

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-626				Issued on Date	22/03/2023
Assessment Reference	Plot 626	Prop Type Ref	Maplethorne-As-DET			
Property	Plot 621, 3 Bed, K, WC, B, En					
SAP Rating	84 B	DER	17.73	TER	18.63	
Environmental	85 B	% DER<TER	4.85			
CO ₂ Emissions (t/year)	1.40	DFEE	51.20	TFEE	57.60	
General Requirements Compliance	Pass	% DFEE<TFEE	11.12			
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 96 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.63 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.73 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.2 kWh/m²/yrOK

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	1.30 (max. 2.00)	1.30 (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 ESPl 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 East: 0.72 m², No overhang

Windows facing South East: 7.64 m², No overhang

Windows facing South West: 0.72 m², No overhang

Windows facing North West: 5.06 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 0.027 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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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					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) =	0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =		0.4122 (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	0.5255	0.5152	0.5049	0.4534	0.4431	0.3916	0.3916	0.3813	0.4122	0.4431	0.4637	0.4843 (22b)
Effective ac	0.6381	0.6327	0.6275	0.6028	0.5982	0.5767	0.5767	0.5727	0.5849	0.5982	0.6075	0.6173 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	67.0843			(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
168.7292 (35)
6.7004 (36)
(33) + (36) = 73.7846 (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	52.0968	51.6590	51.2299	49.2143	48.8372	47.0817	47.0817	46.7566	47.7579	48.8372	49.6001	50.3977 (38)
Heat transfer coeff	125.8815	125.4437	125.0145	122.9990	122.6219	120.8664	120.8664	120.5413	121.5426	122.6219	123.3847	124.1823 (39)
Average = Sum(39)m / 12 =												122.9972 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3107	1.3062	1.2851	1.2812	1.2628	1.2628	1.2594	1.2699	1.2812	1.2892	1.2975 (40)
HLP (average)												1.2851 (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
Average daily hot water use (litres/day)
2.6961 (42)
98.2325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558	14.1290 (61)
Total heat required for water heating calculated for each month	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (64)
Heat gains from water heating, kWh/month	56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.5601	20.9259	17.0181	12.8838	9.6308	8.1307	8.7855	11.4198	15.3276	19.4619	22.7149	24.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.2000	251.7859	245.2695	231.3968	213.8850	197.4264	186.4310	183.8451	190.3616	204.2343	221.7460	238.2047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	415.5677	413.2461	398.1013	373.6727	348.7378	324.9097	309.5836	316.0233	328.7210	353.3739	381.6392	402.9634	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast					0.7200	11.2829	0.4600	0.0000	0.7700		2.8774 (75)		
Southeast					4.3100	36.7938	0.4600	0.0000	0.7700		56.1695 (77)		
Southwest					0.7200	36.7938	0.4600	0.0000	0.7700		9.3833 (79)		
Northwest					5.0600	11.2829	0.4600	0.0000	0.7700		20.2219 (81)		
Southeast					3.3300	36.7938	0.4600	0.0000	0.7700		43.3978 (77)		
Solar gains	132.0500	232.6026	338.6369	453.7475	539.4145	549.2286	523.8075	457.7993	378.1701	262.5704	159.5627	112.1031	(83)
Total gains	547.6176	645.8487	736.7382	827.4201	888.1523	874.1383	833.3911	773.8226	706.8911	615.9443	541.2018	515.0665	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6355	35.7599	35.8827	36.4707	36.5828	37.1142	37.1142	37.2143	36.9077	36.5828	36.3566	36.1231
alpha	3.3757	3.3840	3.3922	3.4314	3.4389	3.4743	3.4743	3.4810	3.4605	3.4389	3.4238	3.4082
util living area	0.9921	0.9855	0.9715	0.9360	0.8603	0.7269	0.5821	0.6345	0.8370	0.9559	0.9867	0.9936 (86)
MIT	19.0213	19.2426	19.6047	20.0875	20.5185	20.8224	20.9400	20.9183	20.6831	20.1217	19.4917	18.9932 (87)
Th 2	19.8289	19.8325	19.8360	19.8525	19.8556	19.8701	19.8701	19.8727	19.8645	19.8556	19.8493	19.8428 (88)
util rest of house	0.9902	0.9820	0.9640	0.9181	0.8183	0.6418	0.4549	0.5097	0.7723	0.9401	0.9829	0.9920 (89)
MIT 2	17.2030	17.5268	18.0532	18.7526	19.3435	19.7270	19.8397	19.8272	19.5739	18.8139	17.9019	17.1703 (90)
Living area fraction	17.4796	17.7878	18.2893	18.9557	19.5222	19.8937	20.0071	19.9932	19.7426	19.0128	18.1437	17.4476 (91)
MIT	17.4796	17.7878	18.2893	18.9557	19.5222	19.8937	20.0071	19.9932	19.7426	19.0128	18.1437	17.4476 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3296	17.6378	18.1393	18.8057	19.3722	19.7437	19.8571	19.8432	19.5926	18.8628	17.9937	17.2976 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9834	0.9717	0.9483	0.8963	0.7965	0.6309	0.4533	0.5061	0.7531	0.9205	0.9730	0.9863	(94)
Ext temp.	538.5522	627.5594	698.6713	741.5996	707.3905	551.4596	377.7767	391.6024	532.3738	566.9558	526.5880	508.0323	(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	1640.1820	1597.8756	1455.0759	1218.3871	940.7826	621.6978	393.6717	415.0453	667.5856	1013.2039	1344.1212	1626.4897	(97)
Space heating kWh	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	819.6125	652.0525	562.7650	343.2870	173.6437	0.0000	0.0000	0.0000	0.0000	332.0086	588.6239	832.1323	(98)
Space heating per m2												4304.1255	(98)
												44.9705	(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													4755.9397 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	819.6125	652.0525	562.7650	343.2870	173.6437	0.0000	0.0000	0.0000	0.0000	332.0086	588.6239	832.1323	(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)	905.6492	720.5000	621.8398	379.3226	191.8715	0.0000	0.0000	0.0000	0.0000	366.8603	650.4132	919.4832	(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	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163	(64)
Efficiency of water heater (217)m	89.9217	89.8742	89.7760	89.5506	89.0719	87.3000	87.3000	87.3000	87.3000	89.5028	89.8084	89.9426	(216)
Fuel for water heating, kWh/month	193.9294	170.1397	176.8021	155.9892	151.5702	135.0886	126.8064	143.1997	144.2255	161.9929	174.3294	188.2493	(219)
Water heating fuel used												1922.3225	(219)
Annual totals kWh/year													
Space heating fuel - main system												4755.9397	(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)												416.0794	(232)
Total delivered energy for all uses												7169.3416	(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	4755.9397	0.2160	1027.2830 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1922.3225	0.2160	415.2217 (264)
Space and water heating			1442.5046 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total CO2, kg/year			1697.3748 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7300 (273)

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

DER		17.7300	ZC1
Total Floor Area		95.7100	
Assumed number of occupants		2.6961	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.4290	ZC2
CO2 emissions from cooking, equation (L16)		1.9194	ZC3
Total CO2 emissions		35.0784	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		35.0784	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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1213 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3713 (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) =				0.3713 (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	0.4734	0.4641	0.4548	0.4084	0.3991	0.3527	0.3527	0.3434	0.3713	0.3991	0.4177	0.4362	(22b)				
Effective ac	0.6120	0.6077	0.6034	0.5834	0.5796	0.5622	0.5622	0.5590	0.5689	0.5796	0.5872	0.5951	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			14.1400	1.3258	18.7462		(27)					
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218		(28a)					
EW Brick AAC015	148.1200	16.2700	131.8500	0.1800	23.7330		(29a)					
Plane Ceiling	47.8600		47.8600	0.1300	6.2218		(30)					
Total net area of external elements Aum(A, m2)			243.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.0528		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5562 (36)					
Total fabric heat loss						(33) + (36) =	67.6090 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.9694	Feb 49.6142	Mar 49.2661	Apr 47.6309	May 47.3249	Jun 45.9007	Jul 45.9007	Aug 45.6369	Sep 46.4493	Oct 47.3249	Nov 47.9438	Dec 48.5909 (38)
Heat transfer coeff	117.5784	117.2233	116.8751	115.2399	114.9339	113.5097	113.5097	113.2459	114.0583	114.9339	115.5529	116.1999 (39)
Average = Sum(39)m / 12 =												115.2384 (39)
HLP	Jan 1.2285	Feb 1.2248	Mar 1.2211	Apr 1.2041	May 1.2009	Jun 1.1860	Jul 1.1860	Aug 1.1832	Sep 1.1917	Oct 1.2009	Nov 1.2073	Dec 1.2141 (40)
HLP (average)												1.2040 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	Jan 108.0557	Feb 104.1264	Mar 100.1971	Apr 96.2678	May 92.3385	Jun 88.4092	Jul 88.4092	Aug 92.3385	Sep 96.2678	Oct 100.1971	Nov 104.1264	Dec 108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)
Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	47.4746	47.0547	43.5991	45.0524	47.0547	47.4746	50.9589	49.3151	50.9589 (61)
Solar input	211.2025	186.1774	195.5812	173.5598	168.0365	147.9971	141.7925	158.0654	159.8111	181.8763	192.2217	206.1462 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	211.2025	186.1774	195.5812	173.5598	168.0365	147.9971	141.7925	158.0654	159.8111	181.8763	192.2217	206.1462 (64)
	66.0207	58.1067	60.8266	53.7920	51.9901	45.6121	43.4292	48.6747	49.2205	56.2698	59.8452	64.3395 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.5601	20.9259	17.0181	12.8838	9.6308	8.1307	8.7855	11.4198	15.3276	19.4619	22.7149	24.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.2000	251.7859	245.2695	231.3968	213.8850	197.4264	186.4310	183.8451	190.3616	204.2343	221.7460	238.2047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	88.7375	86.4684	81.7562	74.7111	69.8792	63.3502	58.3726	65.4230	68.3619	75.6314	83.1184	86.4778	(72)
Total internal gains	427.9393	425.6218	410.4854	385.4333	359.8366	335.3489	320.0307	327.1295	340.4926	365.7691	394.0209	415.3390	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					0.7200	11.2829	0.6300	0.7000	0.7700		2.4827 (75)	
Southeast					7.6400	36.7938	0.6300	0.7000	0.7700		85.9093 (77)	
Southwest					0.7200	36.7938	0.6300	0.7000	0.7700		8.0962 (79)	
Northwest					5.0600	11.2829	0.6300	0.7000	0.7700		17.4480 (81)	
Solar gains	113.9361	200.6956	292.1848	391.5051	465.4209	473.8888	451.9548	395.0012	326.2951	226.5525	137.6748	96.7255 (83)
Total gains	541.8754	626.3173	702.6702	776.9384	825.2575	809.2377	771.9855	722.1307	666.7876	592.3217	531.6957	512.0645 (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	56.5285	56.6997	56.8686	57.6756	57.8291	58.5547	58.5547	58.6911	58.2731	57.8291	57.5194	57.1991	
alpha	4.7686	4.7800	4.7912	4.8450	4.8553	4.9036	4.9036	4.9127	4.8849	4.8553	4.8346	4.8133	
util living area	0.9984	0.9966	0.9913	0.9731	0.9168	0.7829	0.6177	0.6741	0.8909	0.9830	0.9968	0.9988	(86)
MIT	19.6238	19.7772	20.0331	20.3797	20.6964	20.9094	20.9780	20.9667	20.8121	20.4040	19.9549	19.6026	(87)
Th 2	19.8973	19.9002	19.9031	19.9168	19.9193	19.9312	19.9312	19.9334	19.9266	19.9193	19.9141	19.9087	(88)
util rest of house	0.9979	0.9954	0.9880	0.9619	0.8800	0.6925	0.4822	0.5401	0.8287	0.9740	0.9955	0.9984	(89)
MIT 2	18.0649	18.2910	18.6656	19.1735	19.6083	19.8673	19.9228	19.9190	19.7669	19.2156	18.5609	18.0419	(90)
Living area fraction	18.3021	18.5171	18.8736	19.3570	19.7738	20.0259	20.0833	20.0784	19.9259	19.3964	18.7730	18.2793	(92)
Temperature adjustment	18.3021	18.5171	18.8736	19.3570	19.7738	20.0259	20.0833	20.0784	19.9259	19.3964	18.7730	18.2793	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	540.0564	621.9495	691.1195	741.2844	721.2339	567.6970	387.9973	404.2737	552.5244	573.1913	528.1042	510.7503	(94)
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	1646.3431	1596.2378	1446.1712	1205.0655	927.9554	615.8886	395.3902	416.5610	664.4887	1011.0026	1348.8427	1636.0185	(97)
Month fracti	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 kWh	823.0773	654.7217	561.7584	333.9223	153.8008	0.0000	0.0000	0.0000	0.0000	325.7316	590.9317	837.1996	(98)
Space heating												4281.1435	(98)
Space heating per m2												44.7304	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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													4583.6654 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	823.0773	654.7217	561.7584	333.9223	153.8008	0.0000	0.0000	0.0000	0.0000	325.7316	590.9317	837.1996	(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)	881.2391	700.9868	601.4544	357.5186	164.6689	0.0000	0.0000	0.0000	0.0000	348.7491	632.6892	896.3593	(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	211.2025	186.1774	195.5812	173.5598	168.0365	147.9971	141.7925	158.0654	159.8111	181.8763	192.2217	206.1462	(64)
Efficiency of water heater (217)m	88.1363	87.9508	87.5560	86.6717	84.8292	80.3000	80.3000	80.3000	80.3000	86.5017	87.6928	88.2079	(216)
Fuel for water heating, kWh/month	239.6317	211.6837	223.3784	200.2496	198.0880	184.3053	176.5785	196.8436	199.0176	210.2576	219.1990	233.7049	(219)
Water heating fuel used												2492.9379	(219)
Annual totals kWh/year													
Space heating fuel - main system												4583.6654	(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)												416.0794	(232)
Total delivered energy for all uses												7567.6827	(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	4583.6654	0.2160	990.0717 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2492.9379	0.2160	538.4746 (264)
Space and water heating			1528.5463 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total CO2, kg/m2/year			1783.4165 (272)
Emissions per m2 for space and water heating			15.9706 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2562 (272b)
Emissions per m2 for pumps and fans			0.4067 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9706 * 1.00) + 2.2562 + 0.4067, rounded to 2 d.p.			18.6300 (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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1213 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3718 (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) =	0.3718 (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												
Effective ac	0.4740	0.4647	0.4554	0.4089	0.3996	0.3532	0.3532	0.3439	0.3718	0.3996	0.4182	0.4368 (22b)
	0.6123	0.6080	0.6037	0.5836	0.5799	0.5624	0.5624	0.5591	0.5691	0.5799	0.5875	0.5954 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss							(33) + (36) = 73.7846 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	49.9941	49.6379	49.2889	47.6492	47.3424	45.9144	45.9144	45.6499	46.4644	47.3424	47.9630	48.6118 (38)
Heat transfer coeff	123.7787	123.4226	123.0735	121.4339	121.1271	119.6990	119.6990	119.4345	120.2491	121.1271	121.7477	122.3965 (39)
Average = Sum(39)m / 12 =												121.4324 (39)
HLP	1.2933	1.2895	1.2859	1.2688	1.2656	1.2506	1.2506	1.2479	1.2564	1.2656	1.2720	1.2788 (40)
HLP (average)												1.2688 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1545.5797 (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	34.0518	29.7819	30.7322	26.7931	25.7086	22.1846	20.5573	23.5898	23.8715	27.8200	30.3677	32.9773 (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	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.5601	20.9259	17.0181	12.8838	9.6308	8.1307	8.7855	11.4198	15.3276	19.4619	22.7149	24.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.2000	251.7859	245.2695	231.3968	213.8850	197.4264	186.4310	183.8451	190.3616	204.2343	221.7460	238.2047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	45.7685	44.3183	41.3068	37.2126	34.5546	30.8119	27.6308	31.7067	33.1549	37.3924	42.1773	44.3243	(72)
Total internal gains	381.9702	380.4717	367.0360	344.9348	321.5120	299.8106	286.2889	290.4132	302.2856	324.5301	350.0798	370.1855	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				0.7200	11.2829	0.4600		0.0000		0.7700		2.8774 (75)	
Southeast				4.3100	36.7938	0.4600		0.0000		0.7700		56.1695 (77)	
Southwest				0.7200	36.7938	0.4600		0.0000		0.7700		9.3833 (79)	
Northwest				5.0600	11.2829	0.4600		0.0000		0.7700		20.2219 (81)	
Southeast				3.3300	36.7938	0.4600		0.0000		0.7700		43.3978 (77)	
Solar gains	132.0500	232.6026	338.6369	453.7475	539.4145	549.2286	523.8075	457.7993	378.1701	262.5704	159.5627	112.1031	(83)
Total gains	514.0202	613.0743	705.6729	798.6823	860.9265	849.0393	810.0964	748.2124	680.4557	587.1005	509.6425	482.2886	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.2409	36.3455	36.4486	36.9407	37.0343	37.4761	37.4761	37.5591	37.3047	37.0343	36.8455	36.6502	
alpha	3.4161	3.4230	3.4299	3.4627	3.4690	3.4984	3.4984	3.5039	3.4870	3.4690	3.4564	3.4433	
util living area	0.9935	0.9876	0.9745	0.9408	0.8673	0.7361	0.5912	0.6463	0.8471	0.9609	0.9889	0.9948	(86)
MIT	19.0143	19.2357	19.5981	20.0787	20.5123	20.8182	20.9385	20.9151	20.6740	20.1067	19.4763	18.9818	(87)
Th 2	19.8461	19.8490	19.8519	19.8654	19.8679	19.8797	19.8797	19.8819	19.8752	19.8679	19.8628	19.8575	(88)
util rest of house	0.9919	0.9845	0.9678	0.9241	0.8268	0.6522	0.4640	0.5219	0.7850	0.9467	0.9856	0.9935	(89)
MIT 2	18.0415	18.2637	18.6246	19.1037	19.5115	19.7789	19.8582	19.8491	19.6688	19.1400	18.5145	18.0175	(90)
Living area fraction	18.1895	18.4116	18.7727	19.2520	19.6638	19.9370	20.0225	20.0113	19.8217	19.2871	18.6608	18.1641	(91)
MIT	18.1895	18.4116	18.7727	19.2520	19.6638	19.9370	20.0225	20.0113	19.8217	19.2871	18.6608	18.1641	(92)
Temperature adjustment	18.1895	18.4116	18.7727	19.2520	19.6638	19.9370	20.0225	20.0113	19.8217	19.2871	18.6608	18.1641	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	508.1643	600.3069	677.0465	728.9136	704.3746	557.8358	390.1185	402.3815	531.7189	550.0839	499.8282	477.8335	(94)
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	1719.2263	1667.6337	1510.4395	1257.0870	964.6267	638.8292	409.6733	431.3134	688.0328	1052.2394	1407.4965	1709.1625	(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	901.0301	717.2436	620.0444	380.2849	193.6276	0.0000	0.0000	0.0000	0.0000	373.6037	653.5212	916.1088	(98)
Space heating													4755.4642 (98)
Space heating per m2													(98) / (4) = 49.6862 (99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1125.1706	885.7726	907.7025	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7672	0.8380	0.8059	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	863.2469	742.2894	731.4885	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1095.5554	1047.8872	977.5367	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	167.2621	227.3648	183.0599	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												577.6868	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.8155	56.8412	45.7650	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												144.4217	(107)
Space cooling per m2												1.5090	(108)
Energy for space heating												49.6862	(99)
Energy for space cooling												1.5090	(108)
Total												51.1951	(109)
Dwelling Fabric Energy Efficiency (DFEE)												51.2	(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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =		0.1213 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3713 (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) =				0.3713 (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	0.4734	0.4641	0.4548	0.4084	0.3991	0.3527	0.3527	0.3434	0.3713	0.3991	0.4177	0.4362 (22b)					
Effective ac	0.6120	0.6077	0.6034	0.5834	0.5796	0.5622	0.5622	0.5590	0.5689	0.5796	0.5872	0.5951 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			14.1400	1.3258	18.7462		(27)					
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218		(28a)					
EW Brick AAC015	148.1200	16.2700	131.8500	0.1800	23.7330		(29a)					
Plane Ceiling	47.8600		47.8600	0.1300	6.2218		(30)					
Total net area of external elements Aum(A, m2)			243.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.0528		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5562 (36)					
Total fabric heat loss						(33) + (36) =	67.6090 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.9694	Feb 49.6142	Mar 49.2661	Apr 47.6309	May 47.3249	Jun 45.9007	Jul 45.9007	Aug 45.6369	Sep 46.4493	Oct 47.3249	Nov 47.9438	Dec 48.5909 (38)
Heat transfer coeff	117.5784	117.2233	116.8751	115.2399	114.9339	113.5097	113.5097	113.2459	114.0583	114.9339	115.5529	116.1999 (39)
Average = Sum(39)m / 12 =												115.2384 (39)
HLP	Jan 1.2285	Feb 1.2248	Mar 1.2211	Apr 1.2041	May 1.2009	Jun 1.1860	Jul 1.1860	Aug 1.1832	Sep 1.1917	Oct 1.2009	Nov 1.2073	Dec 1.2141 (40)
HLP (average)												1.2040 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	Jan 108.0557	Feb 104.1264	Mar 100.1971	Apr 96.2678	May 92.3385	Jun 88.4092	Jul 88.4092	Aug 92.3385	Sep 96.2678	Oct 100.1971	Nov 104.1264	Dec 108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)
Energy content (annual)										Total = Sum(45)m =		1545.5797 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	34.0518	29.7819	30.7322	26.7931	25.7086	22.1846	20.5573	23.5898	23.8715	27.8200	30.3677	32.9773 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	134.8053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.5601	20.9259	17.0181	12.8838	9.6308	8.1307	8.7855	11.4198	15.3276	19.4619	22.7149	24.2149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.2000	251.7859	245.2695	231.3968	213.8850	197.4264	186.4310	183.8451	190.3616	204.2343	221.7460	238.2047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	36.4805	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	45.7685	44.3183	41.3068	37.2126	34.5546	30.8119	27.6308	31.7067	33.1549	37.3924	42.1773	44.3243	(72)
Total internal gains	381.9702	380.4717	367.0360	344.9348	321.5120	299.8106	286.2889	290.4132	302.2856	324.5301	350.0798	370.1855	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (75)		
Southeast					7.6400	36.7938	0.6300	0.7000	0.7700	85.9093 (77)		
Southwest					0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)		
Northwest					5.0600	11.2829	0.6300	0.7000	0.7700	17.4480 (81)		
Solar gains	113.9361	200.6956	292.1848	391.5051	465.4209	473.8888	451.9548	395.0012	326.2951	226.5525	137.6748	96.7255 (83)
Total gains	495.9064	581.1673	659.2207	736.4400	786.9329	773.6994	738.2437	685.4143	628.5807	551.0827	487.7546	466.9110 (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	56.5285	56.6997	56.8686	57.6756	57.8291	58.5547	58.5547	58.6911	58.2731	57.8291	57.5194	57.1991		
alpha	4.7686	4.7800	4.7912	4.8450	4.8553	4.9036	4.9036	4.9127	4.8849	4.8553	4.8346	4.8133		
util living area	0.9989	0.9975	0.9933	0.9781	0.9285	0.8034	0.6408	0.7010	0.9085	0.9873	0.9978	0.9992	(86)	
MIT	19.5796	19.7342	19.9927	20.3450	20.6711	20.8978	20.9743	20.9605	20.7897	20.3668	19.9128	19.5591	(87)	
Th 2	19.8973	19.9002	19.9031	19.9168	19.9193	19.9312	19.9312	19.9334	19.9266	19.9193	19.9141	19.9087	(88)	
util rest of house	0.9986	0.9966	0.9908	0.9687	0.8953	0.7154	0.5026	0.5658	0.8523	0.9803	0.9969	0.9989	(89)	
MIT 2	18.6022	18.7587	19.0184	19.3763	19.6858	19.8809	19.9243	19.9214	19.8012	19.4032	18.9484	18.5907	(90)	
Living area fraction														
MIT	18.7509	18.9071	19.1666	19.5237	19.8357	20.0356	20.0841	20.0795	19.9516	19.5498	19.0951	18.7380	(92)	
Temperature adjustment														
adjusted MIT	18.7509	18.9071	19.1666	19.5237	19.8357	20.0356	20.0841	20.0795	19.9516	19.5498	19.0951	18.7380	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	494.9166	578.5395	651.5698	710.0836	702.0581	561.1144	386.6507	401.7298	536.7805	538.3953	485.7226	466.2178	(94)
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	1699.1117	1641.9584	1480.4082	1224.2713	935.0719	616.9945	395.4748	416.6864	667.4192	1028.6335	1386.0686	1689.3129	(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	895.9212	714.6175	616.6558	370.2151	173.3623	0.0000	0.0000	0.0000	0.0000	364.7372	648.2491	909.9828	(98)
Space heating												4693.7409	(98)
Space heating per m2												49.0413	(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	1066.9910	839.9716	860.6691	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8059	0.8823	0.8507	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	859.9201	741.1018	732.1416	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1007.4958	963.9035	904.1363	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	106.2545	165.7645	127.9641	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											399.9830 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	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	26.5636	41.4411	31.9910	0.0000	0.0000	0.0000 (107)
Space cooling											99.9958 (107)
Space cooling per m2											1.0448 (108)
Energy for space heating											49.0413 (99)
Energy for space cooling											1.0448 (108)
Total											50.0861 (109)
Target Fabric Energy Efficiency (TFEE)											57.6 (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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =	0.4122 (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	0.4328	0.4122	0.4122	0.3813	0.3813	0.3400	0.3503	0.3297	0.3400	0.3607	0.3607	0.3916 (22b)
	0.5937	0.5849	0.5849	0.5727	0.5727	0.5578	0.5614	0.5544	0.5578	0.5650	0.5650	0.5767 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss							(33) + (36) = 73.7846 (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	48.4688	47.7579	47.7579	46.7566	46.7566	45.5430	45.8334	45.2612	45.5430	46.1325	46.1325	47.0817 (38)
Heat transfer coeff	122.2534	121.5426	121.5426	120.5413	120.5413	119.3276	119.6180	119.0459	119.3276	119.9171	119.9171	120.8664 (39)
Average = Sum(39)m / 12 =												120.3701 (39)
HLP	1.2773	1.2699	1.2699	1.2594	1.2594	1.2468	1.2498	1.2438	1.2468	1.2529	1.2529	1.2628 (40)
HLP (average)												1.2577 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558	14.1290 (61)
Total heat required for water heating calculated for each month	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.9003	52.3148	42.5452	32.2095	24.0770	20.3268	21.9638	28.5494	38.3189	48.6547	56.7872	60.5374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	371.9403	375.7999	366.0739	345.3684	319.2314	294.6663	278.2553	274.3957	284.1217	304.8272	330.9643	355.5293	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	618.0015	613.0022	588.7860	551.3232	512.8836	478.6989	458.9394	468.0568	489.8258	527.5130	569.2829	600.9638	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				0.7200	12.9236	0.4600	0.0000	0.7700	3.2958 (75)			
Southeast				4.3100	40.4699	0.4600	0.0000	0.7700	61.7815 (77)			
Southwest				0.7200	40.4699	0.4600	0.0000	0.7700	10.3208 (79)			
Northwest				5.0600	12.9236	0.4600	0.0000	0.7700	23.1623 (81)			
Southeast				3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (77)			
Solar gains	146.2940	232.3466	335.6072	466.0678	541.8675	591.2343	557.4671	496.8249	407.1726	280.4399	181.1879	122.9477 (83)
Total gains	764.2955	845.3488	924.3932	1017.3910	1054.7510	1069.9332	1016.4065	964.8817	896.9984	807.9528	750.4708	723.9115 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.6931	36.9077	36.9077	37.2143	37.2143	37.5928	37.5015	37.6817	37.5928	37.4080	37.4080	37.1142
alpha	3.4462	3.4605	3.4605	3.4810	3.4810	3.5062	3.5001	3.5121	3.5062	3.4939	3.4939	3.4743
util living area	0.9753	0.9639	0.9362	0.8694	0.7408	0.5233	0.3580	0.3855	0.6686	0.8860	0.9581	0.9788 (86)
MIT	19.4652	19.6441	19.9897	20.4167	20.7647	20.9527	20.9910	20.9884	20.8808	20.4701	19.9181	19.4409 (87)
Th 2	19.8586	19.8645	19.8645	19.8727	19.8727	19.8828	19.8804	19.8851	19.8828	19.8779	19.8779	19.8701 (88)
util rest of house	0.9695	0.9555	0.9207	0.8367	0.6755	0.4197	0.2320	0.2556	0.5723	0.8498	0.9466	0.9737 (89)
MIT 2	17.8641	18.1245	18.6170	19.2118	19.6542	19.8558	19.8783	19.8821	19.7969	19.3005	18.5308	17.8366 (90)
Living area fraction	fLA = Living area / (4) =											0.1521 (91)
MIT	18.1077	18.3557	18.8258	19.3951	19.8232	20.0226	20.0475	20.0504	19.9618	19.4784	18.7419	18.0807 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9577	18.2057	18.6758	19.2451	19.6732	19.8726	19.8975	19.9004	19.8118	19.3284	18.5919	17.9307 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9554	0.9384	0.8993	0.8146	0.6624	0.4187	0.2340	0.2575	0.5654	0.8275	0.9282	0.9609 (94)
Useful gains	730.1939	793.2784	831.3032	828.7839	698.6515	447.9614	237.7896	248.4299	507.1859	668.5872	696.5619	695.6202 (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	1571.8940	1532.1244	1370.4950	1126.4712	804.3932	462.1119	238.9424	250.0482	550.3091	926.7709	1270.1457	1550.7979 (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	626.2249	496.5045	401.1588	214.3348	78.6718	0.0000	0.0000	0.0000	0.0000	192.0887	412.9803	636.2522 (98)
Space heating												3058.2160 (98)
RHI space heating demand												3058 (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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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					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) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =	0.4122 (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	0.5255	0.5152	0.5049	0.4534	0.4431	0.3916	0.3916	0.3813	0.4122	0.4431	0.4637	0.4843 (22b)
Effective ac	0.6381	0.6327	0.6275	0.6028	0.5982	0.5767	0.5767	0.5727	0.5849	0.5982	0.6075	0.6173 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss						(33) + (36) =	73.7846 (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	52.0968	51.6590	51.2299	49.2143	48.8372	47.0817	47.0817	46.7566	47.7579	48.8372	49.6001	50.3977 (38)
Heat transfer coeff	125.8815	125.4437	125.0145	122.9990	122.6219	120.8664	120.8664	120.5413	121.5426	122.6219	123.3847	124.1823 (39)
Average = Sum(39)m / 12 =												122.9972 (39)
HLP	1.3152	1.3107	1.3062	1.2851	1.2812	1.2628	1.2628	1.2594	1.2699	1.2812	1.2892	1.2975 (40)
HLP (average)												1.2851 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558	14.1290 (61)
Total heat required for water heating calculated for each month	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (64)
												Total per year (kWh/year) = Sum(64)m = 1711.1415 (64)
Heat gains from water heating, kWh/month	56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.9003	52.3148	42.5452	32.2095	24.0770	20.3268	21.9638	28.5494	38.3189	48.6547	56.7872	60.5374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	371.9403	375.7999	366.0739	345.3684	319.2314	294.6663	278.2553	274.3957	284.1217	304.8272	330.9643	355.5293	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	618.0015	613.0022	588.7860	551.3232	512.8836	478.6989	458.9394	468.0568	489.8258	527.5130	569.2829	600.9638	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					0.7200	11.2829	0.4600	0.0000			0.7700			2.8774 (75)		
Southeast					4.3100	36.7938	0.4600	0.0000			0.7700			56.1695 (77)		
Southwest					0.7200	36.7938	0.4600	0.0000			0.7700			9.3833 (79)		
Northwest					5.0600	11.2829	0.4600	0.0000			0.7700			20.2219 (81)		
Southeast					3.3300	36.7938	0.4600	0.0000			0.7700			43.3978 (77)		
Solar gains					132.0500	232.6026	338.6369	453.7475	539.4145	549.2286	523.8075	457.7993	378.1701	262.5704	159.5627	112.1031 (83)
Total gains					750.0514	845.6048	927.4230	1005.0707	1052.2981	1027.9275	982.7469	925.8560	867.9959	790.0833	728.8456	713.0669 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6355	35.7599	35.8827	36.4707	36.5828	37.1142	37.1142	37.2143	36.9077	36.5828	36.3566	36.1231
alpha	3.3757	3.3840	3.3922	3.4314	3.4389	3.4743	3.4743	3.4810	3.4605	3.4389	3.4238	3.4082
util living area	0.9799	0.9688	0.9469	0.8976	0.8048	0.6562	0.5097	0.5541	0.7623	0.9167	0.9686	0.9829 (86)
MIT	19.2647	19.4747	19.8113	20.2507	20.6245	20.8727	20.9603	20.9466	20.7729	20.2950	19.7113	19.2342 (87)
Th 2	19.8289	19.8325	19.8360	19.8525	19.8556	19.8701	19.8701	19.8727	19.8645	19.8556	19.8493	19.8428 (88)
util rest of house	0.9753	0.9616	0.9343	0.8722	0.7546	0.5690	0.3918	0.4360	0.6867	0.8906	0.9601	0.9790 (89)
MIT 2	17.5549	17.8598	18.3443	18.9715	19.4696	19.7721	19.8510	19.8447	19.6679	19.0474	18.2159	17.5196 (90)
Living area fraction	17.8150	18.1055	18.5675	19.1661	19.6453	19.9395	20.0197	20.0123	19.8360	19.2372	18.4434	17.7804 (91)
MIT	17.8150	18.1055	18.5675	19.1661	19.6453	19.9395	20.0197	20.0123	19.8360	19.2372	18.4434	17.7804 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6650	17.9555	18.4175	19.0161	19.4953	19.7895	19.8697	19.8623	19.6860	19.0872	18.2934	17.6304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9627	0.9453	0.9136	0.8489	0.7361	0.5622	0.3918	0.4349	0.6728	0.8677	0.9437	0.9676	(94)
Ext temp.	722.0446	799.3780	847.3109	853.2499	774.6364	577.8754	385.0515	402.6253	584.0035	685.5416	687.8335	689.9696	(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	1682.4069	1637.7265	1489.8623	1244.2685	955.8690	627.2375	395.1985	417.3518	678.9390	1040.7184	1381.0926	1667.8202	(97)
Space heating kWh	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	714.5095	563.3702	478.0582	281.5334	134.8371	0.0000	0.0000	0.0000	0.0000	264.2516	499.1465	727.5208	(98)
Space heating per m2												3663.2274	(98)
												(98) / (4) = 38.2742	(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												4047.7651	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	714.5095	563.3702	478.0582	281.5334	134.8371	0.0000	0.0000	0.0000	0.0000	264.2516	499.1465	727.5208	(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)	789.5133	622.5085	528.2412	311.0866	148.9913	0.0000	0.0000	0.0000	0.0000	291.9907	551.5431	803.8904	(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	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163	(64)
Efficiency of water heater (217)m	89.8539	89.7973	89.6806	89.4131	88.8702	87.3000	87.3000	87.3000	87.3000	89.3398	89.7148	89.8780	(216)
Fuel for water heating, kWh/month	194.0759	170.2853	176.9902	156.2291	151.9142	135.0886	126.8064	143.1997	144.2255	162.2885	174.5112	188.3846	(219)
Water heating fuel used												1923.9993	(219)
Annual totals kWh/year													
Space heating fuel - main system												4047.7651	(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)												416.0794	(232)
Total delivered energy for all uses												6462.8437	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4047.7651	3.4800	140.8622 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1923.9993	3.4800	66.9552 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	416.0794	13.1900	54.8809 (250)
Additional standing charges			120.0000 (251)
Total energy cost			392.5908 (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] = 1.1718 (257)
SAP value	83.6530
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	4047.7651	0.2160	874.3173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1923.9993	0.2160	415.5838 (264)
Space and water heating			1289.9011 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total kg/year			1544.7713 (272)
CO2 emissions per m2			16.1400 (273)
EI value			85.2889
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	$3.48 / 0.8881 = 3.918$, stars = 4
Water heating environmental impact	$0.216 / 0.8881 = 0.2432$, 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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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					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) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =	0.4122 (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	0.4328	0.4122	0.4122	0.3813	0.3813	0.3400	0.3503	0.3297	0.3400	0.3607	0.3607	0.3916 (22b)
Effective ac	0.5937	0.5849	0.5849	0.5727	0.5727	0.5578	0.5614	0.5544	0.5578	0.5650	0.5650	0.5767 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss							(33) + (36) = 73.7846 (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	48.4688	47.7579	47.7579	46.7566	46.7566	45.5430	45.8334	45.2612	45.5430	46.1325	46.1325	47.0817 (38)
Heat transfer coeff	122.2534	121.5426	121.5426	120.5413	120.5413	119.3276	119.6180	119.0459	119.3276	119.9171	119.9171	120.8664 (39)
Average = Sum(39)m / 12 =												120.3701 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2773	1.2699	1.2699	1.2594	1.2594	1.2468	1.2498	1.2438	1.2468	1.2529	1.2529	1.2628 (40)
HLP (average)												1.2577 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558	14.1290 (61)
Total heat required for water heating calculated for each month	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (64)
	Total per year (kWh/year) = Sum(64)m = 1711.1415 (64)											
Heat gains from water heating, kWh/month	56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.9003	52.3148	42.5452	32.2095	24.0770	20.3268	21.9638	28.5494	38.3189	48.6547	56.7872	60.5374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	371.9403	375.7999	366.0739	345.3684	319.2314	294.6663	278.2553	274.3957	284.1217	304.8272	330.9643	355.5293	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	618.0015	613.0022	588.7860	551.3232	512.8836	478.6989	458.9394	468.0568	489.8258	527.5130	569.2829	600.9638	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					0.7200	12.9236	0.4600	0.0000			0.7700			3.2958 (75)
Southeast					4.3100	40.4699	0.4600	0.0000			0.7700			61.7815 (77)
Southwest					0.7200	40.4699	0.4600	0.0000			0.7700			10.3208 (79)
Northwest					5.0600	12.9236	0.4600	0.0000			0.7700			23.1623 (81)
Southeast					3.3300	40.4699	0.4600	0.0000			0.7700			47.7337 (77)
Solar gains	146.2940	232.3466	335.6072	466.0678	541.8675	591.2343	557.4671	496.8249	407.1726	280.4399	181.1879	122.9477	(83)	
Total gains	764.2955	845.3488	924.3932	1017.3910	1054.7510	1069.9332	1016.4065	964.8817	896.9984	807.9528	750.4708	723.9115	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.6931	36.9077	36.9077	37.2143	37.2143	37.5928	37.5015	37.6817	37.5928	37.4080	37.4080	37.1142
alpha	3.4462	3.4605	3.4605	3.4810	3.4810	3.5062	3.5001	3.5121	3.5062	3.4939	3.4939	3.4743
util living area	0.9753	0.9639	0.9362	0.8694	0.7408	0.5233	0.3580	0.3855	0.6686	0.8860	0.9581	0.9788 (86)
MIT	19.4652	19.6441	19.9897	20.4167	20.7647	20.9527	20.9910	20.9884	20.8808	20.4701	19.9181	19.4409 (87)
Th 2	19.8586	19.8645	19.8645	19.8727	19.8727	19.8828	19.8804	19.8851	19.8828	19.8779	19.8779	19.8701 (88)
util rest of house	0.9695	0.9555	0.9207	0.8367	0.6755	0.4197	0.2320	0.2556	0.5723	0.8498	0.9466	0.9737 (89)
MIT 2	17.8641	18.1245	18.6170	19.2118	19.6542	19.8558	19.8783	19.8821	19.7969	19.3005	18.5308	17.8366 (90)
Living area fraction	18.1077	18.3557	18.8258	19.3951	19.8232	20.0226	20.0475	20.0504	fLA = Living area / (4) =			0.1521 (91)
MIT	18.1077	18.3557	18.8258	19.3951	19.8232	20.0226	20.0475	20.0504	19.9618	19.4784	18.7419	18.0807 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9577	18.2057	18.6758	19.2451	19.6732	19.8726	19.8975	19.9004	19.8118	19.3284	18.5919	17.9307 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9554	0.9384	0.8993	0.8146	0.6624	0.4187	0.2340	0.2575	0.5654	0.8275	0.9282	0.9609	(94)
Useful gains	730.1939	793.2784	831.3032	828.7839	698.6515	447.9614	237.7896	248.4299	507.1859	668.5872	696.5619	695.6202	(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	1571.8940	1532.1244	1370.4950	1126.4712	804.3932	462.1119	238.9424	250.0482	550.3091	926.7709	1270.1457	1550.7979	(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	626.2249	496.5045	401.1588	214.3348	78.6718	0.0000	0.0000	0.0000	0.0000	192.0887	412.9803	636.2522	(98)
Space heating												3058.2160	(98)
Space heating per m2											(98) / (4) =	31.9529	(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													3379.2442 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.2249	496.5045	401.1588	214.3348	78.6718	0.0000	0.0000	0.0000	0.0000	192.0887	412.9803	636.2522	(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)	691.9612	548.6238	443.2694	236.8341	86.9301	0.0000	0.0000	0.0000	0.0000	212.2527	456.3318	703.0411	(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	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163	(64)
Efficiency of water heater (217)m	89.7832	89.7256	89.5692	89.2097	88.4515	87.3000	87.3000	87.3000	87.3000	89.0953	89.5972	89.8081	(216)
Fuel for water heating, kWh/month	194.2287	170.4215	177.2103	156.5853	152.6333	135.0886	126.8064	143.1997	144.2255	162.7339	174.7403	188.5313	(219)
Water heating fuel used												1926.4047	(219)
Annual totals kWh/year													
Space heating fuel - main system												3379.2442	(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)												416.0794	(232)
Total delivered energy for all uses												5796.7283	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3379.2442	9.7400	329.1384 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1926.4047	9.7400	187.6318 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	416.0794	36.8500	153.3252 (250)
Additional standing charges			104.0000 (251)
Total energy cost			801.7330 (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	3379.2442	0.2160	729.9168 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.4047	0.2160	416.1034 (264)
Space and water heating			1146.0202 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total kg/year			1400.8904 (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	3379.2442	1.2200	4122.6779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.4047	1.2200	2350.2138 (264)
Space and water heating			6472.8917 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	416.0794	3.0700	1277.3636 (268)
Primary energy kWh/year			7980.5054 (272)
Primary energy kWh/m2/year			83.3821 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 85

(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	-£ 78	-188 kg (13.4%)
U Solar photovoltaic panels	+ 9.5	-£ 672	-947 kg (78.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£78	1.97 kg/m²	B 85
Solar photovoltaic panels	£672	9.89 kg/m²	A 94
Total Savings	£750	11.86 kg/m²	A 96

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 96

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	£181	£199	-£18
Mains gas	£621	£524	£97
Space heating	£461	£461	£0
Water heating	£188	£110	£78
Lighting	£153	£153	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£802	£51	£751
Total cost of uses	£802	£52	£750
Delivered energy	61 kWh/m²	32 kWh/m²	29 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	12 kg/m²
Primary energy	83 kWh/m²	14 kWh/m²	70 kWh/m²

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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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					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) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =	0.4122 (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	0.5255	0.5152	0.5049	0.4534	0.4431	0.3916	0.3916	0.3813	0.4122	0.4431	0.4637	0.4843 (22b)
Effective ac	0.6381	0.6327	0.6275	0.6028	0.5982	0.5767	0.5767	0.5727	0.5849	0.5982	0.6075	0.6173 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss							(33) + (36) = 73.7846 (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	52.0968	51.6590	51.2299	49.2143	48.8372	47.0817	47.0817	46.7566	47.7579	48.8372	49.6001	50.3977 (38)
Heat transfer coeff	125.8815	125.4437	125.0145	122.9990	122.6219	120.8664	120.8664	120.5413	121.5426	122.6219	123.3847	124.1823 (39)
Average = Sum(39)m / 12 =												122.9972 (39)
HLP	1.3152	1.3107	1.3062	1.2851	1.2812	1.2628	1.2628	1.2594	1.2699	1.2812	1.2892	1.2975 (40)
HLP (average)												1.2851 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1545.5797 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558	14.1290 (61)
Total heat required for water heating calculated for each month	174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (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												1.1734 (H8)
Utilisation factor												0.5735 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.2325 (H14)
Volume ratio Veff/V												0.7635 (H15)
Solar storage volume factor												0.9460 (H16)
Solar input												-865.2421 (H17)
Solar input	-25.0903	-41.8685	-71.3068	-95.5652	-118.0628	-116.0745	-114.5405	-100.0746	-78.3785	-53.5233	-29.7607	-20.9963 (63)
												Solar input (sum of months) = Sum(63)m = -865.2421 (63)
Output from w/h	149.2944	111.0432	87.4191	44.1241	16.9437	1.8579	0.0000	24.9387	47.5304	91.4649	126.8017	148.3200 (64)
												Total per year (kWh/year) = Sum(64)m = 849.7380 (64)
Heat gains from water heating, kWh/month	56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.9003	52.3148	42.5452	32.2095	24.0770	20.3268	21.9638	28.5494	38.3189	48.6547	56.7872	60.5374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	371.9403	375.7999	366.0739	345.3684	319.2314	294.6663	278.2553	274.3957	284.1217	304.8272	330.9643	355.5293	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	618.0015	613.0022	588.7860	551.3232	512.8836	478.6989	458.9394	468.0568	489.8258	527.5130	569.2829	600.9638	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					0.7200	11.2829		0.4600	0.0000	0.7700		2.8774 (75)				
Southeast					4.3100	36.7938		0.4600	0.0000	0.7700		56.1695 (77)				
Southwest					0.7200	36.7938		0.4600	0.0000	0.7700		9.3833 (79)				
Northwest					5.0600	11.2829		0.4600	0.0000	0.7700		20.2219 (81)				
Southeast					3.3300	36.7938		0.4600	0.0000	0.7700		43.3978 (77)				
Solar gains					132.0500	232.6026	338.6369	453.7475	539.4145	549.2286	523.8075	457.7993	378.1701	262.5704	159.5627	112.1031 (83)
Total gains					750.0514	845.6048	927.4230	1005.0707	1052.2981	1027.9275	982.7469	925.8560	867.9959	790.0833	728.8456	713.0669 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6355	35.7599	35.8827	36.4707	36.5828	37.1142	37.1142	37.2143	36.9077	36.5828	36.3566	36.1231
alpha	3.3757	3.3840	3.3922	3.4314	3.4389	3.4743	3.4743	3.4810	3.4605	3.4389	3.4238	3.4082
util living area	0.9799	0.9688	0.9469	0.8976	0.8048	0.6562	0.5097	0.5541	0.7623	0.9167	0.9686	0.9829 (86)
MIT	19.2647	19.4747	19.8113	20.2507	20.6245	20.8727	20.9603	20.9466	20.7729	20.2950	19.7113	19.2342 (87)
Th 2	19.8289	19.8325	19.8360	19.8525	19.8556	19.8701	19.8701	19.8727	19.8645	19.8556	19.8493	19.8428 (88)
util rest of house	0.9753	0.9616	0.9343	0.8722	0.7546	0.5690	0.3918	0.4360	0.6867	0.8906	0.9601	0.9790 (89)
MIT 2	17.5549	17.8598	18.3443	18.9715	19.4696	19.7721	19.8510	19.8447	19.6679	19.0474	18.2159	17.5196 (90)
Living area fraction	17.8150	18.1055	18.5675	19.1661	19.6453	19.9395	20.0197	20.0123	19.8360	19.2372	18.4434	17.7804 (91)
MIT	17.8150	18.1055	18.5675	19.1661	19.6453	19.9395	20.0197	20.0123	19.8360	19.2372	18.4434	17.7804 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6650	17.9555	18.4175	19.0161	19.4953	19.7895	19.8697	19.8623	19.6860	19.0872	18.2934	17.6304 (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	0.9627	0.9453	0.9136	0.8489	0.7361	0.5622	0.3918	0.4349	0.6728	0.8677	0.9437	0.9676	(94)
Useful gains	722.0446	799.3780	847.3109	853.2499	774.6364	577.8754	385.0515	402.6253	584.0035	685.5416	687.8335	689.9696	(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	1682.4069	1637.7265	1489.8623	1244.2685	955.8690	627.2375	395.1985	417.3518	678.9390	1040.7184	1381.0926	1667.8202	(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	714.5095	563.3702	478.0582	281.5334	134.8371	0.0000	0.0000	0.0000	0.0000	264.2516	499.1465	727.5208	(98)
Space heating												3663.2274	(98)
Space heating per m2											(98) / (4) =	38.2742	(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													4047.7651	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	714.5095	563.3702	478.0582	281.5334	134.8371	0.0000	0.0000	0.0000	0.0000	264.2516	499.1465	727.5208	(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)	789.5133	622.5085	528.2412	311.0866	148.9913	0.0000	0.0000	0.0000	0.0000	291.9907	551.5431	803.8904	(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	149.2944	111.0432	87.4191	44.1241	16.9437	1.8579	0.0000	24.9387	47.5304	91.4649	126.8017	148.3200	(64)	
Efficiency of water heater	89.9303	89.9571	89.9901	90.0528	90.1312	87.3000	87.3000	87.3000	87.3000	89.6550	89.8330	89.9417	(216)	
Fuel for water heating, kWh/month	166.0113	123.4402	97.1431	48.9981	18.7989	2.1281	0.0000	28.5666	54.4449	102.0187	141.1527	164.9069	(219)	
Water heating fuel used												947.6095	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4047.7651	(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)													416.0794	(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												3809.2146	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4047.7651	3.4800	140.8622	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	947.6095	3.4800	32.9768	(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	416.0794	13.1900	54.8809	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			137.3845	(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] =	0.4101	(257)
SAP value		94.2795	
SAP rating (Section 12)		94	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4047.7651	0.2160	874.3173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	947.6095	0.2160	204.6837 (264)
Space and water heating			1079.0009 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			463.3839 (272)
CO2 emissions per m2			4.8400 (273)
EI value			95.5871
EI rating			96 (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	47.8600 (1b)	x 2.5400 (2b)	= 121.5644 (1b) - (3b)
First floor	47.8500 (1c)	x 2.6300 (2c)	= 125.8455 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.4099 (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) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4122 (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) =		0.4122 (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	0.4328	0.4122	0.4122	0.3813	0.3813	0.3400	0.3503	0.3297	0.3400	0.3607	0.3607	0.3916 (22b)
Effective ac	0.5937	0.5849	0.5849	0.5727	0.5727	0.5578	0.5614	0.5544	0.5578	0.5650	0.5650	0.5767 (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)
Window (Uw = 1.30)			10.8100	1.2357	13.3584		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			47.8600	0.1300	6.2218	75.0000	3589.5000 (28a)
EW Brick AAC015	148.1200	16.2700	131.8500	0.2500	32.9625	52.3000	6895.7550 (29a)
Plane Ceiling	47.8600		47.8600	0.1600	7.6576	9.0000	430.7400 (30)
Total net area of external elements Aum(A, m ²)			243.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.0843		(33)
GF Timber			73.5600			9.0000	662.0400 (32c)
1F Timber			110.7300			9.0000	996.5700 (32c)
GF Masonry			30.4300			75.0000	2282.2500 (32c)
Internal Floor			47.8600			18.0000	861.4800 (32d)
Internal Ceiling			47.8600			9.0000	430.7400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16149.0750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.7292 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7004 (36)
Total fabric heat loss							(33) + (36) = 73.7846 (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	48.4688	47.7579	47.7579	46.7566	46.7566	45.5430	45.8334	45.2612	45.5430	46.1325	46.1325	47.0817 (38)
Heat transfer coeff	122.2534	121.5426	121.5426	120.5413	120.5413	119.3276	119.6180	119.0459	119.3276	119.9171	119.9171	120.8664 (39)
Average = Sum(39)m / 12 =												120.3701 (39)
HLP	1.2773	1.2699	1.2699	1.2594	1.2594	1.2468	1.2498	1.2438	1.2468	1.2529	1.2529	1.2628 (40)
HLP (average)												1.2577 (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												2.6961 (42)
Average daily hot water use (litres/day)												98.2325 (43)
Daily hot water use	108.0557	104.1264	100.1971	96.2678	92.3385	88.4092	88.4092	92.3385	96.2678	100.1971	104.1264	108.0557 (44)
Energy conte	160.2436	140.1500	144.6223	126.0852	120.9818	104.3981	96.7401	111.0107	112.3366	130.9174	142.9066	155.1873 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum (45)m = 1545.5797 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.0365	21.0225	21.6933	18.9128	18.1473	15.6597	14.5110	16.6516	16.8505	19.6376	21.4360	23.2781 (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	14.1411	12.7616	14.1037	13.6041	14.0247	13.5343	13.9618	14.0026	13.5723	14.0708	13.6558 (61)
Total heat required for water heating calculated for each month											
174.3847	152.9117	158.7259	139.6893	135.0064	117.9324	110.7020	125.0133	125.9089	144.9882	156.5624	169.3163 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1140.0998 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1915.3676 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.2393 (H8)
Collector performance factor											0.5538 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											98.2325 (H14)
Solar storage volume factor											0.7635 (H15)
Solar input											0.9460 (H16)
Solar input	-27.1574	-40.8174	-68.7417	-95.0221	-114.4386	-120.4417	-117.5496	-104.9725	-81.9314	-55.7364	-33.0105 (H17)
Output from w/h											
147.2273	112.0942	89.9842	44.6672	20.5678	0.0000	0.0000	20.0408	43.9775	89.2518	123.5519	146.8163 (64)
Heat gains from water heating, kWh/month											
56.8163	49.7903	51.6128	45.3244	43.7326	38.0959	35.6566	40.4117	40.7450	47.0477	50.9304	55.1320 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	161.7663	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.9003	52.3148	42.5452	32.2095	24.0770	20.3268	21.9638	28.5494	38.3189	48.6547	56.7872	60.5374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	371.9403	375.7999	366.0739	345.3684	319.2314	294.6663	278.2553	274.3957	284.1217	304.8272	330.9643	355.5293	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	53.8727	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	-107.8442	(71)
Water heating gains (Table 5)	76.3660	74.0927	69.3721	62.9505	58.7804	52.9110	47.9255	54.3168	56.5903	63.2362	70.7367	74.1022	(72)
Total internal gains	618.0015	613.0022	588.7860	551.3232	512.8836	478.6989	458.9394	468.0568	489.8258	527.5130	569.2829	600.9638	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				

Northeast					0.7200	12.9236		0.4600	0.0000	0.7700		3.2958 (75)				
Southeast					4.3100	40.4699		0.4600	0.0000	0.7700		61.7815 (77)				
Southwest					0.7200	40.4699		0.4600	0.0000	0.7700		10.3208 (79)				
Northwest					5.0600	12.9236		0.4600	0.0000	0.7700		23.1623 (81)				
Southeast					3.3300	40.4699		0.4600	0.0000	0.7700		47.7337 (77)				

Solar gains					146.2940	232.3466	335.6072	466.0678	541.8675	591.2343	557.4671	496.8249	407.1726	280.4399	181.1879	122.9477 (83)
Total gains					764.2955	845.3488	924.3932	1017.3910	1054.7510	1069.9332	1016.4065	964.8817	896.9984	807.9528	750.4708	723.9115 (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)												
tau	36.6931	36.9077	36.9077	37.2143	37.2143	37.5928	37.5015	37.6817	37.5928	37.4080	37.4080	37.1142
alpha	3.4462	3.4605	3.4605	3.4810	3.4810	3.5062	3.5001	3.5121	3.5062	3.4939	3.4939	3.4743
util living area	0.9753	0.9639	0.9362	0.8694	0.7408	0.5233	0.3580	0.3855	0.6686	0.8860	0.9581	0.9788 (86)
MIT	19.4652	19.6441	19.9897	20.4167	20.7647	20.9527	20.9910	20.9884	20.8808	20.4701	19.9181	19.4409 (87)
Th 2	19.8586	19.8645	19.8645	19.8727	19.8727	19.8828	19.8804	19.8851	19.8828	19.8779	19.8779	19.8701 (88)
util rest of house	0.9695	0.9555	0.9207	0.8367	0.6755	0.4197	0.2320	0.2556	0.5723	0.8498	0.9466	0.9737 (89)
MIT 2	17.8641	18.1245	18.6170	19.2118	19.6542	19.8558	19.8783	19.8821	19.7969	19.3005	18.5308	17.8366 (90)
Living area fraction	18.1077	18.3557	18.8258	19.3951	19.8232	20.0226	20.0475	20.0504	19.9618	19.4784	18.7419	18.0807 (92)
Temperature adjustment	17.9577	18.2057	18.6758	19.2451	19.6732	19.8726	19.8975	19.9004	19.8118	19.3284	18.5919	17.9307 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9554	0.9384	0.8993	0.8146	0.6624	0.4187	0.2340	0.2575	0.5654	0.8275	0.9282	0.9609	(94)
Useful gains	730.1939	793.2784	831.3032	828.7839	698.6515	447.9614	237.7896	248.4299	507.1859	668.5872	696.5619	695.6202	(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	1571.8940	1532.1244	1370.4950	1126.4712	804.3932	462.1119	238.9424	250.0482	550.3091	926.7709	1270.1457	1550.7979	(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	626.2249	496.5045	401.1588	214.3348	78.6718	0.0000	0.0000	0.0000	0.0000	192.0887	412.9803	636.2522	(98)
Space heating												3058.2160	(98)
Space heating per m2											(98) / (4) =	31.9529	(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													3379.2442	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	626.2249	496.5045	401.1588	214.3348	78.6718	0.0000	0.0000	0.0000	0.0000	192.0887	412.9803	636.2522	(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)	691.9612	548.6238	443.2694	236.8341	86.9301	0.0000	0.0000	0.0000	0.0000	212.2527	456.3318	703.0411	(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	147.2273	112.0942	89.9842	44.6672	20.5678	0.0000	0.0000	20.0408	43.9775	89.2518	123.5519	146.8163	(64)	
Efficiency of water heater	89.8729	89.8931	89.8963	89.9315	89.8177	87.3000	87.3000	87.3000	87.3000	89.4597	89.7425	89.8823	(216)	
Fuel for water heating, kWh/month	163.8172	124.6972	100.0978	49.6680	22.8995	0.0000	0.0000	22.9562	50.3751	99.7675	137.6738	163.3429	(219)	
Water heating fuel used												935.2954	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3379.2442	(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)													416.0794	(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													3031.4593	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3379.2442	9.7400	329.1384	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	935.2954	9.7400	91.0978	(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	416.0794	36.8500	153.3252	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			51.4211	(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	3379.2442	0.2160	729.9168	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	935.2954	0.2160	202.0238	(264)
Space and water heating			931.9406	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	416.0794	0.5190	215.9452	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			266.0219 (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	3379.2442	1.2200	4122.6779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	935.2954	1.2200	1141.0604 (264)
Space and water heating			5263.7383 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	416.0794	3.0700	1277.3636 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1324.6819 (272)
Primary energy kWh/m2/year			13.8406 (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 West
Overshading	Average or unknown
Thermal mass parameter	168.7 (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	326.58 (P1)
Transmission heat loss coefficient	73.78 (37)
Summer heat loss coefficient	400.37 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	0.7200	98.8453	0.4600	0.0000	0.9000	29.4638
South East	4.3100	119.9223	0.4600	0.0000	0.9000	213.9822
South West	0.7200	119.9223	0.4600	0.0000	0.9000	35.7465
North West	5.0600	98.8453	0.4600	0.0000	0.9000	207.0650
South East	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273

total: 651.5849

	Jun	Jul	Aug	
Solar gains	691	652	581	(P4)
Internal gains	476	456	465	
Total summer gains	1167	1108	1046	(P5)
Summer gain/loss ratio	2.91	2.77	2.61	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 168.7)	0.82	0.82	0.82	
Threshold temperature	19.73	21.49	21.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			