

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-629				Issued on Date	22/03/2023
Assessment Reference	Plot 629	Prop Type Ref	Islington-As-DET			
Property	Plot 629, 3 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.71	TER	18.72	
Environmental	85 B	% DER<TER	5.39			
CO ₂ Emissions (t/year)	1.47	DFEE	52.22	TFEE	59.48	
General Requirements Compliance	Pass	% DFEE<TFEE	12.21			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 101 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
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.72 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.71 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 59.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.2 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (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: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 7.68 m², No overhang
Windows facing South: 8.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.029 W/m²K

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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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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 (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	426.0099	423.7000	408.2077	383.1607	357.5269	333.0462	317.3011	323.7796	336.7949	362.0692	391.0739	413.0199 (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	
North	7.6800				10.6334		0.4600		0.0000		0.7700		28.9255 (74)	
South	5.0200				46.7521		0.4600		0.0000		0.7700		83.1291 (78)	
South	3.3300				46.7521		0.4600		0.0000		0.7700		55.1434 (78)	
Solar gains	167.1981	281.7329	382.3943	476.9036	542.9851	544.5336	522.5922	471.3981	414.2695	310.0542	199.5835	143.5939	(83)	
Total gains	593.2080	705.4330	790.6021	860.0642	900.5120	877.5798	839.8933	795.1777	751.0644	672.1234	590.6573	556.6139	(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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9897	0.9814	0.9665	0.9337	0.8672	0.7459	0.6051	0.6475	0.8309	0.9474	0.9828	0.9916 (86)
MIT	18.9010	19.1418	19.5091	19.9932	20.4363	20.7752	20.9189	20.8966	20.6480	20.0725	19.4080	18.8728 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9872	0.9770	0.9582	0.9158	0.8272	0.6630	0.4754	0.5223	0.7660	0.9296	0.9781	0.9896 (89)
MIT 2	17.0215	17.3735	17.9074	18.6106	19.2237	19.6612	19.8049	19.7912	19.5160	18.7351	17.7746	16.9898 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	17.3484	17.6811	18.1860	18.8511	19.4346	19.8549	19.9986	19.9834	19.7129	18.9678	18.0587	17.3173 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1984	17.5311	18.0360	18.7011	19.2846	19.7049	19.8486	19.8334	19.5629	18.8178	17.9087	17.1673 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9788	0.9644	0.9403	0.8926	0.8038	0.6510	0.4755	0.5201	0.7466	0.9078	0.9660	0.9824 (94)
Useful gains	580.6250	680.3202	743.4004	767.6662	723.8516	571.2663	399.3837	413.5945	560.7564	610.1210	570.5699	546.8035 (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												
	1756.6367	1713.5219	1558.9531	1300.5386	1002.9518	664.1823	422.6680	445.3569	715.2338	1086.6798	1439.3042	1739.2872 (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												
	874.9527	694.3116	606.7713	383.6682	207.6505	0.0000	0.0000	0.0000	0.0000	354.5598	625.4888	887.2079 (98)
Space heating												4634.6106 (98)
Space heating per m2										(98) / (4) =		45.9874 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5121.1166 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	874.9527	694.3116	606.7713	383.6682	207.6505	0.0000	0.0000	0.0000	0.0000	354.5598	625.4888	887.2079 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	966.7985	767.1951	670.4655	423.9427	229.4481	0.0000	0.0000	0.0000	0.0000	391.7787	691.1478	980.3402 (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 requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Efficiency of water heater (217)m	89.9470	89.8998	89.8114	89.6161	89.2032	87.3000	87.3000	87.3000	87.3000	89.5400	89.8349	87.3000 (216)
Fuel for water heating, kWh/month	196.0565	172.0002	178.7043	157.6019	153.0112	136.5557	128.1658	144.7599	145.8047	163.7160	176.2258	190.3114 (219)
Water heating fuel used												1942.9135 (219)
Annual totals kWh/year												1942.9135 (219)
Space heating fuel - main system												5121.1166 (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)												423.5919 (232)
Total delivered energy for all uses												7562.6221 (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	5121.1166	0.2160	1106.1612 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.9135	0.2160	419.6693 (264)
Space and water heating			1525.8305 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/year			1784.5997 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7100 (273)

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

DER		17.7100 ZC1
Total Floor Area	TFA	100.7800
Assumed number of occupants	N	2.7466
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.1457 ZC2
CO2 emissions from cooking, equation (L16)		1.8349 ZC3
Total CO2 emissions		34.6905 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		34.6905 ZC8

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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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (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	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)

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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)
Combi loss	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (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)
Output from w/h	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Heat gains from water heating, kWh/month	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250 (72)
Total internal gains	438.3799	436.0741	420.5905	395.1201	368.8166	343.6684	327.9314	335.0769	348.7656	374.4631	403.4541	425.3940 (73)

6. Solar gains

[Jan]													
	Area				Solar flux		g		FF		Access		Gains
	m2				Table 6a		or Table 6b		or Table 6c		factor		W
					W/m2						Table 6d		
North	7.6800				10.6334		0.6300		0.7000		0.7700		24.9577 (74)
South	8.3500				46.7521		0.6300		0.7000		0.7700		119.3051 (78)
Solar gains	144.2628	243.0865	329.9398	411.4848	468.5017	469.8378	450.9062	406.7346	357.4426	267.5228	172.2058	123.8966 (83)	
Total gains	582.6427	679.1607	750.5303	806.6049	837.3183	813.5062	778.8376	741.8115	706.2082	641.9859	575.6599	549.2906 (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	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026
util living area	0.9983	0.9961	0.9910	0.9755	0.9296	0.8126	0.6515	0.6980	0.8944	0.9816	0.9964	0.9987 (86)
MIT	19.5845	19.7465	19.9989	20.3365	20.6523	20.8859	20.9703	20.9586	20.7982	20.3907	19.9307	19.5646 (87)
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799 (88)
util rest of house	0.9977	0.9948	0.9876	0.9650	0.8964	0.7246	0.5096	0.5604	0.8324	0.9719	0.9949	0.9982 (89)
MIT 2	17.9863	18.2252	18.5949	19.0925	19.5310	19.8235	19.8946	19.8906	19.7290	19.1767	18.5061	17.9665 (90)
Living area fraction									fLA = Living area /	(4) =	0.1739 (91)	
MIT	18.2643	18.4898	18.8391	19.3088	19.7260	20.0083	20.0817	20.0764	19.9150	19.3879	18.7539	18.2445 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2643	18.4898	18.8391	19.3088	19.7260	20.0083	20.0817	20.0764	19.9150	19.3879	18.7539	18.2445 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	580.4871	673.8726	737.7887	772.4262	745.3610	597.1837	415.9837	432.9141	588.5721	619.8234	571.3425	547.7436 (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	1783.6105	1729.7730	1565.2318	1299.2012	998.7299	663.4063	427.0848	449.7548	717.2599	1093.5309	1459.1413	1769.7638 (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	895.1238	709.5650	615.6177	379.2781	188.5064	0.0000	0.0000	0.0000	0.0000	352.4384	639.2151	909.1830 (98)
Space heating												4688.9275 (98)
Space heating per m2										(98) / (4) =		46.5264 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5020.2650 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	895.1238	709.5650	615.6177	379.2781	188.5064	0.0000	0.0000	0.0000	0.0000	352.4384	639.2151	909.1830	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	958.3766	759.7056	659.1196	406.0793	201.8270	0.0000	0.0000	0.0000	0.0000	377.3430	684.3845	973.4294	(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 requirement	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
Efficiency of water heater (217)m	88.2648	88.0806	87.7216	86.9384	85.3104	80.3000	80.3000	80.3000	80.3000	86.6679	87.8283	80.3000	(216)
Fuel for water heating, kWh/month	241.5006	213.3154	224.9706	202.0740	199.3767	186.5567	178.7355	199.2482	201.4487	211.6994	220.8485	235.5250	(219)
Water heating fuel used												2515.2993	(219)
Annual totals kWh/year													
Space heating fuel - main system												5020.2650	(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)												423.5919	(232)
Total delivered energy for all uses												8034.1562	(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	5020.2650	0.2160	1084.3772 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2515.2993	0.2160	543.3046 (264)
Space and water heating			1627.6819 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/m2/year			1886.4511 (272)
Emissions per m2 for space and water heating			16.1508 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1814 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1508 * 1.00) + 2.1814 + 0.3862, rounded to 2 d.p.			18.7200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4040 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4040 (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	0.5152	0.5051	0.4950	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747 (22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	54.3927	53.9497	53.5155	51.4761	51.0946	49.3183	49.3183	48.9894	50.0025	51.0946	51.8665	52.6735 (38)
Heat transfer coeff	133.9196	133.4767	133.0425	131.0031	130.6215	128.8453	128.8453	128.5163	129.5294	130.6215	131.3934	132.2004 (39)
Average = Sum(39)m / 12 =												131.0013 (39)
HLP	1.3288	1.3244	1.3201	1.2999	1.2961	1.2785	1.2785	1.2752	1.2853	1.2961	1.3038	1.3118 (40)
HLP (average)												1.2999 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (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	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658 (72)
Total internal gains	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348 (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

North	7.6800	10.6334	0.4600	0.0000	0.7700	28.9255 (74)
South	5.0200	46.7521	0.4600	0.0000	0.7700	83.1291 (78)
South	3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)

Solar gains	167.1981	281.7329	382.3943	476.9036	542.9851	544.5336	522.5922	471.3981	414.2695	310.0542	199.5835	143.5939 (83)
Total gains	559.2932	672.3513	759.2504	831.0672	873.0457	852.2663	816.4063	769.3468	724.3981	643.0203	558.8056	523.5287 (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	33.2500	33.3603	33.4692	33.9902	34.0895	34.5595	34.5595	34.6479	34.3769	34.0895	33.8892	33.6824
alpha	3.2167	3.2240	3.2313	3.2660	3.2726	3.3040	3.3040	3.3099	3.2918	3.2726	3.2593	3.2455
util living area	0.9913	0.9837	0.9696	0.9383	0.8738	0.7548	0.6141	0.6588	0.8403	0.9525	0.9853	0.9930 (86)
MIT	18.8960	19.1372	19.5046	19.9855	20.4302	20.7704	20.9170	20.8931	20.6396	20.0594	19.3943	18.8632 (87)
Th 2	19.8183	19.8217	19.8251	19.8409	19.8439	19.8577	19.8577	19.8603	19.8524	19.8439	19.8379	19.8316 (88)
util rest of house	0.9892	0.9798	0.9620	0.9215	0.8353	0.6732	0.4847	0.5341	0.7777	0.9362	0.9812	0.9913 (89)
MIT 2	17.9109	18.1527	18.5185	19.0000	19.4221	19.7264	19.8273	19.8175	19.6226	19.0805	18.4215	17.8878 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	18.0822	18.3239	18.6900	19.1715	19.5974	19.9080	20.0169	20.0046	19.7995	19.2507	18.5907	18.0575 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0822	18.3239	18.6900	19.1715	19.5974	19.9080	20.0169	20.0046	19.7995	19.2507	18.5907	18.0575 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9849	0.9731	0.9523	0.9091	0.8254	0.6773	0.5045	0.5518	0.7742	0.9252	0.9750	0.9877 (94)
Ext temp.	550.8642	654.2442	723.0281	755.5385	720.5997	577.2516	411.8952	424.5135	560.8360	594.9050	544.8109	517.0805 (95)
Heat loss rate W	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)
Month fracti	1845.7106	1791.7805	1621.7884	1345.5919	1031.5713	683.9127	440.2455	463.2497	738.2533	1129.9725	1509.8065	1831.9631 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	963.3657	764.4244	668.6777	424.8385	231.3629	0.0000	0.0000	0.0000	0.0000	398.0902	694.7968	978.2727 (98)
												5123.8288 (98)
										(98) / (4) =		50.8417 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1211.1455	953.4549	976.7241	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7302	0.8059	0.7788	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	884.4019	768.3514	760.6560	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1102.0872	1057.9250	1004.9285	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	156.7334	215.4428	181.7388	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			553.9150 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	39.1834	53.8607	45.4347	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												138.4787 (107)
Energy for space heating												1.3741 (108)
Energy for space cooling												50.8417 (99)
Total												1.3741 (108)
Dwelling Fabric Energy Efficiency (DFEE)												52.2158 (109)
												52.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (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	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(59)
Heat gains from water heating, kWh/month	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	(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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348	(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		
North													7.6800	10.6334		0.6300		0.7000		0.7700		24.9577 (74)	
South													8.3500	46.7521		0.6300		0.7000		0.7700		119.3051 (78)	
Solar gains	144.2628	243.0865	329.9398	411.4848	468.5017	469.8378	450.9062	406.7346	357.4426	267.5228	172.2058	123.8966	(83)										
Total gains	536.3580	633.7049	706.7959	765.6484	798.5623	777.5705	744.7203	704.6833	667.5712	600.4890	531.4279	503.8314	(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	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395		
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026		
util living area	0.9988	0.9971	0.9930	0.9799	0.9396	0.8316	0.6745	0.7239	0.9105	0.9859	0.9974	0.9991	(86)	
MIT	19.5426	19.7058	19.9605	20.3030	20.6266	20.8726	20.9656	20.9515	20.7763	20.3556	19.8908	19.5233	(87)	
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799	(88)	
util rest of house	0.9984	0.9961	0.9902	0.9711	0.9099	0.7469	0.5308	0.5860	0.8545	0.9781	0.9964	0.9988	(89)	
MIT 2	18.5410	18.7064	18.9627	19.3132	19.6236	19.8418	19.8968	19.8938	19.7675	19.3702	18.9043	18.5322	(90)	
Living area fraction									fLA = Living area / (4) =			0.1739	(91)	
MIT	18.7152	18.8803	19.1363	19.4854	19.7981	20.0211	20.0827	20.0778	19.9430	19.5416	19.0759	18.7046	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7152	18.8803	19.1363	19.4854	19.7981	20.0211	20.0827	20.0778	19.9430	19.5416	19.0759	18.7046	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	535.1334	630.3945	698.1403	740.2673	724.1127	588.8415	414.0675	429.6763	572.2056	585.2807	528.8733	502.9787	(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	1841.2031	1779.4711	1602.9269	1321.2376	1007.6960	664.9721	427.2089	449.9309	720.7114	1112.6573	1499.4600	1827.7471	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)	
Space heating kWh	971.7158	772.1794	673.1612	418.2986	210.9860	0.0000	0.0000	0.0000	0.0000	392.3682	698.8225	985.6276	(98)	
Space heating												5123.1594	(98)	
Space heating per m2												50.8351	(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	1153.0466	907.7176	929.7567	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7709	0.8556	0.8278	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	888.9387	776.6056	769.6666	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1014.7804	974.1361	929.3478	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	90.6060	146.9627	118.8028	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												356.3715	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	22.6515	36.7407	29.7007	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												89.0929 (107)
Space cooling per m2												0.8840 (108)
Energy for space heating												50.8351 (99)
Energy for space cooling												0.8840 (108)
Total												51.7191 (109)
Target Fabric Energy Efficiency (TFEE)												59.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.3630		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss						(33) + (36) =	79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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)
Output from w/h	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
RHI water heating demand												1730 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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
North			7.6800		11.9814		0.4600		0.0000		0.7700		32.5926 (74)
South			5.0200		50.9848		0.4600		0.0000		0.7700		90.6553 (78)
South			3.3300		50.9848		0.4600		0.0000		0.7700		60.1359 (78)
Solar gains	183.3838	278.1750	374.3131	484.8318	541.5653	582.9227	552.7016	506.9865	440.7628	327.1550	224.2564	155.9938	(83)
Total gains	817.2006	906.9757	978.3364	1050.4320	1067.6487	1073.8556	1023.2915	986.7610	942.8378	867.8803	807.8695	772.2228	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area	0.9709	0.9582	0.9310	0.8707	0.7558	0.5483	0.3789	0.4014	0.6704	0.8764	0.9514	0.9749 (86)
MIT	19.3630	19.5545	19.9041	20.3362	20.7084	20.9335	20.9861	20.9833	20.8583	20.4283	19.8506	19.3387 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house	0.9644	0.9489	0.9148	0.8388	0.6923	0.4414	0.2445	0.2652	0.5745	0.8391	0.9387	0.9692 (89)
MIT 2	17.7101	17.9887	18.4871	19.0928	19.5741	19.8229	19.8563	19.8606	19.7580	19.2328	18.4278	17.6838 (90)
Living area fraction	17.9976	18.2611	18.7336	19.3091	19.7714	20.0161	20.0528	20.0559	fLA = Living area / (4) =	19.9494	19.4408	18.6753
MIT	17.9976	18.2611	18.7336	19.3091	19.7714	20.0161	20.0528	20.0559	19.9494	19.4408	18.6753	17.9717 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8476	18.1111	18.5836	19.1591	19.6214	19.8661	19.9028	19.9059	19.7994	19.2908	18.5253	17.8217 (93)

8. Space heating requirement

Utilisation	0.9483	0.9297	0.8918	0.8153	0.6777	0.4418	0.2497	0.2703	0.5686	0.8159	0.9182	0.9546 (94)
Useful gains	774.9607	843.1873	872.4436	856.4496	723.5287	474.4340	255.5319	266.7026	536.0810	708.1100	741.8258	737.1302 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1679.9869	1638.0299	1464.2231	1201.0070	858.8745	495.7863	257.5446	269.3369	589.8268	991.7562	1357.2771	1655.1609 (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	673.3395	534.1342	440.2839	248.0813	100.6973	0.0000	0.0000	0.0000	0.0000	211.0328	443.1250	683.0149 (98)
Space heating												3333.7088 (98)
RHI space heating demand												3334 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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 (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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			
North				7.6800	10.6334	0.4600	0.0000	0.7700	28.9255 (74)			
South				5.0200	46.7521	0.4600	0.0000	0.7700	83.1291 (78)			
South				3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)			
Solar gains	167.1981	281.7329	382.3943	476.9036	542.9851	544.5336	522.5922	471.3981	414.2695	310.0542	199.5835	143.5939 (83)
Total gains	801.0149	910.5337	986.4177	1042.5037	1069.0686	1035.4665	993.1821	951.1727	916.3445	850.7795	783.1965	759.8229 (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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9762	0.9632	0.9414	0.8968	0.8149	0.6772	0.5322	0.5690	0.7602	0.9077	0.9631	0.9796 (86)
MIT	19.1435	19.3719	19.7143	20.1586	20.5496	20.8340	20.9446	20.9299	20.7394	20.2427	19.6258	19.1134 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9710	0.9552	0.9280	0.8717	0.7666	0.5906	0.4103	0.4489	0.6851	0.8802	0.9537	0.9752 (89)
MIT 2	17.3716	17.7028	18.1957	18.8332	19.3610	19.7161	19.8200	19.8127	19.6128	18.9634	18.0853	17.3379 (90)
Living area fraction												
	fLA = Living area / (4) =											0.1739 (91)
MIT	17.6798	17.9932	18.4599	19.0638	19.5678	19.9105	20.0156	20.0070	19.8087	19.1859	18.3532	17.6467 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5298	17.8432	18.3099	18.9138	19.4178	19.7605	19.8656	19.8570	19.6587	19.0359	18.2032	17.4967 (93)

8. Space heating requirement

Utilisation	0.9563	0.9366	0.9054	0.8471	0.7464	0.5832	0.4123	0.4495	0.6712	0.8558	0.9352	0.9620 (94)
Useful gains	766.0410	852.8245	893.1102	883.0758	797.9285	603.8871	409.4840	427.5967	615.0665	728.1199	732.4158	730.9146 (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												
	1801.7686	1755.8576	1595.9683	1328.7564	1020.5615	671.4171	424.8745	448.4134	727.7850	1115.5248	1478.5207	1783.4749 (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												
	770.5814	606.8382	522.9264	320.8900	165.6390	0.0000	0.0000	0.0000	0.0000	288.2292	537.1956	783.1049 (98)
Space heating												3995.4047 (98)
Space heating per m2												(98) / (4) = 39.6448 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4414.8118 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	770.5814	606.8382	522.9264	320.8900	165.6390	0.0000	0.0000	0.0000	0.0000	288.2292	537.1956	783.1049 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	851.4711	670.5395	577.8193	354.5746	183.0265	0.0000	0.0000	0.0000	0.0000	318.4853	593.5863	865.3092 (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 requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Efficiency of water heater (217)m	89.8864	89.8313	89.7276	89.4974	89.0258	87.3000	87.3000	87.3000	87.3000	89.3953	89.7512	87.3000 (216)
Fuel for water heating, kWh/month	196.1886	172.1312	178.8712	157.8110	153.3161	136.5557	128.1658	144.7599	145.8047	163.9810	176.3902	190.4338 (219)
Water heating fuel used												1944.4092 (219)
Annual totals kWh/year												
Space heating fuel - main system												4414.8118 (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)												423.5919 (232)
Total delivered energy for all uses												6857.8128 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4414.8118	3.4800	153.6355 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.4092	3.4800	67.6654 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	423.5919	13.1900	55.8718 (250)
Additional standing charges			120.0000 (251)
Total energy cost			407.0652 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1728 (257)
SAP value		83.6398
SAP rating (Section 12)		84 (258)
SAP band		B

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	4414.8118	0.2160	953.5993 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.4092	0.2160	419.9924 (264)
Space and water heating			1373.5917 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1632.3609 (272)
CO2 emissions per m2			16.2000 (273)
EI value			84.9954
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8885 = 3.917$, stars = 4
Water heating environmental impact	$0.216 / 0.8885 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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 (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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	
North				7.6800	11.9814		0.4600	0.0000	0.7700		32.5926 (74)	
South				5.0200	50.9848		0.4600	0.0000	0.7700		90.6553 (78)	
South				3.3300	50.9848		0.4600	0.0000	0.7700		60.1359 (78)	
Solar gains	183.3838	278.1750	374.3131	484.8318	541.5653	582.9227	552.7016	506.9865	440.7628	327.1550	224.2564	155.9938 (83)
Total gains	817.2006	906.9757	978.3364	1050.4320	1067.6487	1073.8556	1023.2915	986.7610	942.8378	867.8803	807.8695	772.2228 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area												
	0.9709	0.9582	0.9310	0.8707	0.7558	0.5483	0.3789	0.4014	0.6704	0.8764	0.9514	0.9749 (86)
MIT	19.3630	19.5545	19.9041	20.3362	20.7084	20.9335	20.9861	20.9833	20.8583	20.4283	19.8506	19.3387 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house												
	0.9644	0.9489	0.9148	0.8388	0.6923	0.4414	0.2445	0.2652	0.5745	0.8391	0.9387	0.9692 (89)
MIT 2	17.7101	17.9887	18.4871	19.0928	19.5741	19.8229	19.8563	19.8606	19.7580	19.2328	18.4278	17.6838 (90)
Living area fraction												
	fLA = Living area / (4) =											0.1739 (91)
MIT	17.9976	18.2611	18.7336	19.3091	19.7714	20.0161	20.0528	20.0559	19.9494	19.4408	18.6753	17.9717 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8476	18.1111	18.5836	19.1591	19.6214	19.8661	19.9028	19.9059	19.7994	19.2908	18.5253	17.8217 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9483	0.9297	0.8918	0.8153	0.6777	0.4418	0.2497	0.2703	0.5686	0.8159	0.9182	0.9546 (94)
Useful gains	774.9607	843.1873	872.4436	856.4496	723.5287	474.4340	255.5319	266.7026	536.0810	708.1100	741.8258	737.1302 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	1679.9869	1638.0299	1464.2231	1201.0070	858.8745	495.7863	257.5446	269.3369	589.8268	991.7562	1357.2771	1655.1609 (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												
	673.3395	534.1342	440.2839	248.0813	100.6973	0.0000	0.0000	0.0000	0.0000	211.0328	443.1250	683.0149 (98)
Space heating												3333.7088 (98)
Space heating per m2										(98) / (4) =		33.0791 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3683.6562 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.3395	534.1342	440.2839	248.0813	100.6973	0.0000	0.0000	0.0000	0.0000	211.0328	443.1250	683.0149	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	744.0215	590.2036	486.5016	274.1230	111.2677	0.0000	0.0000	0.0000	0.0000	233.1854	489.6408	754.7126	(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 requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8167	89.7613	89.6224	89.3123	88.6305	87.3000	87.3000	87.3000	87.3000	89.1604	89.6352	87.3000	(216)
Fuel for water heating, kWh/month	196.3408	172.2655	179.0812	158.1379	153.9999	136.5557	128.1658	144.7599	145.8047	164.4130	176.6185	190.5796	(219)
Water heating fuel used												1946.7225	(219)
Annual totals kWh/year													
Space heating fuel - main system												3683.6562	(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)												423.5919	(232)
Total delivered energy for all uses												6128.9706	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3683.6562	9.7400	358.7881 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.7225	9.7400	189.6108 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	423.5919	36.8500	156.0936 (250)
Additional standing charges			104.0000 (251)
Total energy cost			836.1300 (255)

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	3683.6562	0.2160	795.6697 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.7225	0.2160	420.4921 (264)
Space and water heating			1216.1618 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1474.9310 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3683.6562	1.2200	4494.0605 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.7225	1.2200	2375.0015 (264)
Space and water heating			6869.0620 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Primary energy kWh/year			8399.7391 (272)
Primary energy kWh/m2/year			83.3473 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 85

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 1.1	-£ 79	-189 kg (12.8%)
U Solar photovoltaic panels	+ 9.2	-£ 672	-947 kg (73.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	1.88 kg/m ²	B 85 B 87
Solar photovoltaic panels	£672	9.39 kg/m ²	A 94 A 95
Total Savings	£751	11.27 kg/m ²	

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 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	£184	£202	-£18
Mains gas	£652	£555	£97
Space heating	£490	£490	£0
Water heating	£190	£111	£79
Lighting	£156	£156	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£836	£85	£751
Total cost of uses	£836	£85	£751
Delivered energy	61 kWh/m ²	33 kWh/m ²	27 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	3 kg/m ²	11 kg/m ²
Primary energy	83 kWh/m ²	17 kWh/m ²	66 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1593 (H8)
Utilisation factor												0.5779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-869.6671 (H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037 (63)
Solar input (sum of months) = Sum (63)m =												-869.6671 (63)
Output from w/h	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129 (64)
Total per year (kWh/year) = Sum (64)m =												863.6545 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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)
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(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
North				7.6800	10.6334		0.4600		0.0000		0.7700		28.9255 (74)
South				5.0200	46.7521		0.4600		0.0000		0.7700		83.1291 (78)
South				3.3300	46.7521		0.4600		0.0000		0.7700		55.1434 (78)
Solar gains	167.1981	281.7329	382.3943	476.9036	542.9851	544.5336	522.5922	471.3981	414.2695	310.0542	199.5835		143.5939 (83)
Total gains	801.0149	910.5337	986.4177	1042.5037	1069.0686	1035.4665	993.1821	951.1727	916.3445	850.7795	783.1965		759.8229 (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	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area	0.9762	0.9632	0.9414	0.8968	0.8149	0.6772	0.5322	0.5690	0.7602	0.9077	0.9631	0.9796 (86)
MIT	19.1435	19.3719	19.7143	20.1586	20.5496	20.8340	20.9446	20.9299	20.7394	20.2427	19.6258	19.1134 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house	0.9710	0.9552	0.9280	0.8717	0.7666	0.5906	0.4103	0.4489	0.6851	0.8802	0.9537	0.9752 (89)
MIT 2	17.3716	17.7028	18.1957	18.8332	19.3610	19.7161	19.8200	19.8127	19.6128	18.9634	18.0853	17.3379 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.6798	17.9932	18.4599	19.0638	19.5678	19.9105	20.0156	20.0070	19.8087	19.1859	18.3532	17.6467 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5298	17.8432	18.3099	18.9138	19.4178	19.7605	19.8656	19.8570	19.6587	19.0359	18.2032	17.4967 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9563	0.9366	0.9054	0.8471	0.7464	0.5832	0.4123	0.4495	0.6712	0.8558	0.9352	0.9620	(94)
Useful gains	766.0410	852.8245	893.1102	883.0758	797.9285	603.8871	409.4840	427.5967	615.0665	728.1199	732.4158	730.9146	(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	1801.7686	1755.8576	1595.9683	1328.7564	1020.5615	671.4171	424.8745	448.4134	727.7850	1115.5248	1478.5207	1783.4749	(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	770.5814	606.8382	522.9264	320.8900	165.6390	0.0000	0.0000	0.0000	0.0000	288.2292	537.1956	783.1049	(98)
Space heating												3995.4047	(98)
Space heating per m2											(98) / (4) =	39.6448	(99)

8c. Space cooling requirement

Not applicable

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4414.8118 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	770.5814	606.8382	522.9264	320.8900	165.6390	0.0000	0.0000	0.0000	0.0000	288.2292	537.1956	783.1049	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	851.4711	670.5395	577.8193	354.5746	183.0265	0.0000	0.0000	0.0000	0.0000	318.4853	593.5863	865.3092	(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	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129	(64)
Efficiency of water heater	89.9593	89.9840	90.0209	90.0924	90.1789	87.3000	87.3000	87.3000	87.3000	89.6993	89.8646	87.3000	(216)
(217)m	89.9593	89.9840	90.0209	90.0924	90.1789	87.3000	87.3000	87.3000	87.3000	89.6993	89.8646	89.9695	(217)
Fuel for water heating, kWh/month	167.9962	125.0725	98.6719	50.1516	19.7655	2.9152	0.0000	29.5406	55.5649	103.4504	142.8810	166.8486	(219)
Water heating fuel used												962.8584	(219)
Annual totals kWh/year													
Space heating fuel - main system												4414.8118	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												423.5919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												4199.0227	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4414.8118	3.4800	153.6355	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.8584	3.4800	33.5075	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	423.5919	13.1900	55.8718	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			151.6793	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.4370	(257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	93.9039	
SAP rating (Section 12)			94	(258)
SAP band			A	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4414.8118	0.2160	953.5993 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.8584	0.2160	207.9774 (264)
Space and water heating			1161.5768 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			549.8587 (272)
CO2 emissions per m2			5.4600 (273)
EI value			94.9457
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

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Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1564.4598 (45)
Water storage loss:	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Total storage loss:												
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 (56)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2243 (H8)
Utilisation factor												0.5582 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-887.0104 (H17)
Solar input	-27.3017	-41.0345	-69.1072	-95.5273	-115.0470	-121.0820	-118.1746	-105.5306	-82.3670	-56.0328	-33.1860	-22.6197 (63)
Solar input (sum of months) = Sum (63)m =												-887.0104 (63)
Output from w/h	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969 (64)
Total per year (kWh/year) = Sum (64)m =												851.2283 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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)
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(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		
North				7.6800	11.9814	0.4600	0.0000		0.7700	32.5926 (74)		
South				5.0200	50.9848	0.4600	0.0000		0.7700	90.6553 (78)		
South				3.3300	50.9848	0.4600	0.0000		0.7700	60.1359 (78)		
Solar gains	183.3838	278.1750	374.3131	484.8318	541.5653	582.9227	552.7016	506.9865	440.7628	327.1550	224.2564	155.9938 (83)
Total gains	817.2006	906.9757	978.3364	1050.4320	1067.6487	1073.8556	1023.2915	986.7610	942.8378	867.8803	807.8695	772.2228 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area	0.9709	0.9582	0.9310	0.8707	0.7558	0.5483	0.3789	0.4014	0.6704	0.8764	0.9514	0.9749 (86)
MIT	19.3630	19.5545	19.9041	20.3362	20.7084	20.9335	20.9861	20.9833	20.8583	20.4283	19.8506	19.3387 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house	0.9644	0.9489	0.9148	0.8388	0.6923	0.4414	0.2445	0.2652	0.5745	0.8391	0.9387	0.9692 (89)
MIT 2	17.7101	17.9887	18.4871	19.0928	19.5741	19.8229	19.8563	19.8606	19.7580	19.2328	18.4278	17.6838 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.9976	18.2611	18.7336	19.3091	19.7714	20.0161	20.0528	20.0559	19.9494	19.4408	18.6753	17.9717 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8476	18.1111	18.5836	19.1591	19.6214	19.8661	19.9028	19.9059	19.7994	19.2908	18.5253	17.8217 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9483	0.9297	0.8918	0.8153	0.6777	0.4418	0.2497	0.2703	0.5686	0.8159	0.9182	0.9546	(94)
Useful gains	774.9607	843.1873	872.4436	856.4496	723.5287	474.4340	255.5319	266.7026	536.0810	708.1100	741.8258	737.1302	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1679.9869	1638.0299	1464.2231	1201.0070	858.8745	495.7863	257.5446	269.3369	589.8268	991.7562	1357.2771	1655.1609	(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	673.3395	534.1342	440.2839	248.0813	100.6973	0.0000	0.0000	0.0000	0.0000	211.0328	443.1250	683.0149	(98)
Space heating												3333.7088	(98)
Space heating per m2											(98) / (4) =	33.0791	(99)

8c. Space cooling requirement

Not applicable

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3683.6562 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.3395	534.1342	440.2839	248.0813	100.6973	0.0000	0.0000	0.0000	0.0000	211.0328	443.1250	683.0149	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	744.0215	590.2036	486.5016	274.1230	111.2677	0.0000	0.0000	0.0000	0.0000	233.1854	489.6408	754.7126	(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	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969	(64)
Efficiency of water heater	89.9028	89.9220	89.9334	89.9868	89.9213	87.3000	87.3000	87.3000	87.3000	89.5148	89.7754	87.3000	(216)
(217)m	89.9028	89.9220	89.9334	89.9868	89.9213	87.3000	87.3000	87.3000	87.3000	89.5148	89.7754	89.9111	(217)
Fuel for water heating, kWh/month	165.7848	126.3244	101.6192	50.7956	23.8474	0.0000	0.0000	23.8772	51.4554	101.1660	139.3770	165.2709	(219)
Water heating fuel used												949.5179	(219)
Annual totals kWh/year													
Space heating fuel - main system												3683.6562	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												423.5919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												3357.6064	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3683.6562	9.7400	358.7881	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.5179	9.7400	92.4830	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	423.5919	36.8500	156.0936	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			85.2244	(255)

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	3683.6562	0.2160	795.6697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.5179	0.2160	205.0959	(264)
Space and water heating			1000.7656	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	423.5919	0.5190	219.8442	(268)
Energy saving/generation technologies				

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PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			338.7459 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3683.6562	1.2200	4494.0605 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.5179	1.2200	1158.4119 (264)
Space and water heating			5652.4724 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1736.4794 (272)
Primary energy kWh/m2/year			17.2304 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	159.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	343.88 (P1)
Transmission heat loss coefficient	79.53 (37)
Summer heat loss coefficient	423.41 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Shading	Gains W
North	7.6800	81.1852	0.4600	0.0000	0.9000	258.1299
South	5.0200	112.2060	0.4600	0.0000	0.9000	233.1955
South	3.3300	112.2060	0.4600	0.0000	0.9000	154.6894
total:						646.0148

	Jun	Jul	Aug	
Solar gains	681	646	593	(P4)
Internal gains	488	468	477	
Total summer gains	1169	1114	1069	(P5)
Summer gain/loss ratio	2.76	2.63	2.53	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 159.1)	0.89	0.89	0.89	
Threshold temperature	19.65	21.42	21.21	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			