1945	0.3865	0.6008	0.7409	(94)
Useful gains	622.1620	644.4868	594.8449	491.0061	343.0037	190.1725	96.2912	100.6276	233.7131	401.4257	536.8743	602.9053	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	742.2030	722.7905	627.3013	500.2907	344.7374	190.2802	96.2970	100.6352	234.1529	409.5821	586.5002	731.4945	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	89.3105	52.6201	24.1476	6.6849	1.2899	0.0000	0.0000	0.0000	0.0000	6.0683	35.7306	95.6704	(98)
Space heating												311.5223	(98)
Space heating per m2										(98) / (4) =		4.2969	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	358.6531	266.1911	268.9898	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9965	0.9985	0.9983	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	357.3870	265.7904	268.5302	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1538.9580	1479.6317	1425.9585	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	850.7311	903.0979	861.1266	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2614.9557	(104)
Cooled fraction										fC = cooled area / (4) =		0.8276	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	176.0133	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												176.0133	(107)
Space cooling per m2												2.4278	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	311.5223	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	114.4844	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	212.6140	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2050.3673	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	753.5100	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1399.3757	(310b)
Electricity used for heat distribution	24.7998	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	40.7438	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	164.1853	(330a)
Total electricity for the above, kWh/year	164.1853	(331)
Electricity for lighting (calculated in Appendix L)	319.7039	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3004.6172	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	114.4844	5.0000	5.7242	(340a)
Space heating from Combined Heat and Power	212.6140	3.5000	7.4415	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	753.5100	5.0000	37.6755	(342a)
Water heating from Combined Heat and Power	1399.3757	3.5000	48.9781	(342b)
Space cooling	40.7438	15.7000	6.3968	(348)
Mechanical ventilation fans	164.1853	15.7000	25.7771	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	319.7039	15.7000	50.1935	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			224.0868	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	913.6784	0.2160	197.3545	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	386.5709	0.2160	83.4993	(363)
less credit emissions for electricity	-135.2998	0.5190	-70.2206	(364)
Water heating from Combined Heat and Power	2544.3195	0.2160	549.5730	(365)
less credit emissions for electricity	-890.5118	0.5190	-462.1756	(366)
Electrical energy for heat distribution	24.7998	0.5190	12.8711	(372)
Total CO2 associated with community systems			310.9017	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			310.9017	(376)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space cooling	40.7438	0.5190	21.1460 (377)
Pumps and fans	164.1853	0.5190	85.2122 (378)
Energy for lighting	319.7039	0.5190	165.9263 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			427.4863 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	913.6784	1.2200	1114.6876	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	386.5709	1.2200	471.6165	(363)
less credit emissions for electricity	-135.2998	3.0700	-415.3704	(364)
Water heating from Combined Heat and Power	2544.3195	1.2200	3104.0697	(365)
less credit emissions for electricity	-890.5118	3.0700	-2733.8713	(366)
Electrical energy for heat distribution	24.7998	3.0700	76.1355	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			1617.2677	(373)
Space and water heating			1617.2677	(376)
Space cooling	40.7438	3.0700	125.0836	(377)
Pumps and fans	164.1853	3.0700	504.0489	(378)
Energy for lighting	319.7039	3.0700	981.4911	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2306.8912	(383)
Primary energy kWh/m2/year			31.8192	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: A 94

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£82	£82	£0
Community scheme	£189	£189	£0
Space heating	£128	£128	£0
Space cooling	£6	£6	£0
Water heating	£87	£87	£0
Lighting	£50	£50	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£224	£224	£0
Total cost of uses	£224	£224	£0
Delivered energy	41 kWh/m²	41 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.4 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	32 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	387.59 (P1)
Transmission heat loss coefficient	36.39 (37)
Summer heat loss coefficient	423.97 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	1.000	0.360	Wide overhang
South West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	0.920	0.90	0.360	0.239 (P8)
South West	0.920	0.90	1.000	0.828 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	12.0000	119.9223	0.6800	0.8000	0.2392	168.5326
South West	8.0000	119.9223	0.6800	0.8000	0.8280	388.9214
total:						557.4540

	Jun	Jul	Aug	
Solar gains	585	557	520	(P3)
Internal gains	456	439	447	
Total summer gains	1041	997	967	(P5)
Summer gain/loss ratio	2.46	2.35	2.28	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.76	21.55	21.38	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007048	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0505
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	89 B	**DER**	6.03	**TER**	12.54
Environmental	95 A	**% DER<TER**	51.92		
CO_2 Emissions (t/year)	0.50	**DFEE**	24.14	**TFEE**	28.75
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.02		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)       02/05/2018

FullRefNo:                      001

Regs Region:                    England
SAP Region:                     Thames Valley
Postcode:                       SW7 4DN
DwellingOrientation:            South East
Property Type:                  Flat, Mid-Terrace
Storeys:                        1
Date Built:                     2017
Sheltered Sides:                2
Sunlight Shade:                 Average or unknown
Measurements                    Perimeter, Floor Area, Storey Height
     1st Storey:                12.1, 95.5, 2.7
Living Area:                    30 m2, fraction: 31.4%
Thermal Mass:                   Simple calculation
Thermal Mass Simple:            Low
Thermal MassValue:              100
External Walls                  Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                 14.67, 32.67, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                  Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                  Area, Kappa, Construction, Element
     Party Ceilings 1           73, 80, Concrete floor slab, carpeted
Heat Loss Floors                Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                    Area, Kappa, Construction, Element
     Party Floor 1              73, 40
Description                     Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                     Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                    Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                        Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                  Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 18.00,
Conservatory:                   None
Draught Proofing:               100
Draught Lobby:                  Yes
Thermal Bridges
     Bridging:                  Calculate Bridges
     Y                          0.287
     List of Bridges            Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                         External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                         External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                         External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                         External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                         External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                         External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                         External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                         External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                         External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                         External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                        External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                        External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                        External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                        External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                        External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                        External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                        External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                        External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                        External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                        External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                        External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                        External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                        External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                        External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                        External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                        Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                        Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                        Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                        Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                        Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                        Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                        Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                        Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                        External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                        External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                        External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                        External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                        External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                        External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
     39.                        External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                        External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     41.                       External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:                 True
Designed q50:                  3
AsBuilt q50:                   15
Property Tested:               False
Mechanical Ventilation
     MV System Present         Yes
     Windows In Hot Weather    Windows fully open
     Cross Ventilation         Yes
     Night Ventilation         Yes
     Air Change Rate           6.00
     Approved Installation     Yes
     DataType                  Database
     Type                      Balanced mechanical ventilation with heat recovery
     Database Ref Number       500167
     Configuration             2
     HR Duct Insulated         Yes
     ManufacturerSFP           0.55
     DuctType                  Rigid
     HR Efficiency             92
     Wet Rooms                 2
Chimneys MHS:                  0
Chimneys SHS:                  0
Chimneys Other:                0
Chimneys Total:                0
Open Flues MHS:                0
Open Flues SHS:                0
Open Flues Other:              0
Open Flues Total:              0
Intermittent Fans:             0
Passive Vents:                 0
Flueless Gas Fires:            0
Cooling System
     Cooled Area               60.00
     Data Source               SAP table
     Type                      Split or Multi-Split
     Class                     A
     Control                   Modulating
Light Fittings:                10
LEL Fittings:                  10
Percentage of LEL Fittings:    100
External Lights Fitted:        No
External LELs Fitted:          No
Electricity Tariff:            Standard
Main Heating 1                 None
Main Heating 2                 None
Heating Systems Interaction    Each system heats separate parts of dwelling
Smoke Control Area             Unknown
Community Heating
     Type                      Space and Water Combined
     PCDF Index                n/a
     Distribution Loss         Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls                  CCJ
     Ctrl SAP Code             2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                         Boilers, Space and Water, 35, 95
     2                         Combined Heat and Power, Space and Water, 65, 90
Secondary Heating              None
Water Heating
     Type                      CommunityHeating
     WHS                       HWP From main heating 1
     Low Water Usage           Yes
     SAP Code                  901
     Showers in Property       Non-electric only
     Hot Water Cylinder        None
Flue Gas Heat Recovery System  None
Waste Water Heat Recovery      none
PV Unit
Type                           More Dwellings, One Block
Apportioned Energy             300
Wind Turbine                   None
Terrain Type:                  Urban
Small Scale Hydro              None
Special Features               None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 12.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.03 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)28.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)24.1 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
Floor           (no floor)
Roof            (no roof)
```

SAP2012 - 9.92 input data (DesignData) -

Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Slight	OK
Based on:			
Overshading:		Average	
Windows facing South East:		18.00 m², No overhang	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1500	2.2005			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8112			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	32.1712	(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	23.1074	22.8362	22.5649	21.2088	20.9376	19.5815	19.5815	19.3102	20.1239	20.9376	21.4800	22.0225	(38)
Heat transfer coeff	55.2786	55.0073	54.7361	53.3800	53.1088	51.7526	51.7526	51.4814	52.2951	53.1088	53.6512	54.1937	(39)
Average = Sum(39)m / 12 =												53.3122	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5788	0.5760	0.5732	0.5590	0.5561	0.5419	0.5419	0.5391	0.5476	0.5561	0.5618	0.5675	(40)
HLP (average)												0.5582	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6938 (42)
Average daily hot water use (litres/day)	98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0230	21.0107	21.6812	18.9022	18.1371	15.6509	14.5029	16.6423	16.8410	19.6266	21.4239	23.2650	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
215.4303 189.9987 199.8178 179.5080 176.1906 157.8331 151.9626 166.2252 165.7671 186.1207 196.3200 210.3769 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
215.4303 189.9987 199.8178 179.5080 176.1906 157.8331 151.9626 166.2252 165.7671 186.1207 196.3200 210.3769 (64)
Total per year (kWh/year) = Sum(64)m = 2195.5510 (64)
Heat gains from water heating, kWh/month
97.4725 86.5156 92.2813 84.6947 84.4253 77.4878 76.3695 81.1118 80.1259 87.7270 90.2847 95.7922 (65)

---

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	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
22.5029 19.9868 16.2544 12.3056 9.1986 7.7658 8.3913 10.9073 14.6397 18.5885 21.6955 23.1283 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
248.8409 251.4231 244.9161 231.0634 213.5768 197.1419 186.1624 183.5802 190.0873 203.9400 221.4265 237.8614 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 36.4689 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 (71)
Water heating gains (Table 5)
131.0114 128.7435 124.0340 117.6316 113.4748 107.6219 102.6471 109.0212 111.2859 117.9127 125.3954 128.7530 (72)
Total internal gains
465.7619 463.5602 448.6112 424.4073 399.6570 375.9364 360.6075 366.9154 379.4196 403.8478 431.9242 453.1494 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	36.7938	0.6800	0.8000	0.7700	249.6776	(77)

Solar gains	249.6776	425.2934	581.9050	721.0085	807.5896	801.7495	772.9721	708.3787	630.0800	470.0398	299.0563	213.6720	(83)
Total gains	715.4396	888.8536	1030.5162	1145.4158	1207.2466	1177.6860	1133.5796	1075.2941	1009.4997	873.8877	730.9804	666.8214	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.9893	48.2259	48.4648	49.6961	49.9499	51.2588	51.2588	51.5288	50.7271	49.9499	49.4449	48.9500	
alpha	4.1993	4.2151	4.2310	4.3131	4.3300	4.4173	4.4173	4.4353	4.3818	4.3300	4.2963	4.2633	
util living area	0.8949	0.8068	0.6915	0.5421	0.4040	0.2805	0.2007	0.2200	0.3549	0.5971	0.8192	0.9120	(86)
MIT	20.3402	20.6065	20.8103	20.9412	20.9855	20.9979	20.9996	20.9995	20.9939	20.9281	20.6548	20.2914	(87)
Th 2	20.4491	20.4517	20.4542	20.4671	20.4697	20.4826	20.4826	20.4851	20.4774	20.4697	20.4645	20.4594	(88)
util rest of house	0.8853	0.7925	0.6729	0.5211	0.3819	0.2580	0.1772	0.1955	0.3286	0.5717	0.8033	0.9036	(89)
MIT 2	19.5634	19.9349	20.2133	20.3962	20.4536	20.4806	20.4823	20.4847	20.4713	20.3850	20.0177	19.5030	(90)

Living area fraction fLA = Living area / (4) = 0.3141 (91)

MIT	19.8074	20.1459	20.4008	20.5674	20.6207	20.6431	20.6448	20.6464	20.6355	20.5556	20.2178	19.7507	(92)

Temperature adjustment 0.0000
adjusted MIT 19.8074 20.1459 20.4008 20.5674 20.6207 20.6431 20.6448 20.6464 20.6355 20.5556 20.2178 19.7507 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8730	0.7840	0.6710	0.5251	0.3883	0.2650	0.1846	0.2032	0.3366	0.5759	0.7955	0.8914	(94)
Useful gains	624.5579	696.8993	691.5266	601.4413	468.7187	312.0883	209.2312	218.4630	339.8051	503.2727	581.4962	594.4059	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	857.2267	838.6365	760.8785	622.8052	473.7672	312.7457	209.3293	218.6118	341.7750	528.7293	703.7877	842.7482	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	173.1056	95.2474	51.5978	15.3820	3.7560	0.0000	0.0000	0.0000	0.0000	18.9397	88.0499	184.7667	(98)

Space heating 630.8451 (98)
Space heating per m2 (98) / (4) = 6.6057 (99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	486.4748	382.9695	391.2587	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9949	0.9977	0.9970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.9818	382.0942	390.1001	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1466.1202	1412.6856	1345.9969	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	707.1396	766.7600	711.1873	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2185.0868	(104)
Cooled fraction										fC = cooled area / (4) =		0.6283	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	111.0690	120.4335	111.7048	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												343.2074	(107)
Space cooling per m2												3.5938	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	630.8451	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	231.8356	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	430.5518	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2195.5510	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	806.8650	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1498.4635	(310b)
Electricity used for heat distribution	29.6772	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	79.4461	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	216.2717	(330a)
Total electricity for the above, kWh/year	216.2717	(331)
Electricity for lighting (calculated in Appendix L)	397.4074	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3660.8411	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1093.3690	0.2160	236.1677	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	782.8215	0.2160	169.0894	(363)
less credit emissions for electricity	-273.9875	0.5190	-142.1995	(364)
Water heating from Combined Heat and Power	2724.4791	0.2160	588.4875	(365)
less credit emissions for electricity	-953.5677	0.5190	-494.9016	(366)
Electrical energy for heat distribution	29.6772	0.5190	15.4024	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			372.0459	(373)
Space and water heating			372.0459	(376)
Space cooling	79.4461	0.5190	41.2326	(377)
Pumps and fans	216.2717	0.5190	112.2450	(378)
Energy for lighting	397.4074	0.5190	206.2544	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			576.0779	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.0300	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.0300	ZC1
Total Floor Area	TFA	95.5000	
Assumed number of occupants	N	2.6938	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4406	ZC2
CO2 emissions from cooking, equation (L16)		1.9230	ZC3
Total CO2 emissions		23.3937	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.3937	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1163	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3663	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3114	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3970	0.3892	0.3815	0.3425	0.3347	0.2958	0.2958	0.2880	0.3114	0.3347	0.3503	0.3659	(22b)
Effective ac	0.5788	0.5758	0.5728	0.5587	0.5560	0.5438	0.5438	0.5415	0.5485	0.5560	0.5614	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			18.0000	1.3258	23.8636			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1800	2.6406			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.5042			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		31.9042	(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	49.2517	48.9913	48.7360	47.5371	47.3127	46.2685	46.2685	46.0751	46.6707	47.3127	47.7665	48.2410	(38)
Heat transfer coeff	81.1560	80.8955	80.6403	79.4413	79.2170	78.1727	78.1727	77.9793	78.5750	79.2170	79.6708	80.1452	(39)
Average = Sum(39)m / 12 =												79.4402	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8498	0.8471	0.8444	0.8318	0.8295	0.8186	0.8186	0.8165	0.8228	0.8295	0.8342	0.8392	(40)
HLP (average)												0.8318	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6938 (42)
Average daily hot water use (litres/day)		98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0230	21.0107	21.6812	18.9022	18.1371	15.6509	14.5029	16.6423	16.8410	19.6266	21.4239	23.2650	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	206.7484	182.1570	191.1359	171.1062	167.5087	149.4312	143.2807	157.5433	157.3653	177.4388	187.9181	201.6950	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	206.7484	182.1570	191.1359	171.1062	167.5087	149.4312	143.2807	157.5433	157.3653	177.4388	187.9181	201.6950	(64)
								Total per year (kWh/year) = Sum(64)m =				2093.3286	(64)
Heat gains from water heating, kWh/month													
	90.5270	80.2423	85.3358	77.9732	77.4798	70.7663	69.4239	74.1663	73.4044	80.7815	83.5632	88.8467	(65)

---

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	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5029	19.9868	16.2544	12.3056	9.1986	7.7658	8.3913	10.9073	14.6397	18.5885	21.6955	23.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8409	251.4231	244.9161	231.0634	213.5768	197.1419	186.1624	183.5802	190.0873	203.9400	221.4265	237.8614	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	(71)
Water heating gains (Table 5)													
	121.6760	119.4081	114.6987	108.2962	104.1395	98.2866	93.3118	99.6858	101.9505	108.5773	116.0600	119.4176	(72)
Total internal gains													
	459.4265	457.2248	442.2759	418.0719	393.3216	369.6010	354.2721	360.5800	373.0842	397.5125	425.5888	446.8140	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	36.7938	0.6300	0.7000	0.7700	202.4041	(77)

Solar gains	202.4041	344.7691	471.7281	584.4940	654.6820	649.9477	626.6189	574.2555	510.7818	381.0433	242.4335	173.2158	(83)
Total gains	661.8307	801.9939	914.0040	1002.5659	1048.0036	1019.5487	980.8911	934.8356	883.8660	778.5558	668.0223	620.0298	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.7185	81.9816	82.2411	83.4823	83.7187	84.8371	84.8371	85.0475	84.4028	83.7187	83.2419	82.7491	
alpha	6.4479	6.4654	6.4827	6.5655	6.5812	6.6558	6.6558	6.6698	6.6269	6.5812	6.5495	6.5166	
util living area													
	0.9949	0.9828	0.9475	0.8489	0.6809	0.4885	0.3504	0.3833	0.6039	0.8913	0.9852	0.9965	(86)
MIT	20.2751	20.4648	20.6841	20.8850	20.9759	20.9977	20.9998	20.9996	20.9912	20.8643	20.5312	20.2405	(87)
Th 2	20.2104	20.2127	20.2150	20.2258	20.2278	20.2373	20.2373	20.2390	20.2336	20.2278	20.2237	20.2195	(88)
util rest of house													
	0.9934	0.9779	0.9336	0.8165	0.6314	0.4313	0.2898	0.3201	0.5408	0.8590	0.9801	0.9955	(89)
MIT 2	19.2447	19.5199	19.8297	20.1018	20.2067	20.2358	20.2372	20.2389	20.2275	20.0842	19.6265	19.2016	(90)
Living area fraction									fLA = Living area / (4) =			0.3141	(91)
MIT	19.5684	19.8168	20.0981	20.3478	20.4483	20.4751	20.4767	20.4778	20.4674	20.3292	19.9107	19.5280	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5684	19.8168	20.0981	20.3478	20.4483	20.4751	20.4767	20.4778	20.4674	20.3292	19.9107	19.5280	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9749	0.9313	0.8220	0.6459	0.4492	0.3089	0.3400	0.5603	0.8637	0.9776	0.9942	(94)
Useful gains	656.3741	781.8737	851.1890	824.0605	676.8790	458.0233	302.9717	317.8297	495.2554	672.4113	653.0368	616.4430	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1239.1229	1206.6993	1096.5540	909.4288	693.0141	459.2762	303.0561	317.9876	500.3210	770.7218	1020.6361	1228.4652	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	433.5651	285.4828	182.5515	61.4652	12.0045	0.0000	0.0000	0.0000	0.0000	73.1430	264.6715	455.3445	(98)
Space heating												1768.2281	(98)
Space heating per m2											(98) / (4) =	18.5155	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1891.1531	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	433.5651	285.4828	182.5515	61.4652	12.0045	0.0000	0.0000	0.0000	0.0000	73.1430	264.6715	455.3445	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	463.7060	305.3292	195.2423	65.7381	12.8390	0.0000	0.0000	0.0000	0.0000	78.2278	283.0711	486.9995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	206.7484	182.1570	191.1359	171.1062	167.5087	149.4312	143.2807	157.5433	157.3653	177.4388	187.9181	201.6950	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.7445	86.0079	84.6916	82.3739	80.4360	79.8000	79.8000	79.8000	79.8000	82.6524	85.7273	86.9222	(217)
Fuel for water heating, kWh/month													
	238.3419	211.7911	225.6846	207.7189	208.2510	187.2572	179.5497	197.4226	197.1996	214.6807	219.2046	232.0408	(219)
Water heating fuel used												2519.1426	(219)
Annual totals kWh/year													
Space heating fuel - main system												1891.1531	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.4074	(232)
Total delivered energy for all uses												4882.7030	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1891.1531	0.2160	408.4891	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2519.1426	0.2160	544.1348	(264)
Space and water heating			952.6239	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.4074	0.5190	206.2544	(268)
Total CO2, kg/m2/year			1197.8033	(272)
Emissions per m2 for space and water heating			9.9751	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1597	(272b)
Emissions per m2 for pumps and fans			0.4076	(272c)
Target Carbon Dioxide Emission Rate (TER) = (9.9751 * 1.00) + 2.1597 + 0.4076, rounded to 2 d.p.			12.5400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1163	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2663	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2264	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2887	0.2830	0.2773	0.2490	0.2434	0.2151	0.2151	0.2094	0.2264	0.2434	0.2547	0.2660	(22b)
Effective ac	0.5417	0.5400	0.5385	0.5310	0.5296	0.5231	0.5231	0.5219	0.5256	0.5296	0.5324	0.5354	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1500	2.2005			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8112			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		32.1712	(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	46.0901	45.9525	45.8176	45.1838	45.0653	44.5133	44.5133	44.4111	44.7259	45.0653	45.3051	45.5559	(38)
Heat transfer coeff	78.2613	78.1237	77.9888	77.3550	77.2364	76.6845	76.6845	76.5822	76.8971	77.2364	77.4763	77.7271	(39)
Average = Sum(39)m / 12 =												77.3544	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8195	0.8180	0.8166	0.8100	0.8088	0.8030	0.8030	0.8019	0.8052	0.8088	0.8113	0.8139	(40)
HLP (average)												0.8100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6938 (42)
Average daily hot water use (litres/day)		98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	34.0326	29.7651	30.7150	26.7781	25.6942	22.1721	20.5457	23.5765	23.8581	27.8043	30.3506	32.9588 (65)

---

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	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5029	19.9868	16.2544	12.3056	9.1986	7.7658	8.3913	10.9073	14.6397	18.5885	21.6955	23.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8409	251.4231	244.9161	231.0634	213.5768	197.1419	186.1624	183.5802	190.0873	203.9400	221.4265	237.8614	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	(71)
Water heating gains (Table 5)													
	45.7428	44.2934	41.2836	37.1917	34.5352	30.7946	27.6152	31.6889	33.1363	37.3714	42.1536	44.2994	(72)
Total internal gains													
	380.4933	379.1101	365.8608	343.9675	320.7173	299.1091	285.5756	289.5831	301.2700	323.3066	348.6824	368.6958	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	36.7938	0.6800	0.8000	0.7700	249.6776	(77)

Solar gains	249.6776	425.2934	581.9050	721.0085	807.5896	801.7495	772.9721	708.3787	630.0800	470.0398	299.0563	213.6720	(83)
Total gains	630.1709	804.4035	947.7657	1064.9759	1128.3069	1100.8586	1058.5477	997.9618	931.3500	793.3464	647.7386	582.3679	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.8964	33.9561	34.0149	34.2935	34.3462	34.5934	34.5934	34.6396	34.4978	34.3462	34.2399	34.1294	
alpha	3.2598	3.2637	3.2677	3.2862	3.2897	3.3062	3.3062	3.3093	3.2999	3.2897	3.2827	3.2753	
util living area	0.9497	0.9016	0.8283	0.7150	0.5754	0.4282	0.3138	0.3456	0.5277	0.7716	0.9153	0.9594	(86)
MIT	19.5032	19.8742	20.2686	20.6299	20.8535	20.9587	20.9888	20.9844	20.9168	20.5946	19.9740	19.4181	(87)
Th 2	20.2365	20.2377	20.2389	20.2447	20.2457	20.2508	20.2508	20.2517	20.2488	20.2457	20.2436	20.2413	(88)
util rest of house	0.9435	0.8905	0.8103	0.6879	0.5387	0.3825	0.2621	0.2919	0.4795	0.7422	0.9037	0.9542	(89)
MIT 2	18.8576	19.2189	19.5970	19.9372	20.1350	20.2247	20.2453	20.2438	20.1930	19.9144	19.3259	18.7779	(90)
Living area fraction									fLA = Living area / (4) =			0.3141	(91)
MIT	19.0604	19.4248	19.8080	20.1548	20.3608	20.4553	20.4789	20.4764	20.4204	20.1281	19.5295	18.9790	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0604	19.4248	19.8080	20.1548	20.3608	20.4553	20.4789	20.4764	20.4204	20.1281	19.5295	18.9790	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9318	0.8769	0.7992	0.6845	0.5445	0.3952	0.2779	0.3082	0.4908	0.7373	0.8910	0.9436	(94)
Useful gains	587.1962	705.3823	757.4373	728.9465	614.3580	435.0051	294.2193	307.5684	457.0789	584.9287	577.1298	549.5382	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1155.1689	1134.7279	1037.8710	870.6148	668.9257	449.0073	297.4498	312.1834	486.0183	735.9160	962.9943	1148.7302	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	422.5717	288.5203	208.6426	102.0012	40.5984	0.0000	0.0000	0.0000	0.0000	112.3345	277.8224	445.7988	(98)
Space heating												1898.2899	(98)
Space heating per m2										(98) / (4) =		19.8774	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	720.8340	567.4650	582.0251	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9416	0.9653	0.9575	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	678.7111	547.7910	557.2608	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1389.2928	1337.6537	1268.6646	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	511.6188	587.6578	529.2844	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1628.5611	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	127.9047	146.9145	132.3211	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												407.1403 (107)
Space cooling per m2												4.2632 (108)
Energy for space heating												19.8774 (99)
Energy for space cooling												4.2632 (108)
Total												24.1406 (109)
Dwelling Fabric Energy Efficiency (DFEE)												24.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1163	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3663	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3114	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3970	0.3892	0.3815	0.3425	0.3347	0.2958	0.2958	0.2880	0.3114	0.3347	0.3503	0.3659	(22b)
Effective ac	0.5788	0.5758	0.5728	0.5587	0.5560	0.5438	0.5438	0.5415	0.5485	0.5560	0.5614	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			18.0000	1.3258	23.8636			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1800	2.6406			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.5042			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		31.9042	(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	49.2517	48.9913	48.7360	47.5371	47.3127	46.2685	46.2685	46.0751	46.6707	47.3127	47.7665	48.2410	(38)
Heat transfer coeff	81.1560	80.8955	80.6403	79.4413	79.2170	78.1727	78.1727	77.9793	78.5750	79.2170	79.6708	80.1452	(39)
Average = Sum(39)m / 12 =												79.4402	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8498	0.8471	0.8444	0.8318	0.8295	0.8186	0.8186	0.8165	0.8228	0.8295	0.8342	0.8392	(40)
HLP (average)												0.8318	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6938	(42)
Average daily hot water use (litres/day)												98.1773	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.0326	29.7651	30.7150	26.7781	25.6942	22.1721	20.5457	23.5765	23.8581	27.8043	30.3506	32.9588	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	134.6890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5029	19.9868	16.2544	12.3056	9.1986	7.7658	8.3913	10.9073	14.6397	18.5885	21.6955	23.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8409	251.4231	244.9161	231.0634	213.5768	197.1419	186.1624	183.5802	190.0873	203.9400	221.4265	237.8614	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	36.4689	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	(71)
Water heating gains (Table 5)													
	45.7428	44.2934	41.2836	37.1917	34.5352	30.7946	27.6152	31.6889	33.1363	37.3714	42.1536	44.2994	(72)
Total internal gains													
	380.4933	379.1101	365.8608	343.9675	320.7173	299.1091	285.5756	289.5831	301.2700	323.3066	348.6824	368.6958	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	36.7938	0.6300	0.7000	0.7700	202.4041	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	202.4041	344.7691	471.7281	584.4940	654.6820	649.9477	626.6189	574.2555	510.7818	381.0433	242.4335	173.2158	(83)
Total gains	582.8974	723.8792	837.5889	928.4615	975.3993	949.0568	912.1945	863.8386	812.0517	704.3499	591.1158	541.9116	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.7185	81.9816	82.2411	83.4823	83.7187	84.8371	84.8371	85.0475	84.4028	83.7187	83.2419	82.7491	
alpha	6.4479	6.4654	6.4827	6.5655	6.5812	6.6558	6.6558	6.6698	6.6269	6.5812	6.5495	6.5166	
util living area	0.9975	0.9899	0.9644	0.8824	0.7222	0.5236	0.3767	0.4146	0.6517	0.9256	0.9923	0.9984	(86)
MIT	20.1950	20.3902	20.6236	20.8518	20.9663	20.9965	20.9997	20.9994	20.9864	20.8205	20.4565	20.1604	(87)
Th 2	20.2104	20.2127	20.2150	20.2258	20.2278	20.2373	20.2373	20.2390	20.2336	20.2278	20.2237	20.2195	(88)
util rest of house	0.9967	0.9869	0.9542	0.8538	0.6724	0.4628	0.3116	0.3464	0.5857	0.9000	0.9895	0.9979	(89)
MIT 2	19.4715	19.6670	19.8956	20.1141	20.2072	20.2358	20.2372	20.2388	20.2271	20.0933	19.7431	19.4448	(90)
Living area fraction									fLA = Living area / (4) =			0.3141	(91)
MIT	19.6988	19.8942	20.1243	20.3458	20.4457	20.4747	20.4767	20.4778	20.4656	20.3218	19.9672	19.6696	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6988	19.8942	20.1243	20.3458	20.4457	20.4747	20.4767	20.4778	20.4656	20.3218	19.9672	19.6696	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9854	0.9529	0.8586	0.6869	0.4819	0.3321	0.3678	0.6062	0.9035	0.9883	0.9974	(94)
Useful gains	580.6138	713.2846	798.1275	797.1634	669.9739	457.3467	302.9206	317.7248	492.2382	636.3763	584.2100	540.5217	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1249.7036	1212.9605	1098.6663	909.2718	692.8064	459.2444	303.0528	317.9808	500.1769	770.1283	1025.1389	1239.8175	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	497.8029	335.7822	223.6009	80.7180	16.9874	0.0000	0.0000	0.0000	0.0000	99.5115	317.4688	520.2761	(98)
Space heating												2092.1478	(98)
Space heating per m2											(98) / (4) =	21.9073	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	734.8236	578.4782	592.6430	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9856	0.9952	0.9929	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	724.2382	575.7285	588.4461	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1211.8621	1166.5916	1111.8973	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	351.0892	439.6021	389.4477	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1180.1390	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	87.7723	109.9005	97.3619	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												295.0348	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	3.0894 (108)
Energy for space heating	21.9073 (99)
Energy for space cooling	3.0894 (108)
Total	24.9967 (109)
Target Fabric Energy Efficiency (TFEE)	28.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1500	2.2005			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8112			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	32.1712	(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	19.8527	19.5815	19.3102	18.7678	18.7678	17.6829	18.2253	17.6829	17.4116	17.9541	17.9541	19.0390	(38)
Heat transfer coeff	52.0239	51.7526	51.4814	50.9390	50.9390	49.8541	50.3965	49.8541	49.5828	50.1253	50.1253	51.2102	(39)
Average = Sum(39)m / 12 =												50.6903	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5448	0.5419	0.5391	0.5334	0.5334	0.5220	0.5277	0.5220	0.5192	0.5249	0.5249	0.5362	(40)
HLP (average)												0.5308	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6938 (42)
Average daily hot water use (litres/day)	98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0230	21.0107	21.6812	18.9022	18.1371	15.6509	14.5029	16.6423	16.8410	19.6266	21.4239	23.2650	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
  b) If manufacturer declared loss factor is not known :
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                  0.0152 (51)
  Volume factor from Table 2a                                                                                 1.0294 (52)
  Temperature factor from Table 2b                                                                            0.6000 (53)
Enter (49) or (54) in (55)                                                                                    1.0327 (55)
Total storage loss
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (56)
If cylinder contains dedicated solar storage
              32.0144    28.9162    32.0144    30.9817    32.0144    30.9817    32.0144    32.0144    30.9817    32.0144    30.9817    32.0144 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             215.4303   189.9987   199.8178   179.5080   176.1906   157.8331   151.9626   166.2252   165.7671   186.1207   196.3200   210.3769 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             215.4303   189.9987   199.8178   179.5080   176.1906   157.8331   151.9626   166.2252   165.7671   186.1207   196.3200   210.3769 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   2195.5510 (64)
RHI water heating demand                                                                                      2196 (64)
Heat gains from water heating, kWh/month
              97.4725    86.5156    92.2813    84.6947    84.4253    77.4878    76.3695    81.1118    80.1259    87.7270    90.2847    95.7922 (65)


-------------------------------------------------------------------------------------------------------------
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         161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269   161.6269 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              56.2571    49.9671    40.6360    30.7640    22.9965    19.4146    20.9782    27.2682    36.5993    46.4712    54.2388    57.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             371.4044   375.2584   365.5464   344.8707   318.7714   294.2417   277.8543   274.0003   283.7123   304.3880   330.4873   355.0170 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565    53.8565 (69)
Pumps, fans    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512  -107.7512 (71)
Water heating gains (Table 5)
             131.0114   128.7435   124.0340   117.6316   113.4748   107.6219   102.6471   109.0212   111.2859   117.9127   125.3954   128.7530 (72)
Total internal gains
             666.4050   661.7011   637.9485   600.9984   562.9748   529.0103   509.2117   518.0218   539.3296   576.5040   617.8536   649.3228 (73)


-------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------
Southeast                              18.0000            39.0225            0.6800            0.8000            0.7700          264.8009 (77)
-------------------------------------------------------------------------------------------------------------

Solar gains   264.8009   397.2932   556.8425   715.8663   784.6432   833.8300   800.9476   753.6977   663.1096   488.7479   327.4649   232.2195 (83)
Total gains   931.2059  1058.9943  1194.7910  1316.8647  1347.6180  1362.8403  1310.1593  1271.7196  1202.4392  1065.2519   945.3186   881.5423 (84)


-------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           50.9916    51.2588    51.5288    52.0776    52.0776    53.2109    52.6381    53.2109    53.5019    52.9229    52.9229    51.8018
alpha          4.3994     4.4173     4.4353     4.4718     4.4718     4.5474     4.5092     4.5474     4.5668     4.5282     4.5282     4.4535
util living area
               0.7458     0.6654     0.5331     0.3945     0.2716     0.1536     0.0885     0.0941     0.2102     0.4006     0.6161     0.7655 (86)

MIT           20.7599    20.8548    20.9479    20.9877    20.9981    20.9999    21.0000    21.0000    20.9996    20.9897    20.9184    20.7418 (87)
Th 2          20.4800    20.4826    20.4851    20.4903    20.4903    20.5007    20.4955    20.5007    20.5033    20.4981    20.4981    20.4877 (88)
util rest of house
               0.7296     0.6478     0.5140     0.3756     0.2525     0.1354     0.0691     0.0745     0.1897     0.3781     0.5953     0.7498 (89)
MIT 2         20.1695    20.2979    20.4216    20.4762    20.4884    20.5006    20.4955    20.5007    20.5029    20.4869    20.3980    20.1525 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.3141 (91)
MIT           20.3550    20.4729    20.5869    20.6369    20.6485    20.6575    20.6540    20.6575    20.6590    20.6449    20.5615    20.3376 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT  20.3550    20.4729    20.5869    20.6369    20.6485    20.6575    20.6540    20.6575    20.6590    20.6449    20.5615    20.3376 (93)


-------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.7255     0.6474     0.5178     0.3811     0.2584     0.1411     0.0752     0.0807     0.1961     0.3847     0.5980     0.7450 (94)
Useful gains 675.5923   685.6164   618.7098   501.8182   348.2431   192.2878    98.4728   102.5752   235.8512   409.7823   565.2820   656.7465 (95)
Ext temp.      5.7000     6.2000     8.2000    10.7000    13.8000    16.8000    18.7000    18.6000    15.9000    12.4000     8.7000     5.7000 (96)
Heat loss rate W
             762.4080   738.6583   637.6944   506.1738   348.8571   192.3102    98.4735   102.5762   235.9630   413.2760   594.5602   749.5954 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              64.5909    35.6442    14.1245     3.1360     0.4569     0.0000     0.0000     0.0000     0.0000     2.5993    21.0803    69.0796 (98)
Space heating                                                                                                 210.7117 (98)
RHI space heating demand                                                                                      211 (98)


-------------------------------------------------------------------------------------------------------------
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1500	2.2005			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8112			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	32.1712	(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	23.1074	22.8362	22.5649	21.2088	20.9376	19.5815	19.5815	19.3102	20.1239	20.9376	21.4800	22.0225	(38)
Heat transfer coeff	55.2786	55.0073	54.7361	53.3800	53.1088	51.7526	51.7526	51.4814	52.2951	53.1088	53.6512	54.1937	(39)
Average = Sum(39)m / 12 =												53.3122	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5788	0.5760	0.5732	0.5590	0.5561	0.5419	0.5419	0.5391	0.5476	0.5561	0.5618	0.5675	(40)
HLP (average)												0.5582	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6938 (42)
Average daily hot water use (litres/day)	98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0230	21.0107	21.6812	18.9022	18.1371	15.6509	14.5029	16.6423	16.8410	19.6266	21.4239	23.2650	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
215.4303 189.9987 199.8178 179.5080 176.1906 157.8331 151.9626 166.2252 165.7671 186.1207 196.3200 210.3769 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
215.4303 189.9987 199.8178 179.5080 176.1906 157.8331 151.9626 166.2252 165.7671 186.1207 196.3200 210.3769 (64)
Total per year (kWh/year) = Sum(64)m = 2195.5510 (64)
Heat gains from water heating, kWh/month
97.4725 86.5156 92.2813 84.6947 84.4253 77.4878 76.3695 81.1118 80.1259 87.7270 90.2847 95.7922 (65)

---

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	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
56.2571 49.9671 40.6360 30.7640 22.9965 19.4146 20.9782 27.2682 36.5993 46.4712 54.2388 57.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
371.4044 375.2584 365.5464 344.8707 318.7714 294.2417 277.8543 274.0003 283.7123 304.3880 330.4873 355.0170 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 53.8565 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 -107.7512 (71)
Water heating gains (Table 5)
131.0114 128.7435 124.0340 117.6316 113.4748 107.6219 102.6471 109.0212 111.2859 117.9127 125.3954 128.7530 (72)
Total internal gains
666.4050 661.7011 637.9485 600.9984 562.9748 529.0103 509.2117 518.0218 539.3296 576.5040 617.8536 649.3228 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	36.7938	0.6800	0.8000	0.7700	249.6776	(77)

Solar gains	249.6776	425.2934	581.9050	721.0085	807.5896	801.7495	772.9721	708.3787	630.0800	470.0398	299.0563	213.6720	(83)
Total gains	916.0827	1086.9945	1219.8535	1322.0069	1370.5644	1330.7598	1282.1838	1226.4005	1169.4097	1046.5438	916.9099	862.9949	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.9893	48.2259	48.4648	49.6961	49.9499	51.2588	51.2588	51.5288	50.7271	49.9499	49.4449	48.9500	
alpha	4.1993	4.2151	4.2310	4.3131	4.3300	4.4173	4.4173	4.4353	4.3818	4.3300	4.2963	4.2633	
util living area	0.8108	0.7178	0.6094	0.4769	0.3576	0.2485	0.1775	0.1930	0.3073	0.5116	0.7194	0.8310	(86)
MIT	20.5792	20.7539	20.8824	20.9638	20.9910	20.9987	20.9998	20.9997	20.9966	20.9601	20.7976	20.5470	(87)
Th 2	20.4491	20.4517	20.4542	20.4671	20.4697	20.4826	20.4826	20.4851	20.4774	20.4697	20.4645	20.4594	(88)
util rest of house	0.7971	0.7014	0.5908	0.4576	0.3377	0.2285	0.1567	0.1714	0.2844	0.4880	0.7006	0.8183	(89)
MIT 2	19.8940	20.1333	20.3066	20.4238	20.4597	20.4814	20.4824	20.4849	20.4740	20.4233	20.2076	19.8589	(90)
Living area fraction									fLA = Living area / (4) =			0.3141	(91)
MIT	20.1092	20.3283	20.4875	20.5934	20.6266	20.6439	20.6449	20.6466	20.6382	20.5919	20.3930	20.0750	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1092	20.3283	20.4875	20.5934	20.6266	20.6439	20.6449	20.6466	20.6382	20.5919	20.3930	20.0750	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7882	0.6976	0.5919	0.4622	0.3436	0.2347	0.1632	0.1782	0.2914	0.4935	0.6980	0.8087	(94)
Useful gains	722.0298	758.2386	722.0856	611.0052	470.9433	312.3875	209.2772	218.5361	340.8070	516.4575	640.0093	697.9468	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	873.9108	848.6678	765.6192	624.1960	474.0815	312.7868	209.3356	218.6218	341.9141	530.6580	713.1844	860.3259	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	112.9994	60.7685	32.3890	9.4974	2.3348	0.0000	0.0000	0.0000	0.0000	10.5652	52.6861	120.8100	(98)
Space heating												402.0504	(98)
Space heating per m2										(98) / (4) =		4.2100	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	486.4748	382.9695	391.2587	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9949	0.9977	0.9970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.9818	382.0942	390.1001	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1466.1202	1412.6856	1345.9969	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	707.1396	766.7600	711.1873	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling	2185.0868	(104)
Cooled fraction	fC = cooled area / (4) = 0.6283	(105)

Intermittency factor (Table 10b)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	111.0690	120.4335	111.7048	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling	343.2074	(107)
Space cooling per m2	3.5938	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	402.0504	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	147.7535	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	274.3994	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2195.5510	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	806.8650	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1498.4635	(310b)
Electricity used for heat distribution	27.2748	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	79.4461	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	216.2717	(330a)
Total electricity for the above, kWh/year	216.2717	(331)
Electricity for lighting (calculated in Appendix L)	397.4074	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3420.6066	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	147.7535	4.2400	6.2647	(340a)
Space heating from Combined Heat and Power	274.3994	2.9700	8.1497	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	806.8650	4.2400	34.2111	(342a)
Water heating from Combined Heat and Power	1498.4635	2.9700	44.5044	(342b)
Space cooling	79.4461	13.1900	10.4789	(348)
Mechanical ventilation fans	216.2717	13.1900	28.5262	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	397.4074	13.1900	52.4180	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			264.9831	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7921	(357)
SAP value	88.9499	
SAP rating (Section 12)	89	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1004.8616	0.2160	217.0501	(367)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	498.9080	0.2160	107.7641 (363)
less credit emissions for electricity	-174.6178	0.5190	-90.6266 (364)
Water heating from Combined Heat and Power	2724.4791	0.2160	588.4875 (365)
less credit emissions for electricity	-953.5677	0.5190	-494.9016 (366)
Electrical energy for heat distribution	27.2748	0.5190	14.1556 (372)
Total CO2 associated with community systems			341.9291 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			341.9291 (376)
Space cooling	79.4461	0.5190	41.2326 (377)
Pumps and fans	216.2717	0.5190	112.2450 (378)
Energy for lighting	397.4074	0.5190	206.2544 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			545.9611 (383)
CO2 emissions per m2			5.7200 (384)
EI value			94.7930 (384a)
EI rating			95 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	95.5000 (1b)	x	2.7000 (2b)	=	257.8500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	257.8500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			18.0000	1.1450	20.6107			(27)
External Wall 1	32.6700	18.0000	14.6700	0.1500	2.2005			(29a)
Total net area of external elements Aum(A, m2)			32.6700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8112			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	32.1712	(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	19.8527	19.5815	19.3102	18.7678	18.7678	17.6829	18.2253	17.6829	17.4116	17.9541	17.9541	19.0390	(38)
Heat transfer coeff	52.0239	51.7526	51.4814	50.9390	50.9390	49.8541	50.3965	49.8541	49.5828	50.1253	50.1253	51.2102	(39)
Average = Sum(39)m / 12 =												50.6903	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5448	0.5419	0.5391	0.5334	0.5334	0.5220	0.5277	0.5220	0.5192	0.5249	0.5249	0.5362	(40)
HLP (average)												0.5308	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6938 (42)
Average daily hot water use (litres/day)	98.1773 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9950	104.0679	100.1408	96.2138	92.2867	88.3596	88.3596	92.2867	96.2138	100.1408	104.0679	107.9950	(44)
Energy conte	160.1535	140.0713	144.5410	126.0144	120.9138	104.3394	96.6858	110.9484	112.2734	130.8439	142.8263	155.1001	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7112	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0230	21.0107	21.6812	18.9022	18.1371	15.6509	14.5029	16.6423	16.8410	19.6266	21.4239	23.2650	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	215.4303	189.9987	199.8178	179.5080	176.1906	157.8331	151.9626	166.2252	165.7671	186.1207	196.3200	210.3769 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	215.4303	189.9987	199.8178	179.5080	176.1906	157.8331	151.9626	166.2252	165.7671	186.1207	196.3200	210.3769 (64)

Total per year (kWh/year) = Sum(64)m = 2195.5510 (64)

Heat gains from water heating, kWh/month

	97.4725	86.5156	92.2813	84.6947	84.4253	77.4878	76.3695	81.1118	80.1259	87.7270	90.2847	95.7922 (65)

---

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	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	161.6269	(66)

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

	56.2571	49.9671	40.6360	30.7640	22.9965	19.4146	20.9782	27.2682	36.5993	46.4712	54.2388	57.8207	(67)

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

	371.4044	375.2584	365.5464	344.8707	318.7714	294.2417	277.8543	274.0003	283.7123	304.3880	330.4873	355.0170	(68)

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

	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	53.8565	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	-107.7512	(71)

Water heating gains (Table 5)

	131.0114	128.7435	124.0340	117.6316	113.4748	107.6219	102.6471	109.0212	111.2859	117.9127	125.3954	128.7530	(72)

Total internal gains

	666.4050	661.7011	637.9485	600.9984	562.9748	529.0103	509.2117	518.0218	539.3296	576.5040	617.8536	649.3228	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	18.0000	39.0225	0.6800	0.8000	0.7700	264.8009	(77)

Solar gains	264.8009	397.2932	556.8425	715.8663	784.6432	833.8300	800.9476	753.6977	663.1096	488.7479	327.4649	232.2195	(83)
Total gains	931.2059	1058.9943	1194.7910	1316.8647	1347.6180	1362.8403	1310.1593	1271.7196	1202.4392	1065.2519	945.3186	881.5423	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.9916	51.2588	51.5288	52.0776	52.0776	53.2109	52.6381	53.2109	53.5019	52.9229	52.9229	51.8018	
alpha	4.3994	4.4173	4.4353	4.4718	4.4718	4.5474	4.5092	4.5474	4.5668	4.5282	4.5282	4.4535	
util living area													
	0.7458	0.6654	0.5331	0.3945	0.2716	0.1536	0.0885	0.0941	0.2102	0.4006	0.6161	0.7655	(86)
MIT	20.7599	20.8548	20.9479	20.9877	20.9981	20.9999	21.0000	21.0000	20.9996	20.9897	20.9184	20.7418	(87)
Th 2	20.4800	20.4826	20.4851	20.4903	20.4903	20.5007	20.4955	20.5007	20.5033	20.4981	20.4981	20.4877	(88)
util rest of house													
	0.7296	0.6478	0.5140	0.3756	0.2525	0.1354	0.0691	0.0745	0.1897	0.3781	0.5953	0.7498	(89)
MIT 2	20.1695	20.2979	20.4216	20.4762	20.4884	20.5006	20.4955	20.5007	20.5029	20.4869	20.3980	20.1525	(90)
Living area fraction									fLA = Living area / (4) =			0.3141	(91)
MIT	20.3550	20.4729	20.5869	20.6369	20.6485	20.6575	20.6540	20.6575	20.6590	20.6449	20.5615	20.3376	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3550	20.4729	20.5869	20.6369	20.6485	20.6575	20.6540	20.6575	20.6590	20.6449	20.5615	20.3376	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7255	0.6474	0.5178	0.3811	0.2584	0.1411	0.0752	0.0807	0.1961	0.3847	0.5980	0.7450	(94)
Useful gains	675.5923	685.6164	618.7098	501.8182	348.2431	192.2878	98.4728	102.5752	235.8512	409.7823	565.2820	656.7465	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	762.4080	738.6583	637.6944	506.1738	348.8571	192.3102	98.4735	102.5762	235.9630	413.2760	594.5602	749.5954	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	64.5909	35.6442	14.1245	3.1360	0.4569	0.0000	0.0000	0.0000	0.0000	2.5993	21.0803	69.0796	(98)
Space heating												210.7117	(98)
Space heating per m2											(98) / (4) =	2.2064	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	358.9492	267.1015	269.2119	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9989	0.9996	0.9996	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	358.5439	266.9940	269.0909	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1503.6168	1445.3842	1398.9672	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	824.4525	876.7223	840.6280	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2541.8028	(104)
Cooled fraction											fC = cooled area / (4) =	0.6283	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	129.4952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												129.4952	(107)
Space cooling per m2												1.3560	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	210.7117	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	77.4365	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	143.8107	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2195.5510	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	806.8650	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1498.4635	(310b)
Electricity used for heat distribution	25.2658	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	29.9757	(315)
Annual totals kWh/year		
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	216.2717	(330a)
Total electricity for the above, kWh/year	216.2717	(331)
Electricity for lighting (calculated in Appendix L)	397.4074	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3170.2305	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	77.4365	5.0000	3.8718	(340a)
Space heating from Combined Heat and Power	143.8107	3.5000	5.0334	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	806.8650	5.0000	40.3432	(342a)
Water heating from Combined Heat and Power	1498.4635	3.5000	52.4462	(342b)
Space cooling	29.9757	15.7000	4.7062	(348)
Mechanical ventilation fans	216.2717	15.7000	33.9547	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	397.4074	15.7000	62.3930	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			244.6485	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	930.8437	0.2160	201.0622	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	261.4740	0.2160	56.4784	(363)
less credit emissions for electricity	-91.5159	0.5190	-47.4968	(364)
Water heating from Combined Heat and Power	2724.4791	0.2160	588.4875	(365)
less credit emissions for electricity	-953.5677	0.5190	-494.9016	(366)
Electrical energy for heat distribution	25.2658	0.5190	13.1129	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			316.7427	(373)
Space and water heating			316.7427	(376)
Space cooling	29.9757	0.5190	15.5574	(377)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Pumps and fans	216.2717	0.5190	112.2450 (378)
Energy for lighting	397.4074	0.5190	206.2544 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			495.0995 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	930.8437	1.2200	1135.6293	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	261.4740	1.2200	318.9983	(363)
less credit emissions for electricity	-91.5159	3.0700	-280.9538	(364)
Water heating from Combined Heat and Power	2724.4791	1.2200	3323.8645	(365)
less credit emissions for electricity	-953.5677	3.0700	-2927.4528	(366)
Electrical energy for heat distribution	25.2658	3.0700	77.5659	(372)
Total CO2 associated with community systems			1647.6514	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1647.6514	(376)
Space cooling	29.9757	3.0700	92.0255	(377)
Pumps and fans	216.2717	3.0700	663.9541	(378)
Energy for lighting	397.4074	3.0700	1220.0406	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			2702.6716	(383)
Primary energy kWh/m2/year			28.3002	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 95

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)
Recommendation texts revision number 4.9c (22 Feb 2014)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£101	£101	£0
Community scheme	£191	£191	£0
Space heating	£132	£132	£0
Space cooling	£5	£5	£0
Water heating	£93	£93	£0
Lighting	£62	£62	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£245	£245	£0
Total cost of uses	£245	£245	£0
Delivered energy	33 kWh/m²	33 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	28 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	510.54 (P1)
Transmission heat loss coefficient	32.17 (37)
Summer heat loss coefficient	542.71 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	18.0000	119.9223	0.6800	0.8000	0.9000	951.1665
total:						951.1665

	Jun	Jul	Aug	
Solar gains	998	951	887	(P3)
Internal gains	529	509	518	
Total summer gains	1528	1460	1405	(P5)
Summer gain/loss ratio	2.81	2.69	2.59	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.11	21.89	21.69	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	007049	**Issued on Date**	02/05/2018
Survey Reference	001	**Prop Type Ref**	0506
Property	Cromwell Road, Kensington, London, SW7 4DN		

SAP Rating	89 B	**DER**	6.56	**TER**	13.92
Environmental	94 A	**% DER<TER**	52.89		
CO_2 Emissions (t/year)	0.55	**DFEE**	31.02	**TFEE**	38.39
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.20		

Surveyor	N Duggan, Tel: 0000 000 0000	**Surveyor ID**	E399-0001
Client			

SAP2012 - 9.92 input data (DesignData) -

```
SAP2012 Input Data (Flat)       02/05/2018

FullRefNo:                      001

Regs Region:                    England
SAP Region:                     Thames Valley
Postcode:                       SW7 4DN
DwellingOrientation:            South East
Property Type:                  Flat, End-Terrace
Storeys:                        1
Date Built:                     2017
Sheltered Sides:                2
Sunlight Shade:                 Average or unknown
Measurements                    Perimeter, Floor Area, Storey Height
     1st Storey:                21, 101.5, 2.7
Living Area:                    30 m2, fraction: 29.6%
Thermal Mass:                   Simple calculation
Thermal Mass Simple:            Low
Thermal MassValue:              100
External Walls                  Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1                 29.7, 56.7, 150, CavityWallPlasterOnDabsDenseBlock, Cavity, 0, 0.15, Calculate
External Roofs                  Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings                  Area, Kappa, Construction, Element
     Party Ceilings 1           73, 80, Concrete floor slab, carpeted
Heat Loss Floors                Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors                    Area, Kappa, Construction, Element
     Party Floor 1              73, 40
Description                     Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
     Window                     Manufacturer, Window, Triple glazed, , , 0.68, , 0.8,
     G = 0.3                    Manufacturer, Window, Triple glazed, , , 0.3, , 0.8,
Openings                        Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
     Opening 1                  Window, External Wall 1, North East, , None, 0, , 0, 0, 0, 12.00,
     Window                     Window, External Wall 1, North West, , None, 1, True, 0, 0, 0, 3.00,
     SE                         Window, External Wall 1, South East, , None, 0, , 0, 0, 0, 12.00,
Conservatory:                   None
Draught Proofing:               100
Draught Lobby:                  Yes
Thermal Bridges
     Bridging:                  Calculate Bridges
     Y                          0.165
     List of Bridges            Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
     0.                         External wall, E1 Steel lintel with perforated steel base plate, Table K1 - Approved, No, 9, 0.5, 0.5, 4.50,
     1.                         External wall, E2 Other lintels (including other steel lintels), , No, 0, 0.3, 0.3, 0.00,
     2.                         External wall, E3 Sill, Table K1 - Approved, No, 9, 0.04, 0.04, 0.36,
     3.                         External wall, E4 Jamb, Table K1 - Approved, No, 25.2, 0.05, 0.05, 1.26,
     4.                         External wall, E5 Ground floor (normal), , No, 0, 0.16, 0.16, 0.00,
     5.                         External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
     6.                         External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
     7.                         External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     8.                         External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
     9.                         External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     10.                        External wall, E7 Party floor between dwellings (in blocks of flats), Table K1 - Approved, No, 36, 0.07, 0.07, 2.52,
     11.                        External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
     12.                        External wall, E9 Balcony between dwellings, wall insulation continuous, Table K1 - Approved, No, 6, 0.02, 0.02, 0.12,
     13.                        External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation , , No, 0, 1, 1, 0.00,
     14.                        External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     15.                        External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
     16.                        External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
     17.                        External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     18.                        External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
     19.                        External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
     20.                        External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
     21.                        External wall, E16 Corner (normal), , No, 0, 0.09, 0.09, 0.00,
     22.                        External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
     23.                        External wall, E18 Party wall between dwellings, Table K1 - Approved, No, 10, 0.06, 0.06, 0.60,
     24.                        External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
     25.                        Party wall, P1 Party wall - Ground floor, , No, 0, 0.16, 0.16, 0.00,
     26.                        Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
     27.                        Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
     28.                        Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 57.76, 0, 0, 0.00,
     29.                        Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
     30.                        Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
     31.                        Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
     32.                        Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
     33.                        External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
     34.                        External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
     35.                        External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
     36.                        External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
     37.                        External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
     38.                        External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
```

SAP2012 - 9.92 input data (DesignData) -

```
     39.                    External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
     40.                    External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
     41.                    External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:              True
Designed q50:               3
AsBuilt q50:                15
Property Tested:            False
Mechanical Ventilation
     MV System Present      Yes
     Windows In Hot Weather Windows fully open
     Cross Ventilation      Yes
     Night Ventilation      Yes
     Air Change Rate        6.00
     Approved Installation  Yes
     DataType               Database
     Type                   Balanced mechanical ventilation with heat recovery
     Database Ref Number    500167
     Configuration          2
     HR Duct Insulated      Yes
     ManufacturerSFP        0.55
     DuctType               Rigid
     HR Efficiency          92
     Wet Rooms              2
Chimneys MHS:               0
Chimneys SHS:               0
Chimneys Other:             0
Chimneys Total:             0
Open Flues MHS:             0
Open Flues SHS:             0
Open Flues Other:           0
Open Flues Total:           0
Intermittent Fans:          0
Passive Vents:              0
Flueless Gas Fires:         0
Cooling System
     Cooled Area            60.00
     Data Source            SAP table
     Type                   Split or Multi-Split
     Class                  A
     Control                Modulating
Light Fittings:             10
LEL Fittings:               10
Percentage of LEL Fittings: 100
External Lights Fitted:     No
External LELs Fitted:       No
Electricity Tariff:         Standard
Main Heating 1              None
Main Heating 2              None
Heating Systems Interaction Each system heats separate parts of dwelling
Smoke Control Area          Unknown
Community Heating
     Type                   Space and Water Combined
     PCDF Index             n/a
     Distribution Loss      Piping system >= 1991, pre-insulated, low temp, variable flow
     Controls               CCJ
     Ctrl SAP Code          2310
Community Heating Heat Sources:Source, Fuel Type, Heating Use, Percentage, Overal Efficiency, Electrical Efficiency, Heat Power Ratio, Heat Efficiency
     1                      Boilers, Space and Water, 35, 95
     2                      Combined Heat and Power, Space and Water, 65, 90
Secondary Heating           None
Water Heating
     Type                   CommunityHeating
     WHS                    HWP From main heating 1
     Low Water Usage        Yes
     SAP Code               901
     Showers in Property    Non-electric only
     Hot Water Cylinder     None
Flue Gas Heat Recovery System None
Waste Water Heat Recovery   none
PV Unit
Type                        More Dwellings, One Block
Apportioned Energy          300
Wind Turbine                None
Terrain Type:               Urban
Small Scale Hydro           None
Special Features            None


-------------------------------------------------------------------------------------------------------
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
-------------------------------------------------------------------------------------------------------

DWELLING AS DESIGNED

Mid-floor flat, total floor area 102 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas (c)
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 13.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  6.56 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)38.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)31.0 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.15 (max. 0.30)        0.15 (max. 0.70)          OK
```

SAP2012 - 9.92 input data (DesignData) -

Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:		3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main heating system:		Community heating scheme	-
Secondary heating system:		None	
5 Cylinder insulation			
Hot water storage		No cylinder	
6 Controls			
Space heating controls:		Charging system linked to use of community heating, TRVsOK	
Hot water controls:		No cylinder	
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum		75%	OK
8 Mechanical ventilation			
Continuous supply and extract system			
Specific fan power:		0.55	
Maximum		1.5	OK
MVHR efficiency:		92%	
Minimum:		70%	OK
9 Summertime temperature			
Overheating risk (Thames Valley):		Medium	OK
Based on:			
Overshading:		Average	
Windows facing North East:		12.00 m², No overhang	
Windows facing South East:		12.00 m², No overhang	
Windows facing North West:		3.00 m², Overhang twice as wide as window, ratio 1.00	
Air change rate:		6.00 ach	
Blinds/curtains:		None	
10 Key features			
Air permeability		3.0 m³/m²h	
Community CHP, Mains gas			
Photovoltaic array			

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.7000	27.0000	29.7000	0.1500	4.4550			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.3710			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7310	(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	24.5592	24.2709	23.9826	22.5413	22.2530	20.8117	20.8117	20.5234	21.3882	22.2530	22.8296	23.4061	(38)
Heat transfer coeff	69.2902	69.0019	68.7137	67.2723	66.9841	65.5427	65.5427	65.2545	66.1193	66.9841	67.5606	68.1371	(39)
Average = Sum(39)m / 12 =												67.2003	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6827	0.6798	0.6770	0.6628	0.6599	0.6457	0.6457	0.6429	0.6514	0.6599	0.6656	0.6713	(40)
HLP (average)												0.6621	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7530 (42)
Average daily hot water use (litres/day)	99.5834 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3671	21.3116	21.9917	19.1729	18.3968	15.8751	14.7106	16.8806	17.0822	19.9077	21.7308	23.5982	(46)
Water storage loss:													
Store volume												110.0000	(47)

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (64)
Total per year (kWh/year) = Sum(64)m = 2217.6741 (64)
Heat gains from water heating, kWh/month
98.2351 87.1827 92.9696 85.2948 85.0011 77.9847 76.8299 81.6401 80.6605 88.3501 90.9648 96.5308 (65)

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	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0660	20.4870	16.6611	12.6136	9.4288	7.9602	8.6013	11.1802	15.0061	19.0537	22.2385	23.7071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.7302	261.4150	254.6493	240.2461	222.0646	204.9766	193.5607	190.8759	197.6415	212.0448	230.2263	247.3143	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)
Water heating gains (Table 5)													
	132.0365	129.7361	124.9592	118.4650	114.2487	108.3120	103.2660	109.7313	112.0285	118.7501	126.3400	129.7457	(72)
Total internal gains													
	478.1274	475.9329	460.5644	435.6194	410.0369	385.5435	369.7227	376.0822	388.9709	414.1433	443.0995	465.0619	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	708.3828	889.3360	1082.4932	1300.5739	1464.9806	1470.7409	1400.2038	1259.0313	1094.1472	886.2198	722.7519	659.6152	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.6904	40.8604	41.0318	41.9109	42.0913	43.0169	43.0169	43.2069	42.6418	42.0913	41.7321	41.3790	
alpha	3.7127	3.7240	3.7355	3.7941	3.8061	3.8678	3.8678	3.8805	3.8428	3.8061	3.7821	3.7586	
util living area													
	0.9304	0.8661	0.7550	0.5816	0.4156	0.2836	0.2056	0.2377	0.4084	0.6879	0.8802	0.9425	(86)
MIT	19.9539	20.2836	20.6229	20.8781	20.9702	20.9950	20.9989	20.9981	20.9801	20.8156	20.3592	19.8963	(87)
Th 2	20.3562	20.3587	20.3612	20.3738	20.3764	20.3890	20.3890	20.3915	20.3839	20.3764	20.3713	20.3663	(88)
util rest of house													
	0.9228	0.8535	0.7357	0.5572	0.3895	0.2570	0.1772	0.2065	0.3740	0.6594	0.8666	0.9360	(89)
MIT 2	18.9448	19.4111	19.8800	20.2274	20.3437	20.3843	20.3882	20.3901	20.3643	20.1573	19.5340	18.8701	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.2430	19.6690	20.0996	20.4197	20.5289	20.5648	20.5687	20.5698	20.5463	20.3519	19.7779	19.1734	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2430	19.6690	20.0996	20.4197	20.5289	20.5648	20.5687	20.5698	20.5463	20.3519	19.7779	19.1734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9073	0.8384	0.7274	0.5590	0.3960	0.2647	0.1855	0.2157	0.3831	0.6582	0.8522	0.9215	(94)
Useful gains	642.7431	745.6240	787.3825	727.0304	580.0829	389.2411	259.8053	271.5403	419.2037	583.3000	615.9573	607.8592	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1035.4065	1019.0899	934.4755	774.9585	591.3943	390.9512	260.1205	272.0995	426.2256	653.2221	856.5273	1020.2441	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	292.1416	183.7691	109.4372	34.5082	8.4156	0.0000	0.0000	0.0000	0.0000	52.0221	173.2104	306.8144	(98)
Space heating												1160.3185	(98)
Space heating per m2											(98) / (4) =	11.4317	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	616.1017	485.0162	495.9339	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9898	0.9947	0.9920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.7997	482.4467	491.9908	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1811.8907	1727.4547	1563.9203	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	865.5055	926.2860	797.5155	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2589.3071	(104)
Cooled fraction											fC = cooled area / (4) =	0.5911	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.9072	136.8896	117.8594	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												382.6562	(107)
Space cooling per m2												3.7700	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1160.3185	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	426.4171	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	791.9174	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2217.6741	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	814.9952	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1513.5626	(310b)
Electricity used for heat distribution	35.4689	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	88.5778	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	229.8594	(330a)
Total electricity for the above, kWh/year	229.8594	(331)
Electricity for lighting (calculated in Appendix L)	407.3525	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	4272.6820	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1306.7498	0.2160	282.2580	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	1439.8498	0.2160	311.0076	(363)
less credit emissions for electricity	-503.9474	0.5190	-261.5487	(364)
Water heating from Combined Heat and Power	2751.9320	0.2160	594.4173	(365)
less credit emissions for electricity	-963.1762	0.5190	-499.8884	(366)
Electrical energy for heat distribution	35.4689	0.5190	18.4084	(372)
Total CO2 associated with community systems			444.6540	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			444.6540	(376)
Space cooling	88.5778	0.5190	45.9719	(377)
Pumps and fans	229.8594	0.5190	119.2970	(378)
Energy for lighting	407.3525	0.5190	211.4159	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(380)
Total CO2, kg/year			665.6389	(383)
Dwelling Carbon Dioxide Emission Rate (DER)			6.5600	(384)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.5600	ZC1
Total Floor Area	TFA	101.5000	
Assumed number of occupants	N	2.7530	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1052	ZC2
CO2 emissions from cooking, equation (L16)		1.8234	ZC3
Total CO2 emissions		23.4886	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.4886	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1460	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3960	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3366	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4291	0.4207	0.4123	0.3702	0.3618	0.3197	0.3197	0.3113	0.3366	0.3618	0.3786	0.3955	(22b)
Effective ac	0.5921	0.5885	0.5850	0.5685	0.5655	0.5511	0.5511	0.5485	0.5566	0.5655	0.5717	0.5782	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			25.3800	1.3258	33.6477			(27)
External Wall 1	56.7000	25.3800	31.3200	0.1800	5.6376			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.2853			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		44.6853	(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	53.5449	53.2216	52.9047	51.4160	51.1375	49.8410	49.8410	49.6009	50.3404	51.1375	51.7010	52.2900	(38)
Heat transfer coeff	98.2303	97.9069	97.5900	96.1014	95.8229	94.5263	94.5263	94.2862	95.0257	95.8229	96.3863	96.9753	(39)
Average = Sum(39)m / 12 =												96.1000	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9678	0.9646	0.9615	0.9468	0.9441	0.9313	0.9313	0.9289	0.9362	0.9441	0.9496	0.9554	(40)
HLP (average)												0.9468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7530 (42)
Average daily hot water use (litres/day)		99.5834 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3671	21.3116	21.9917	19.1729	18.3968	15.8751	14.7106	16.8806	17.0822	19.9077	21.7308	23.5982	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	209.0421	184.1631	193.2060	172.9110	169.2404	150.9256	144.6654	159.1322	158.9732	179.3127	189.9637	203.9163	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	209.0421	184.1631	193.2060	172.9110	169.2404	150.9256	144.6654	159.1322	158.9732	179.3127	189.9637	203.9163	(64)
								Total per year (kWh/year) = Sum(64)m =				2115.4517	(64)
Heat gains from water heating, kWh/month													
	91.2896	80.9093	86.0241	78.5733	78.0555	71.2632	69.8844	74.6946	73.9390	81.4046	84.2434	89.5853	(65)

---

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	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0660	20.4870	16.6611	12.6136	9.4288	7.9602	8.6013	11.1802	15.0061	19.0537	22.2385	23.7071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.7302	261.4150	254.6493	240.2461	222.0646	204.9766	193.5607	190.8759	197.6415	212.0448	230.2263	247.3143	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)
Water heating gains (Table 5)													
	122.7011	120.4007	115.6238	109.1296	104.9134	98.9767	93.9306	100.3960	102.6931	109.4148	117.0047	120.4104	(72)
Total internal gains													
	471.7920	469.5975	454.2291	429.2841	403.7015	379.2082	363.3873	369.7469	382.6355	407.8080	436.7641	458.7265	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2800	11.2829	0.6300	0.7000	0.7700	38.8958	(75)
Southeast	11.2800	36.7938	0.6300	0.7000	0.7700	126.8399	(77)
Northwest	2.8200	11.2829	0.6300	0.7000	0.7700	9.7240	(81)

Solar gains	175.4597	315.0223	473.9234	659.1144	803.8904	826.9443	785.2493	672.8267	537.3599	359.7327	213.1013	148.2539	(83)
Total gains	647.2517	784.6198	928.1525	1088.3985	1207.5919	1206.1525	1148.6367	1042.5735	919.9954	767.5407	649.8654	606.9804	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7560	71.9930	72.2268	73.3456	73.5588	74.5677	74.5677	74.7576	74.1758	73.5588	73.1288	72.6846	
alpha	5.7837	5.7995	5.8151	5.8897	5.9039	5.9712	5.9712	5.9838	5.9451	5.9039	5.8753	5.8456	
util living area													
	0.9972	0.9911	0.9686	0.8816	0.7013	0.4975	0.3616	0.4147	0.6825	0.9411	0.9926	0.9980	(86)
MIT	20.0477	20.2352	20.5055	20.8046	20.9574	20.9952	20.9994	20.9987	20.9732	20.7364	20.3329	20.0183	(87)
Th 2	20.1103	20.1129	20.1156	20.1279	20.1302	20.1410	20.1410	20.1430	20.1368	20.1302	20.1255	20.1206	(88)
util rest of house													
	0.9963	0.9884	0.9590	0.8511	0.6469	0.4326	0.2913	0.3382	0.6088	0.9182	0.9898	0.9974	(89)
MIT 2	18.8372	19.1115	19.5000	19.9131	20.0928	20.1381	20.1408	20.1425	20.1177	19.8367	19.2644	18.8020	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.1950	19.4437	19.7972	20.1766	20.3484	20.3914	20.3946	20.3956	20.3706	20.1026	19.5802	19.1615	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1950	19.4437	19.7972	20.1766	20.3484	20.3914	20.3946	20.3956	20.3706	20.1026	19.5802	19.1615	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9856	0.9548	0.8530	0.6611	0.4517	0.3121	0.3608	0.6295	0.9173	0.9875	0.9964	(94)
Useful gains	644.0123	773.3111	886.2355	928.4021	798.2929	544.7590	358.4486	376.1805	579.1788	704.0700	641.7263	604.8097	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1463.1409	1423.9250	1297.6738	1083.6950	828.7110	547.4437	358.6852	376.7254	595.8680	910.5649	1202.9196	1450.8989	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	609.4316	437.2126	306.1101	111.8109	22.6311	0.0000	0.0000	0.0000	0.0000	153.6322	404.0592	629.4904	(98)
Space heating												2674.3781	(98)
Space heating per m2											(98) / (4) =	26.3486	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2860.2974	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	609.4316	437.2126	306.1101	111.8109	22.6311	0.0000	0.0000	0.0000	0.0000	153.6322	404.0592	629.4904	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	651.7985	467.6071	327.3905	119.5839	24.2043	0.0000	0.0000	0.0000	0.0000	164.3125	432.1489	673.2517	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	209.0421	184.1631	193.2060	172.9110	169.2404	150.9256	144.6654	159.1322	158.9732	179.3127	189.9637	203.9163	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.5034	87.0410	86.0362	83.6855	80.9286	79.8000	79.8000	79.8000	79.8000	84.4048	86.7790	87.6252	(217)
Fuel for water heating, kWh/month													
	238.8961	211.5820	224.5637	206.6199	209.1231	189.1298	181.2850	199.4138	199.2146	212.4437	218.9052	232.7142	(219)
Water heating fuel used												2523.8912	(219)
Annual totals kWh/year													
Space heating fuel - main system												2860.2974	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.3525	(232)
Total delivered energy for all uses												5866.5411	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2860.2974	0.2160	617.8242	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2523.8912	0.2160	545.1605	(264)
Space and water heating			1162.9847	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	407.3525	0.5190	211.4159	(268)
Total CO2, kg/m2/year			1413.3257	(272)
Emissions per m2 for space and water heating			11.4580	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0829	(272b)
Emissions per m2 for pumps and fans			0.3835	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.4580 * 1.00) + 2.0829 + 0.3835, rounded to 2 d.p.			13.9200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1460	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.2960	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2516	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3207	0.3145	0.3082	0.2767	0.2704	0.2390	0.2390	0.2327	0.2516	0.2704	0.2830	0.2956	(22b)
Effective ac	0.5514	0.5494	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5316	0.5366	0.5400	0.5437	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.7000	27.0000	29.7000	0.1500	4.4550			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.3710			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3600	(36)
Total fabric heat loss					(33) + (36) =		44.7310	(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	49.8702	49.6896	49.5125	48.6808	48.5252	47.8009	47.8009	47.6667	48.0799	48.5252	48.8400	49.1691	(38)
Heat transfer coeff	94.6012	94.4206	94.2435	93.4119	93.2563	92.5319	92.5319	92.3978	92.8109	93.2563	93.5710	93.9001	(39)
Average = Sum(39)m / 12 =												93.4111	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9320	0.9303	0.9285	0.9203	0.9188	0.9116	0.9116	0.9103	0.9144	0.9188	0.9219	0.9251	(40)
HLP (average)												0.9203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7530	(42)
Average daily hot water use (litres/day)												99.5834	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	34.5200	30.1914	31.1549	27.1616	26.0622	22.4897	20.8400	23.9142	24.1998	28.2025	30.7853	33.4308 (65)

---

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	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	(66)

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

	23.0660	20.4870	16.6611	12.6136	9.4288	7.9602	8.6013	11.1802	15.0061	19.0537	22.2385	23.7071	(67)

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

	258.7302	261.4150	254.6493	240.2461	222.0646	204.9766	193.5607	190.8759	197.6415	212.0448	230.2263	247.3143	(68)

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

	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)

Water heating gains (Table 5)

	46.3979	44.9277	41.8748	37.7244	35.0298	31.2357	28.0107	32.1427	33.6108	37.9066	42.7573	44.9339	(72)

Total internal gains

	392.4888	391.1245	377.4801	354.8788	330.8180	308.4672	294.4675	298.4936	310.5532	333.2998	359.5168	380.2500	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	622.7442	804.5277	999.4088	1219.8333	1385.7617	1393.6645	1324.9486	1181.4427	1015.7296	805.3763	639.1692	574.8033	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.8035	29.8605	29.9166	30.1829	30.2333	30.4700	30.4700	30.5142	30.3784	30.2333	30.1316	30.0260	
alpha	2.9869	2.9907	2.9944	3.0122	3.0156	3.0313	3.0313	3.0343	3.0252	3.0156	3.0088	3.0017	
util living area	0.9615	0.9238	0.8524	0.7215	0.5586	0.4061	0.3013	0.3492	0.5621	0.8159	0.9363	0.9688	(86)
MIT	19.1321	19.5197	20.0189	20.5215	20.8217	20.9496	20.9847	20.9761	20.8669	20.4015	19.6580	19.0516	(87)
Th 2	20.1404	20.1419	20.1433	20.1503	20.1516	20.1576	20.1576	20.1587	20.1553	20.1516	20.1489	20.1462	(88)
util rest of house	0.9563	0.9141	0.8349	0.6923	0.5188	0.3575	0.2457	0.2889	0.5079	0.7874	0.9265	0.9644	(89)
MIT 2	18.4210	18.8011	19.2828	19.7556	20.0192	20.1267	20.1506	20.1472	20.0668	19.6606	18.9472	18.3461	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	18.6312	19.0135	19.5004	19.9820	20.2564	20.3699	20.3972	20.3922	20.3033	19.8796	19.1573	18.5546	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6312	19.0135	19.5004	19.9820	20.2564	20.3699	20.3972	20.3922	20.3033	19.8796	19.1573	18.5546	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9446	0.8989	0.8201	0.6862	0.5239	0.3699	0.2617	0.3059	0.5177	0.7773	0.9126	0.9541	(94)
Useful gains	588.2267	723.1861	819.6574	837.0589	726.0345	515.5510	346.7174	361.3820	525.8893	625.9914	583.3158	548.4023	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1355.7491	1332.6053	1225.2026	1035.1884	797.9402	533.9043	351.3581	368.8698	575.7325	865.3808	1128.2121	1347.9024	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	571.0366	409.5297	301.7256	142.6533	53.4978	0.0000	0.0000	0.0000	0.0000	178.1057	392.3253	594.8281	(98)
Space heating												2643.7020	(98)
Space heating per m2											(98) / (4) =	26.0463	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	869.7999	684.7361	702.2230	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9344	0.9583	0.9430	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	812.7811	656.1511	662.2038	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1734.8144	1652.1995	1486.3317	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	663.8639	741.0600	613.1512	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2018.0751	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	165.9660	185.2650	153.2878	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												504.5188 (107)
Space cooling per m2												4.9706 (108)
Energy for space heating												26.0463 (99)
Energy for space cooling												4.9706 (108)
Total												31.0170 (109)
Dwelling Fabric Energy Efficiency (DFEE)												31.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1460	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3960	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3366	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4291	0.4207	0.4123	0.3702	0.3618	0.3197	0.3197	0.3113	0.3366	0.3618	0.3786	0.3955	(22b)
Effective ac	0.5921	0.5885	0.5850	0.5685	0.5655	0.5511	0.5511	0.5485	0.5566	0.5655	0.5717	0.5782	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			25.3800	1.3258	33.6477			(27)
External Wall 1	56.7000	25.3800	31.3200	0.1800	5.6376			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2853			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4000	(36)
Total fabric heat loss					(33) + (36) =		44.6853	(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	53.5449	53.2216	52.9047	51.4160	51.1375	49.8410	49.8410	49.6009	50.3404	51.1375	51.7010	52.2900	(38)
Heat transfer coeff	98.2303	97.9069	97.5900	96.1014	95.8229	94.5263	94.5263	94.2862	95.0257	95.8229	96.3863	96.9753	(39)
Average = Sum(39)m / 12 =												96.1000	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9678	0.9646	0.9615	0.9468	0.9441	0.9313	0.9313	0.9289	0.9362	0.9441	0.9496	0.9554	(40)
HLP (average)												0.9468	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7530	(42)
Average daily hot water use (litres/day)												99.5834	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.5200	30.1914	31.1549	27.1616	26.0622	22.4897	20.8400	23.9142	24.1998	28.2025	30.7853	33.4308	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	137.6492	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.0660	20.4870	16.6611	12.6136	9.4288	7.9602	8.6013	11.1802	15.0061	19.0537	22.2385	23.7071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	258.7302	261.4150	254.6493	240.2461	222.0646	204.9766	193.5607	190.8759	197.6415	212.0448	230.2263	247.3143	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	36.7649	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)
Water heating gains (Table 5)													
	46.3979	44.9277	41.8748	37.7244	35.0298	31.2357	28.0107	32.1427	33.6108	37.9066	42.7573	44.9339	(72)
Total internal gains													
	392.4888	391.1245	377.4801	354.8788	330.8180	308.4672	294.4675	298.4936	310.5532	333.2998	359.5168	380.2500	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.2800	11.2829	0.6300	0.7000	0.7700	38.8958	(75)
Southeast	11.2800	36.7938	0.6300	0.7000	0.7700	126.8399	(77)
Northwest	2.8200	11.2829	0.6300	0.7000	0.7700	9.7240	(81)

Solar gains	175.4597	315.0223	473.9234	659.1144	803.8904	826.9443	785.2493	672.8267	537.3599	359.7327	213.1013	148.2539	(83)
Total gains	567.9485	706.1468	851.4035	1013.9932	1134.7083	1135.4115	1079.7168	971.3203	847.9131	693.0325	572.6181	528.5039	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7560	71.9930	72.2268	73.3456	73.5588	74.5677	74.5677	74.7576	74.1758	73.5588	73.1288	72.6846	
alpha	5.7837	5.7995	5.8151	5.8897	5.9039	5.9712	5.9712	5.9838	5.9451	5.9039	5.8753	5.8456	
util living area													
	0.9986	0.9947	0.9786	0.9065	0.7355	0.5269	0.3844	0.4445	0.7276	0.9612	0.9961	0.9991	(86)
MIT	19.9728	20.1632	20.4424	20.7659	20.9456	20.9936	20.9992	20.9981	20.9627	20.6823	20.2611	19.9437	(87)
Th 2	20.1103	20.1129	20.1156	20.1279	20.1302	20.1410	20.1410	20.1430	20.1368	20.1302	20.1255	20.1206	(88)
util rest of house													
	0.9981	0.9930	0.9716	0.8800	0.6814	0.4588	0.3098	0.3628	0.6536	0.9444	0.9946	0.9988	(89)
MIT 2	19.1665	19.3581	19.6350	19.9485	20.0969	20.1383	20.1408	20.1425	20.1181	19.8815	19.4668	19.1460	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.4048	19.5961	19.8737	20.1901	20.3478	20.3911	20.3945	20.3954	20.3677	20.1182	19.7016	19.3817	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4048	19.5961	19.8737	20.1901	20.3478	20.3911	20.3945	20.3954	20.3677	20.1182	19.7016	19.3817	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9917	0.9693	0.8821	0.6955	0.4789	0.3319	0.3870	0.6744	0.9442	0.9936	0.9984	(94)
Useful gains	566.5893	700.3055	825.2969	894.4753	789.2088	543.7511	358.3467	375.9112	571.8464	654.3307	568.9476	527.6540	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1483.7470	1438.8458	1305.1375	1084.9949	828.6529	547.4098	358.6791	376.7091	595.5952	912.0622	1214.6176	1472.2536	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	682.3653	496.2990	357.0014	137.1741	29.3465	0.0000	0.0000	0.0000	0.0000	191.7522	464.8824	702.7821	(98)
Space heating												3061.6031	(98)
Space heating per m2											(98) / (4) =	30.1636	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	888.5473	699.4947	716.5752	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9773	0.9909	0.9838	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.3711	693.1514	704.9903	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1432.9602	1365.5649	1240.7341	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	406.5041	500.2757	398.5934	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1305.3731	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	101.6260	125.0689	99.6483	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												326.3433 (107)
Space cooling per m2												3.2152 (108)
Energy for space heating												30.1636 (99)
Energy for space cooling												3.2152 (108)
Total												33.3788 (109)
Target Fabric Energy Efficiency (TFEE)												38.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.7000	27.0000	29.7000	0.1500	4.4550			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.3710			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7310	(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	21.1000	20.8117	20.5234	19.9469	19.9469	18.7938	19.3704	18.7938	18.5056	19.0821	19.0821	20.2352	(38)
Heat transfer coeff	65.8310	65.5427	65.2545	64.6779	64.6779	63.5249	64.1014	63.5249	63.2366	63.8131	63.8131	64.9662	(39)
Average = Sum(39)m / 12 =												64.4137	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6486	0.6457	0.6429	0.6372	0.6372	0.6259	0.6315	0.6259	0.6230	0.6287	0.6287	0.6401	(40)
HLP (average)												0.6346	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7530 (42)
Average daily hot water use (litres/day)	99.5834 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3671	21.3116	21.9917	19.1729	18.3968	15.8751	14.7106	16.8806	17.0822	19.9077	21.7308	23.5982	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)

If cylinder contains dedicated solar storage

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	217.7240	192.0048	201.8879	181.3128	177.9223	159.3274	153.3473	167.8141	167.3751	187.9946	198.3655	212.5982 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	217.7240	192.0048	201.8879	181.3128	177.9223	159.3274	153.3473	167.8141	167.3751	187.9946	198.3655	212.5982 (64)

Total per year (kWh/year) = Sum(64)m = 2217.6741 (64)
RHI water heating demand 2218 (64)
Heat gains from water heating, kWh/month

	98.2351	87.1827	92.9696	85.2948	85.0011	77.9847	76.8299	81.6401	80.6605	88.3501	90.9648	96.5308 (65)

---

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	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	(66)

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

	57.6650	51.2175	41.6529	31.5339	23.5720	19.9004	21.5031	27.9506	37.5152	47.6342	55.5961	59.2676	(67)

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

	386.1644	390.1716	380.0736	358.5763	331.4397	305.9352	288.8966	284.8894	294.9874	316.4847	343.6213	369.1258	(68)

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

	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)

Water heating gains (Table 5)

	132.0365	129.7361	124.9592	118.4650	114.2487	108.3120	103.2660	109.7313	112.0285	118.7501	126.3400	129.7457	(72)

Total internal gains

	685.1964	680.4558	656.0163	617.9058	578.5910	543.4782	522.9963	531.9019	553.8616	592.1996	634.8880	667.4698	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856	(83)
Total gains	932.3513	1072.6741	1262.7853	1493.8737	1621.1812	1689.1855	1607.9487	1489.2722	1311.0671	1091.5693	945.1228	881.2554	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.8285	43.0169	43.2069	43.5921	43.5921	44.3833	43.9841	44.3833	44.5856	44.1828	44.1828	43.3986	
alpha	3.8552	3.8678	3.8805	3.9061	3.9061	3.9589	3.9323	3.9589	3.9724	3.9455	3.9455	3.8932	
util living area	0.8235	0.7528	0.6095	0.4352	0.2857	0.1579	0.0917	0.1024	0.2453	0.4856	0.7179	0.8405	(86)
MIT	20.4900	20.6534	20.8599	20.9656	20.9946	20.9997	21.0000	21.0000	20.9980	20.9598	20.7714	20.4586	(87)
Th 2	20.3865	20.3890	20.3915	20.3966	20.3966	20.4068	20.4017	20.4068	20.4093	20.4042	20.4042	20.3941	(88)
util rest of house	0.8082	0.7344	0.5866	0.4115	0.2621	0.1356	0.0678	0.0771	0.2171	0.4552	0.6951	0.8262	(89)
MIT 2	19.7210	19.9448	20.2203	20.3576	20.3912	20.4066	20.4017	20.4068	20.4077	20.3605	20.1212	19.6847	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.9483	20.1542	20.4094	20.5373	20.5696	20.5819	20.5785	20.5821	20.5822	20.5376	20.3134	19.9134	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9483	20.1542	20.4094	20.5373	20.5696	20.5819	20.5785	20.5821	20.5822	20.5376	20.3134	19.9134	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7964	0.7270	0.5873	0.4171	0.2689	0.1422	0.0749	0.0845	0.2254	0.4621	0.6914	0.8138	(94)
Useful gains	742.5415	779.8211	741.6717	623.0354	435.9157	240.1507	120.4117	125.9059	295.4624	504.3889	653.4871	717.1528	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	937.9769	914.5983	796.7162	636.2583	437.8415	240.2421	120.4159	125.9124	296.0840	519.2869	741.0851	923.3905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	145.4039	90.5702	40.9531	9.5205	1.4328	0.0000	0.0000	0.0000	0.0000	11.0841	63.0705	153.4408	(98)

Space heating 515.4759 (98)
RHI space heating demand 515 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2716	0.2684	0.2652	0.2493	0.2461	0.2301	0.2301	0.2269	0.2365	0.2461	0.2524	0.2588	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.7000	27.0000	29.7000	0.1500	4.4550			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.3710			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7310	(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	24.5592	24.2709	23.9826	22.5413	22.2530	20.8117	20.8117	20.5234	21.3882	22.2530	22.8296	23.4061	(38)
Heat transfer coeff	69.2902	69.0019	68.7137	67.2723	66.9841	65.5427	65.5427	65.2545	66.1193	66.9841	67.5606	68.1371	(39)
Average = Sum(39)m / 12 =												67.2003	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6827	0.6798	0.6770	0.6628	0.6599	0.6457	0.6457	0.6429	0.6514	0.6599	0.6656	0.6713	(40)
HLP (average)												0.6621	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7530 (42)
Average daily hot water use (litres/day)	99.5834 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3671	21.3116	21.9917	19.1729	18.3968	15.8751	14.7106	16.8806	17.0822	19.9077	21.7308	23.5982	(46)
Water storage loss:													
Store volume												110.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (64)
Total per year (kWh/year) = Sum(64)m = 2217.6741 (64)
Heat gains from water heating, kWh/month
98.2351 87.1827 92.9696 85.2948 85.0011 77.9847 76.8299 81.6401 80.6605 88.3501 90.9648 96.5308 (65)

---

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	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.6650	51.2175	41.6529	31.5339	23.5720	19.9004	21.5031	27.9506	37.5152	47.6342	55.5961	59.2676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	386.1644	390.1716	380.0736	358.5763	331.4397	305.9352	288.8966	284.8894	294.9874	316.4847	343.6213	369.1258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)
Water heating gains (Table 5)													
	132.0365	129.7361	124.9592	118.4650	114.2487	108.3120	103.2660	109.7313	112.0285	118.7501	126.3400	129.7457	(72)
Total internal gains													
	685.1964	680.4558	656.0163	617.9058	578.5910	543.4782	522.9963	531.9019	553.8616	592.1996	634.8880	667.4698	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	11.2829	0.6800	0.8000	0.7700	51.0429	(75)
Southeast	12.0000	36.7938	0.6800	0.8000	0.7700	166.4518	(77)
Northwest	3.0000	11.2829	0.6800	0.8000	0.7700	12.7607	(81)

Solar gains	230.2554	413.4032	621.9287	864.9545	1054.9437	1085.1974	1030.4811	882.9491	705.1763	472.0765	279.6524	194.5533	(83)
Total gains	915.4519	1093.8590	1277.9450	1482.8603	1633.5347	1628.6756	1553.4774	1414.8510	1259.0380	1064.2761	914.5404	862.0231	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.6904	40.8604	41.0318	41.9109	42.0913	43.0169	43.0169	43.2069	42.6418	42.0913	41.7321	41.3790	
alpha	3.7127	3.7240	3.7355	3.7941	3.8061	3.8678	3.8678	3.8805	3.8428	3.8061	3.7821	3.7586	
util living area													
	0.8691	0.7944	0.6817	0.5220	0.3753	0.2565	0.1854	0.2117	0.3577	0.6027	0.8012	0.8852	(86)
MIT	20.2407	20.4912	20.7365	20.9153	20.9790	20.9965	20.9993	20.9988	20.9874	20.8831	20.5636	20.1946	(87)
Th 2	20.3562	20.3587	20.3612	20.3738	20.3764	20.3890	20.3890	20.3915	20.3839	20.3764	20.3713	20.3663	(88)
util rest of house													
	0.8571	0.7783	0.6611	0.4986	0.3513	0.2323	0.1598	0.1839	0.3269	0.5740	0.7830	0.8744	(89)
MIT 2	19.3475	19.6955	20.0292	20.2730	20.3534	20.3858	20.3885	20.3906	20.3716	20.2399	19.8120	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.6115	19.9307	20.2383	20.4629	20.5383	20.5663	20.5690	20.5704	20.5536	20.4300	20.0341	19.5583	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6115	19.9307	20.2383	20.4629	20.5383	20.5663	20.5690	20.5704	20.5536	20.4300	20.0341	19.5583	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8417	0.7668	0.6569	0.5020	0.3575	0.2394	0.1673	0.1921	0.3354	0.5766	0.7725	0.8589	(94)
Useful gains	770.5255	838.8180	839.5379	744.3597	584.0369	389.8521	259.9230	271.7681	422.2739	613.6167	706.4984	740.3566	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1060.9353	1037.1445	944.0083	777.8611	592.0264	391.0458	260.1387	272.1346	426.7094	658.4543	873.8379	1046.4697	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	216.0649	133.2754	77.7260	24.1211	5.9442	0.0000	0.0000	0.0000	0.0000	33.3591	120.4844	227.7482	(98)
Space heating												838.7233	(98)
Space heating per m2											(98) / (4) =	8.2633	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	616.1017	485.0162	495.9339	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9898	0.9947	0.9920	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.7997	482.4467	491.9908	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1811.8907	1727.4547	1563.9203	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	865.5055	926.2860	797.5155	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2589.3071	(104)
Cooled fraction										fC = cooled area / (4) =		0.5911	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.9072	136.8896	117.8594	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												382.6562	(107)
Space cooling per m2												3.7700	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	838.7233	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	308.2308	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	572.4287	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2217.6741	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	814.9952	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1513.5626	(310b)
Electricity used for heat distribution	32.0922	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	88.5778	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	229.8594	(330a)
Total electricity for the above, kWh/year	229.8594	(331)
Electricity for lighting (calculated in Appendix L)	407.3525	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3935.0070	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	308.2308	4.2400	13.0690	(340a)
Space heating from Combined Heat and Power	572.4287	2.9700	17.0011	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	814.9952	4.2400	34.5558	(342a)
Water heating from Combined Heat and Power	1513.5626	2.9700	44.9528	(342b)
Space cooling	88.5778	13.1900	11.6834	(348)
Mechanical ventilation fans	229.8594	13.1900	30.3185	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	407.3525	13.1900	53.7298	(350)
Additional standing charges			120.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	13.1900	-39.5700	(352)
Total energy cost			285.7404	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200	(356)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8192	(357)
SAP value	88.5723	
SAP rating (Section 12)	89	(358)
SAP band	B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Efficiency of heat source Boilers			95.0000 (367a)
Space heating from Boilers	1182.3432	0.2160	255.3861 (367)
Electrical efficiency of CHP unit			35.0000 (361)
Heat efficiency of CHP unit			55.0000 (362)
Space heating from Combined Heat and Power	1040.7794	0.2160	224.8084 (363)
less credit emissions for electricity	-364.2728	0.5190	-189.0576 (364)
Water heating from Combined Heat and Power	2751.9320	0.2160	594.4173 (365)
less credit emissions for electricity	-963.1762	0.5190	-499.8884 (366)
Electrical energy for heat distribution	32.0922	0.5190	16.6558 (372)
Total CO2 associated with community systems			402.3216 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			402.3216 (376)
Space cooling	88.5778	0.5190	45.9719 (377)
Pumps and fans	229.8594	0.5190	119.2970 (378)
Energy for lighting	407.3525	0.5190	211.4159 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			623.3065 (383)
CO2 emissions per m2			6.1400 (384)
EI value			94.2988 (384a)
EI rating			94 (385)
EI band			A

Calculation of stars for heating and DHW

Space heating energy efficiency 0.35 × 4.240 × 1.05
0.65 × 2.970 × 1.05
= 3.585, stars = 5
Space heating environmental impact 0.35 × 0.216 × 1.05 / 0.9500
0.65 × (0.216 - 0.350 × 0.519) × 1.05 / 0.550
= 0.1262, stars = 5
Water heating energy efficiency 3.585, stars = 5
Water heating environmental impact 0.1262, stars = 5

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	101.5000 (1b)	x	2.7000 (2b)	=	274.0500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.0500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design q50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.9000	3.8000	3.7000	3.5000	3.5000	3.1000	3.3000	3.1000	3.0000	3.2000	3.2000	3.6000	(22)
Wind factor	0.9750	0.9500	0.9250	0.8750	0.8750	0.7750	0.8250	0.7750	0.7500	0.8000	0.8000	0.9000	(22a)
Adj infilt rate	0.1243	0.1211	0.1179	0.1116	0.1116	0.0988	0.1052	0.0988	0.0956	0.1020	0.1020	0.1148	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	78.2000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2333	0.2301	0.2269	0.2206	0.2206	0.2078	0.2142	0.2078	0.2046	0.2110	0.2110	0.2238	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			27.0000	1.1450	30.9160			(27)
External Wall 1	56.7000	27.0000	29.7000	0.1500	4.4550			(29a)
Total net area of external elements Aum(A, m2)			56.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.3710			(33)
Party Floor 1			73.0000					(32d)
Party Ceilings 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3600	(36)
Total fabric heat loss (33) + (36) =	44.7310	(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	21.1000	20.8117	20.5234	19.9469	19.9469	18.7938	19.3704	18.7938	18.5056	19.0821	19.0821	20.2352	(38)
Heat transfer coeff	65.8310	65.5427	65.2545	64.6779	64.6779	63.5249	64.1014	63.5249	63.2366	63.8131	63.8131	64.9662	(39)
Average = Sum(39)m / 12 =												64.4137	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6486	0.6457	0.6429	0.6372	0.6372	0.6259	0.6315	0.6259	0.6230	0.6287	0.6287	0.6401	(40)
HLP (average)												0.6346	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7530 (42)
Average daily hot water use (litres/day)	99.5834 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.5417	105.5584	101.5750	97.5917	93.6084	89.6250	89.6250	93.6084	97.5917	101.5750	105.5584	109.5417	(44)
Energy conte	162.4472	142.0774	146.6111	127.8191	122.6455	105.8337	98.0705	112.5373	113.8814	132.7178	144.8718	157.3214	(45)
Energy content (annual)										Total = Sum(45)m =		1566.8343	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3671	21.3116	21.9917	19.1729	18.3968	15.8751	14.7106	16.8806	17.0822	19.9077	21.7308	23.5982	(46)

Water storage loss:	
Store volume	110.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
Volume factor from Table 2a 1.0294 (52)
Temperature factor from Table 2b 0.6000 (53)
Enter (49) or (54) in (55) 1.0327 (55)
Total storage loss
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)
If cylinder contains dedicated solar storage
32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
217.7240 192.0048 201.8879 181.3128 177.9223 159.3274 153.3473 167.8141 167.3751 187.9946 198.3655 212.5982 (64)
Total per year (kWh/year) = Sum(64)m = 2217.6741 (64)
Heat gains from water heating, kWh/month
98.2351 87.1827 92.9696 85.2948 85.0011 77.9847 76.8299 81.6401 80.6605 88.3501 90.9648 96.5308 (65)

---

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	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	165.1791	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.6650	51.2175	41.6529	31.5339	23.5720	19.9004	21.5031	27.9506	37.5152	47.6342	55.5961	59.2676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	386.1644	390.1716	380.0736	358.5763	331.4397	305.9352	288.8966	284.8894	294.9874	316.4847	343.6213	369.1258	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	54.2709	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	-110.1194	(71)
Water heating gains (Table 5)													
	132.0365	129.7361	124.9592	118.4650	114.2487	108.3120	103.2660	109.7313	112.0285	118.7501	126.3400	129.7457	(72)
Total internal gains													
	685.1964	680.4558	656.0163	617.9058	578.5910	543.4782	522.9963	531.9019	553.8616	592.1996	634.8880	667.4698	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0000	12.4885	0.6800	0.8000	0.7700	56.4968	(75)
Southeast	12.0000	39.0225	0.6800	0.8000	0.7700	176.5339	(77)
Northwest	3.0000	12.4885	0.6800	0.8000	0.7700	14.1242	(81)

Solar gains	247.1549	392.2183	606.7691	875.9679	1042.5902	1145.7072	1084.9525	957.3703	757.2055	499.3697	310.2347	213.7856	(83)
Total gains	932.3513	1072.6741	1262.7853	1493.8737	1621.1812	1689.1855	1607.9487	1489.2722	1311.0671	1091.5693	945.1228	881.2554	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.8285	43.0169	43.2069	43.5921	43.5921	44.3833	43.9841	44.3833	44.5856	44.1828	44.1828	43.3986	
alpha	3.8552	3.8678	3.8805	3.9061	3.9061	3.9589	3.9323	3.9589	3.9724	3.9455	3.9455	3.8932	
util living area													
	0.8235	0.7528	0.6095	0.4352	0.2857	0.1579	0.0917	0.1024	0.2453	0.4856	0.7179	0.8405	(86)
MIT	20.4900	20.6534	20.8599	20.9656	20.9946	20.9997	21.0000	21.0000	20.9980	20.9598	20.7714	20.4586	(87)
Th 2	20.3865	20.3890	20.3915	20.3966	20.3966	20.4068	20.4017	20.4068	20.4093	20.4042	20.4042	20.3941	(88)
util rest of house													
	0.8082	0.7344	0.5866	0.4115	0.2621	0.1356	0.0678	0.0771	0.2171	0.4552	0.6951	0.8262	(89)
MIT 2	19.7210	19.9448	20.2203	20.3576	20.3912	20.4066	20.4017	20.4068	20.4077	20.3605	20.1212	19.6847	(90)
Living area fraction									fLA = Living area / (4) =			0.2956	(91)
MIT	19.9483	20.1542	20.4094	20.5373	20.5696	20.5819	20.5785	20.5821	20.5822	20.5376	20.3134	19.9134	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9483	20.1542	20.4094	20.5373	20.5696	20.5819	20.5785	20.5821	20.5822	20.5376	20.3134	19.9134	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7964	0.7270	0.5873	0.4171	0.2689	0.1422	0.0749	0.0845	0.2254	0.4621	0.6914	0.8138	(94)
Useful gains	742.5415	779.8211	741.6717	623.0354	435.9157	240.1507	120.4117	125.9059	295.4624	504.3889	653.4871	717.1528	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W													
	937.9769	914.5983	796.7162	636.2583	437.8415	240.2421	120.4159	125.9124	296.0840	519.2869	741.0851	923.3905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	145.4039	90.5702	40.9531	9.5205	1.4328	0.0000	0.0000	0.0000	0.0000	11.0841	63.0705	153.4408	(98)
Space heating												515.4759	(98)
Space heating per m2											(98) / (4) =	5.0786	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.8000	18.7000	18.6000	15.9000	12.4000	8.7000	5.7000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	457.3790	339.7374	343.0343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9972	0.9988	0.9984	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	456.0993	339.3385	342.4937	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1882.6165	1791.1225	1650.9061	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1027.0924	1080.1273	973.4588	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												3080.6786	(104)
Cooled fraction										fC = cooled area / (4) =		0.5911	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	151.7871	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												151.7871	(107)
Space cooling per m2												1.4954	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Boilers	0.3500	(303a)
Fraction of heat from community Combined Heat and Power	0.6500	(303b)
Fraction of total space heat from community Boilers	0.3500	(304a)
Fraction of total space heat from community Combined Heat and Power	0.6500	(304b)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	515.4759	(98)
Space heat from Boilers = (98) x 0.35 x 1.00 x 1.05	189.4374	(307a)
Space heat from Combined Heat and Power = (98) x 0.65 x 1.00 x 1.05	351.8123	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2217.6741	(64)
Water heat from Boilers = (64) x 0.35 x 1.00 x 1.05	814.9952	(310a)
Water heat from Combined Heat and Power = (64) x 0.65 x 1.00 x 1.05	1513.5626	(310b)
Electricity used for heat distribution	28.6981	(313)
Cooling System Energy Efficiency Ratio	4.3200	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	35.1359	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6875)		
mechanical ventilation fans (SFP = 0.6875)	229.8594	(330a)
Total electricity for the above, kWh/year	229.8594	(331)
Electricity for lighting (calculated in Appendix L)	407.3525	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3542.1553	(338)

10b. Fuel costs - using BEDF prices (421)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Boilers	189.4374	5.0000	9.4719	(340a)
Space heating from Combined Heat and Power	351.8123	3.5000	12.3134	(340b)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Boilers	814.9952	5.0000	40.7498	(342a)
Water heating from Combined Heat and Power	1513.5626	3.5000	52.9747	(342b)
Space cooling	35.1359	15.7000	5.5163	(348)
Mechanical ventilation fans	229.8594	15.7000	36.0879	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	407.3525	15.7000	63.9543	(350)
Additional standing charges			89.0000	(351)
Energy saving/generation technologies				
PV Unit	-300.0000	15.7000	-47.1000	(352)
Total energy cost			262.9684	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1057.2975	0.2160	228.3763	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	639.6588	0.2160	138.1663	(363)
less credit emissions for electricity	-223.8806	0.5190	-116.1940	(364)
Water heating from Combined Heat and Power	2751.9320	0.2160	594.4173	(365)
less credit emissions for electricity	-963.1762	0.5190	-499.8884	(366)
Electrical energy for heat distribution	28.6981	0.5190	14.8943	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			359.7717	(373)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space and water heating			359.7717 (376)
Space cooling	35.1359	0.5190	18.2355 (377)
Pumps and fans	229.8594	0.5190	119.2970 (378)
Energy for lighting	407.3525	0.5190	211.4159 (379)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (380)
Total kg/year			553.0202 (383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Boilers			95.0000	(367a)
Space heating from Boilers	1057.2975	1.2200	1289.9030	(367)
Electrical efficiency of CHP unit			35.0000	(361)
Heat efficiency of CHP unit			55.0000	(362)
Space heating from Combined Heat and Power	639.6588	1.2200	780.3837	(363)
less credit emissions for electricity	-223.8806	3.0700	-687.3133	(364)
Water heating from Combined Heat and Power	2751.9320	1.2200	3357.3570	(365)
less credit emissions for electricity	-963.1762	3.0700	-2956.9509	(366)
Electrical energy for heat distribution	28.6981	3.0700	88.1031	(372)
Total CO2 associated with community systems			1871.4825	(373)
(negative value allowed since DFEE <= TFEE)				
Space and water heating			1871.4825	(376)
Space cooling	35.1359	3.0700	107.8672	(377)
Pumps and fans	229.8594	3.0700	705.6685	(378)
Energy for lighting	407.3525	3.0700	1250.5720	(379)
Energy saving/generation technologies				
PV Unit	-300.0000	3.0700	-921.0000	(380)
Primary energy kWh/year			3014.5902	(383)
Primary energy kWh/m2/year			29.7004	(384)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: A 94

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 421 TEST (28 Nov 2017)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£106	£106	£0
Community scheme	£205	£205	£0
Space heating	£147	£147	£0
Space cooling	£6	£6	£0
Water heating	£94	£94	£0
Lighting	£64	£64	£0
Generated (PV)	-£47	-£47	£0
Total cost of fuels	£264	£264	£0
Total cost of uses	£264	£264	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	30 kWh/m²	30 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Oversha ding	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	542.62 (P1)
Transmission heat loss coefficient	44.73 (37)
Summer heat loss coefficient	587.35 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
North West	1.000	0.590	Wide overhang

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	0.590	0.490 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	12.0000	98.8453	0.6800	0.8000	0.9000	522.6622
South East	12.0000	119.9223	0.6800	0.8000	0.9000	634.1110
North West	3.0000	98.8453	0.6800	0.8000	0.4900	71.1401
total:						1227.9133

	Jun	Jul	Aug	
Solar gains	1307	1228	1077	(P3)
Internal gains	543	523	532	
Total summer gains	1850	1751	1609	(P5)
Summer gain/loss ratio	3.15	2.98	2.74	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	20.45	22.18	21.84	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium