

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-621				Issued on Date	22/03/2023
Assessment Reference	Plot 621	Prop Type Ref	Maplethorne-As-DET			
Property	Plot 621, 3 Bed, K, WC, B, En					
SAP Rating	84 B	DER	17.59	TER	18.49	
Environmental	85 B	% DER<TER	4.88			
CO ₂ Emissions (t/year)	1.39	DFEE	50.36	TFEE	56.71	
General Requirements Compliance	Pass	% DFEE<TFEE	11.20			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

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) 18.49 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.59 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.4 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 ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 5.06 m², No overhang
Windows facing East: 0.72 m², No overhang
Windows facing South: 7.64 m², No overhang
Windows facing West: 0.72 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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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			
North					5.0600	10.6334	0.4600	0.0000	0.7700	19.0577 (74)			
East					0.7200	19.6403	0.4600	0.0000	0.7700	5.0087 (76)			
South					4.3100	46.7521	0.4600	0.0000	0.7700	71.3718 (78)			
West					0.7200	19.6403	0.4600	0.0000	0.7700	5.0087 (80)			
South					3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)			
Solar gains	155.5904	263.2159	358.0944	444.7776	502.4434	501.5545	482.3456	438.3274	387.6537	290.0901	185.9644	133.4461	(83)
Total gains	571.1581	676.4620	756.1957	818.4503	851.1811	826.4642	791.9292	754.3507	716.3746	643.4640	567.6036	536.4095	(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	0.9910	0.9834	0.9693	0.9378	0.8724	0.7501	0.6050	0.6459	0.8326	0.9505	0.9847	0.9927 (86)
MIT	19.0502	19.2791	19.6266	20.0786	20.4910	20.8026	20.9323	20.9135	20.6893	20.1508	19.5235	19.0196 (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	0.9888	0.9794	0.9614	0.9203	0.8327	0.6668	0.4757	0.5207	0.7671	0.9331	0.9803	0.9910 (89)
MIT 2	17.2449	17.5795	18.0845	18.7404	19.3097	19.7084	19.8352	19.8241	19.5806	18.8539	17.9477	17.2088 (90)
Living area fraction	17.5195	17.8380	18.3191	18.9440	19.4894	19.8749	20.0021	19.9898	19.7492	19.0512	18.1874	17.4842 (91)
MIT	17.5195	17.8380	18.3191	18.9440	19.4894	19.8749	20.0021	19.9898	19.7492	19.0512	18.1874	17.4842 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3695	17.6880	18.1691	18.7940	19.3394	19.7249	19.8521	19.8398	19.5992	18.9012	18.0374	17.3342 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	560.5703	654.9170	714.6730	735.4328	689.7029	540.8114	374.9131	389.6767	535.9858	587.2293	550.2754	528.2158	(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	1645.2096	1604.1784	1458.8042	1216.9537	936.7560	619.4263	393.0680	414.6395	668.3918	1017.9065	1349.5113	1631.0397	(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	806.9716	637.9037	553.6336	346.6950	183.8075	0.0000	0.0000	0.0000	0.0000	320.4239	575.4499	820.5010	(98)
Space heating												4245.3861	(98)
Space heating per m2												(98) / (4) = 44.3568	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													4691.0344 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	806.9716	637.9037	553.6336	346.6950	183.8075	0.0000	0.0000	0.0000	0.0000	320.4239	575.4499	820.5010	(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)	891.6813	704.8659	611.7499	383.0884	203.1022	0.0000	0.0000	0.0000	0.0000	354.0595	635.8562	906.6310	(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	89.9143	89.8631	89.7668	89.5572	89.1167	87.3000	87.3000	87.3000	87.3000	89.4782	89.7960	89.9361	(216)
Fuel for water heating, kWh/month	193.9454	170.1607	176.8202	155.9778	151.4940	135.0886	126.8064	143.1997	144.2255	162.0374	174.3534	188.2630	(219)
Water heating fuel used												1922.3720	(219)
Annual totals kWh/year													
Space heating fuel - main system												4691.0344	(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												7104.4857	(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	4691.0344	0.2160	1013.2634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1922.3720	0.2160	415.2323 (264)
Space and water heating			1428.4958 (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			1683.3660 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5900 (273)

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

DER		17.5900	ZC1
Total Floor Area	TFA	95.7100	
Assumed number of occupants	N	2.6961	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4290	ZC2
CO2 emissions from cooking, equation (L16)		1.9194	ZC3
Total CO2 emissions		34.9384	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.9384	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North				5.0600	10.6334		0.6300		0.7000	0.7700	16.4435 (74)	
East				0.7200	19.6403		0.6300		0.7000	0.7700	4.3217 (76)	
South				7.6400	46.7521		0.6300		0.7000	0.7700	109.1606 (78)	
West				0.7200	19.6403		0.6300		0.7000	0.7700	4.3217 (80)	
Solar gains	134.2475	227.1095	308.9732	383.7657	433.5212	432.7543	416.1804	378.2003	334.4777	250.2973	160.4550	115.1408 (83)
Total gains	562.1867	652.7313	719.4586	769.1990	793.3578	768.1032	736.2111	705.3298	674.9703	616.0665	554.4758	530.4798 (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	0.9982	0.9959	0.9904	0.9741	0.9266	0.8067	0.6422	0.6863	0.8870	0.9802	0.9962	0.9986	(86)
MIT	19.6433	19.8023	20.0486	20.3731	20.6755	20.8958	20.9740	20.9640	20.8166	20.4250	19.9766	19.6204	(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	0.9975	0.9945	0.9869	0.9633	0.8928	0.7191	0.5039	0.5516	0.8236	0.9698	0.9946	0.9981	(89)
MIT 2	18.0934	18.3274	18.6879	19.1644	19.5827	19.8559	19.9210	19.9176	19.7716	19.2449	18.5924	18.0678	(90)
Living area fraction	18.3291	18.5518	18.8949	19.3483	19.7490	20.0141	20.0812	20.0768	19.9306	19.4244	18.8030	18.3040	(92)
Temperature adjustment	18.3291	18.5518	18.8949	19.3483	19.7490	20.0141	20.0812	20.0768	19.9306	19.4244	18.8030	18.3040	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9961	0.9918	0.9821	0.9556	0.8861	0.7269	0.5247	0.5713	0.8239	0.9631	0.9920	0.9970	(94)
Ext temp.	559.9961	647.3865	706.5718	735.0242	703.0271	558.3259	386.2677	402.9841	556.0768	593.3440	550.0583	528.9040	(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	1649.5255	1600.3084	1448.6587	1204.0605	925.0982	614.5485	395.1516	416.3835	665.0257	1014.2237	1352.3154	1638.8855	(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 per m2	810.6098	640.3635	552.1127	337.7061	165.2209	0.0000	0.0000	0.0000	0.0000	313.1344	577.6251	825.8263	(98)
												4222.5988	(98)
												44.1187	(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													4520.9838 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	810.6098	640.3635	552.1127	337.7061	165.2209	0.0000	0.0000	0.0000	0.0000	313.1344	577.6251	825.8263	(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)	867.8906	685.6140	591.1271	361.5697	176.8961	0.0000	0.0000	0.0000	0.0000	335.2617	618.4423	884.1823	(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	88.1094	87.9094	87.5205	86.6982	85.0087	80.3000	80.3000	80.3000	80.3000	86.4069	87.6474	88.1843	(216)
Fuel for water heating, kWh/month	239.7049	211.7833	223.4690	200.1885	197.6697	184.3053	176.5785	196.8436	199.0176	210.4883	219.3125	233.7674	(219)
Water heating fuel used												2493.1286	(219)
Annual totals kWh/year													
Space heating fuel - main system												4520.9838	(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												7505.1918	(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	4520.9838	0.2160	976.5325 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2493.1286	0.2160	538.5158 (264)
Space and water heating			1515.0483 (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			1769.9185 (272)
Emissions per m2 for space and water heating			15.8296 (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) = (15.8296 * 1.00) + 2.2562 + 0.4067, rounded to 2 d.p.			18.4900 (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	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					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)
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	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)

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

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			
North				5.0600	10.6334	0.4600	0.0000		0.7700	19.0577 (74)			
East				0.7200	19.6403	0.4600	0.0000		0.7700	5.0087 (76)			
South				4.3100	46.7521	0.4600	0.0000		0.7700	71.3718 (78)			
West				0.7200	19.6403	0.4600	0.0000		0.7700	5.0087 (80)			
South				3.3300	46.7521	0.4600	0.0000		0.7700	55.1434 (78)			
Solar gains	155.5904	263.2159	358.0944	444.7776	502.4434	501.5545	482.3456	438.3274	387.6537	290.0901	185.9644	133.4461	(83)
Total gains	537.5606	643.6876	725.1304	789.7124	823.9553	801.3652	768.6345	728.7406	689.9392	614.6203	536.0442	503.6316	(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	0.9925	0.9856	0.9724	0.9425	0.8794	0.7599	0.6149	0.6581	0.8427	0.9557	0.9871	0.9940	(86)
MIT	19.0434	19.2727	19.6204	20.0696	20.4839	20.7975	20.9303	20.9100	20.6804	20.1366	19.5085	19.0084	(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	0.9907	0.9821	0.9653	0.9262	0.8413	0.6780	0.4857	0.5334	0.7797	0.9399	0.9833	0.9926	(89)
MIT 2	18.0705	18.3002	18.6463	19.0952	19.4876	19.7654	19.8549	19.8468	19.6737	19.1681	18.5462	18.0440	(90)
Living area fraction	fLA = Living area / (4) =												0.1521 (91)
MIT	18.2185	18.4482	18.7945	19.2434	19.6391	19.9224	20.0185	20.0086	19.8268	19.3155	18.6926	18.1907	(92)
Temperature adjustment													0.0000
adjusted MIT	18.2185	18.4482	18.7945	19.2434	19.6391	19.9224	20.0185	20.0086	19.8268	19.3155	18.6926	18.1907	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	530.5998	628.3833	693.6256	722.4425	685.5564	546.1562	386.7909	400.1348	535.6712	571.4501	524.1761	498.3518	(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	1722.8169	1672.1505	1513.1254	1256.0425	961.6435	637.0874	409.1910	430.9870	688.6461	1055.6774	1411.3720	1712.4142	(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	887.0095	701.4115	609.7078	384.1920	205.4089	0.0000	0.0000	0.0000	0.0000	360.2651	638.7810	903.2624	(98)
Space heating													4690.0383 (98)
Space heating per m2	(98) / (4) =												49.0026 (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	0.7461	0.8221	0.7972	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	839.4672	728.1943	723.6302	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1039.8324	999.4253	954.7774	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	144.2630	201.7958	171.9735	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												518.0322	(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	36.0657	50.4490	42.9934	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												129.5081	(107)
Space cooling per m2												1.3531	(108)
Energy for space heating												49.0026	(99)
Energy for space cooling												1.3531	(108)
Total												50.3557	(109)
Dwelling Fabric Energy Efficiency (DFEE)												50.4	(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	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												
0.0000	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
North	5.0600	10.6334	0.6300	0.7000	0.7700	16.4435 (74)
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217 (76)
South	7.6400	46.7521	0.6300	0.7000	0.7700	109.1606 (78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217 (80)

Solar gains	134.2475	227.1095	308.9732	383.7657	433.5212	432.7543	416.1804	378.2003	334.4777	250.2973	160.4550	115.1408	(83)
Total gains	516.2177	607.5812	676.0092	728.7006	755.0332	732.5650	702.4693	668.6135	636.7633	574.8275	510.5348	485.3263	(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	0.9987	0.9970	0.9926	0.9789	0.9375	0.8271	0.6665	0.7137	0.9048	0.9849	0.9973	0.9991	(86)
MIT	19.5992	19.7594	20.0084	20.3382	20.6490	20.8825	20.9695	20.9573	20.7947	20.3883	19.9347	19.5768	(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	0.9983	0.9959	0.9898	0.9699	0.9074	0.7428	0.5260	0.5782	0.8473	0.9768	0.9962	0.9988	(89)
MIT 2	18.6217	18.7838	19.0338	19.3699	19.6670	19.8718	19.9229	19.9202	19.8049	19.4239	18.9701	18.6084	(90)
Living area fraction									fLA = Living area / (4) =			0.1521	(91)
MIT	18.7704	18.9322	19.1821	19.5172	19.8164	20.0255	20.0821	20.0780	19.9554	19.5706	19.1168	18.7557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7704	18.9322	19.1821	19.5172	19.8164	20.0255	20.0821	20.0780	19.9554	19.5706	19.1168	18.7557	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9946	0.9872	0.9655	0.9039	0.7515	0.5475	0.5985	0.8492	0.9732	0.9950	0.9982	(94)
Ext temp.	514.9980	604.2909	667.3695	703.5544	682.4457	550.4975	384.5888	400.1671	540.7616	559.4134	507.9681	484.4758	(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	1701.4034	1644.8993	1482.2188	1223.5250	932.8476	615.8521	395.2497	416.5182	667.8617	1031.0236	1388.5797	1691.3759	(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	882.6856	699.2889	606.2479	374.3789	186.2990	0.0000	0.0000	0.0000	0.0000	350.8780	634.0404	897.9337	(98)
Space heating per m2												4631.7524	(98)
												48.3936	(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	0.7837	0.8669	0.8420	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	836.1540	728.1543	724.6957	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	959.4166	922.0893	884.4990	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	88.7490	144.2876	118.8936	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												351.9302 (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	22.1873	36.0719	29.7234	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												87.9826 (107)
Space cooling per m2												0.9193 (108)
Energy for space heating												48.3936 (99)
Energy for space cooling												0.9193 (108)
Total												49.3129 (109)
Target Fabric Energy Efficiency (TFEE)												56.7 (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	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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1617 (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	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)

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												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
North			5.0600		11.9814		0.4600		0.0000		0.7700		21.4738 (74)
East			0.7200		22.3313		0.4600		0.0000		0.7700		5.6950 (76)
South			4.3100		50.9848		0.4600		0.0000		0.7700		77.8335 (78)
West			0.7200		22.3313		0.4600		0.0000		0.7700		5.6950 (80)
South			3.3300		50.9848		0.4600		0.0000		0.7700		60.1359 (78)
Solar gains	170.8332	260.0819	350.4714	451.5532	500.1267	535.7859	509.0778	470.6161	412.1760	306.2298	209.1605	145.1308	(83)
Total gains	788.8347	873.0841	939.2574	1002.8764	1013.0103	1014.4848	968.0173	938.6728	902.0018	833.7428	778.4435	746.0945	(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	0.9730	0.9606	0.9336	0.8734	0.7573	0.5467	0.3747	0.3955	0.6661	0.8777	0.9537	0.9768 (86)
MIT	19.4935	19.6746	20.0043	20.4057	20.7464	20.9457	20.9896	20.9875	20.8822	20.4906	19.9482	19.4669 (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	0.9666	0.9515	0.9176	0.8414	0.6932	0.4403	0.2434	0.2626	0.5698	0.8399	0.9412	0.9713 (89)
MIT 2	17.9045	18.1677	18.6372	19.1977	19.6350	19.8514	19.8779	19.8819	19.7980	19.3262	18.5729	17.8740 (90)
Living area fraction	18.1463	18.3969	18.8452	19.3815	19.8041	20.0179	20.0470	20.0501	fLA = Living area / (4) = 19.9630	19.5033	18.7821	0.1521 (91)
MIT	18.1463	18.3969	18.8452	19.3815	19.8041	20.0179	20.0470	20.0501	19.9630	19.5033	18.7821	18.1163 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9963	18.2469	18.6952	19.2315	19.6541	19.8679	19.8970	19.9001	19.8130	19.3533	18.6321	17.9663 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9518	0.9337	0.8959	0.8191	0.6790	0.4388	0.2454	0.2645	0.5631	0.8178	0.9220	0.9579	(94)
Useful gains	750.8409	815.1734	841.5082	821.4934	687.8725	445.1716	237.5356	248.2390	507.8827	681.8274	717.7544	714.6628	(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	1576.6128	1537.1410	1372.8443	1124.8300	802.0956	461.5430	238.8811	250.0034	550.4533	929.7538	1274.9691	1555.1015	(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	614.3743	485.1622	395.3141	218.4023	84.9820	0.0000	0.0000	0.0000	0.0000	184.4573	401.1947	625.2864	(98)
Space heating												3009.1733	(98)
RHI space heating demand												3009	(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)

	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	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 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)
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	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
North					5.0600	10.6334	0.4600	0.0000			0.7700			19.0577 (74)
East					0.7200	19.6403	0.4600	0.0000			0.7700			5.0087 (76)
South					4.3100	46.7521	0.4600	0.0000			0.7700			71.3718 (78)
West					0.7200	19.6403	0.4600	0.0000			0.7700			5.0087 (80)
South					3.3300	46.7521	0.4600	0.0000			0.7700			55.1434 (78)
Solar gains	155.5904	263.2159	358.0944	444.7776	502.4434	501.5545	482.3456	438.3274	387.6537	290.0901	185.9644	133.4461	(83)	
Total gains	773.5919	876.2181	946.8805	996.1008	1015.3269	980.2535	941.2850	906.3842	877.4794	817.6031	755.2474	734.4099	(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	0.9781	0.9656	0.9440	0.8997	0.8174	0.6773	0.5283	0.5635	0.7579	0.9096	0.9653	0.9814 (86)
MIT	19.2921	19.5088	19.8313	20.2431	20.6028	20.8591	20.9557	20.9437	20.7773	20.3199	19.7408	19.2595 (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	0.9731	0.9578	0.9308	0.8746	0.7688	0.5903	0.4077	0.4444	0.6819	0.8819	0.9561	0.9771 (89)
MIT 2	17.5944	17.9083	18.3721	18.9614	19.4443	19.7602	19.8484	19.8430	19.6723	19.0800	18.2576	17.5560 (90)
Living area fraction	17.8526	18.1518	18.5940	19.1564	19.6206	19.9274	20.0169	20.0104	fLA = Living area / (4) =	19.8404	19.2686	18.4833 (91)
MIT	17.8526	18.1518	18.5940	19.1564	19.6206	19.9274	20.0169	20.0104	19.8404	19.2686	18.4833	17.8152 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7026	18.0018	18.4440	19.0064	19.4706	19.7774	19.8669	19.8604	19.6904	19.1186	18.3333	17.6652 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9597	0.9407	0.9098	0.8514	0.7495	0.5823	0.4073	0.4430	0.6684	0.8588	0.9389	0.9651	(94)
Ext temp.	742.4384	824.2328	861.4337	848.0820	760.9945	570.8089	383.4147	401.5335	586.4672	702.1978	709.1077	708.7896	(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	1687.1449	1643.5383	1493.1797	1243.0760	952.8409	625.7694	394.8557	417.1245	679.4706	1044.5713	1386.0139	1672.1364	(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	702.8616	550.5733	470.0190	284.3956	142.7337	0.0000	0.0000	0.0000	0.0000	254.7259	487.3725	716.7300	(98)
Space heating per m2												3609.4117	(98)
												(98) / (4) =	37.7120 (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													3988.3002 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	702.8616	550.5733	470.0190	284.3956	142.7337	0.0000	0.0000	0.0000	0.0000	254.7259	487.3725	716.7300	(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)	776.6427	608.3683	519.3580	314.2493	157.7168	0.0000	0.0000	0.0000	0.0000	281.4651	538.5331	791.9668	(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	89.8453	89.7846	89.6702	89.4204	88.9157	87.3000	87.3000	87.3000	87.3000	89.3125	89.7006	89.8705	(217)
Fuel for water heating, kWh/month	194.0943	170.3094	177.0107	156.2165	151.8364	135.0886	126.8064	143.1997	144.2255	162.3381	174.5389	188.4003	(219)
Water heating fuel used												1924.0648	(219)
Annual totals kWh/year													
Space heating fuel - main system												3988.3002	(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												6403.4444	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3988.3002	3.4800	138.7928 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1924.0648	3.4800	66.9575 (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			390.5237 (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] =	1.1657 (257)
SAP value		83.7391
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	3988.3002	0.2160	861.4728 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1924.0648	0.2160	415.5980 (264)
Space and water heating			1277.0708 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total kg/year			1531.9410 (272)
CO2 emissions per m2			16.0100 (273)
EI value			85.4111
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			
North				5.0600	11.9814	0.4600	0.0000	0.7700	21.4738 (74)			
East				0.7200	22.3313	0.4600	0.0000	0.7700	5.6950 (76)			
South				4.3100	50.9848	0.4600	0.0000	0.7700	77.8335 (78)			
West				0.7200	22.3313	0.4600	0.0000	0.7700	5.6950 (80)			
South				3.3300	50.9848	0.4600	0.0000	0.7700	60.1359 (78)			
Solar gains	170.8332	260.0819	350.4714	451.5532	500.1267	535.7859	509.0778	470.6161	412.1760	306.2298	209.1605	145.1308 (83)
Total gains	788.8347	873.0841	939.2574	1002.8764	1013.0103	1014.4848	968.0173	938.6728	902.0018	833.7428	778.4435	746.0945 (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	0.9730	0.9606	0.9336	0.8734	0.7573	0.5467	0.3747	0.3955	0.6661	0.8777	0.9537	0.9768 (86)
MIT	19.4935	19.6746	20.0043	20.4057	20.7464	20.9457	20.9896	20.9875	20.8822	20.4906	19.9482	19.4669 (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	0.9666	0.9515	0.9176	0.8414	0.6932	0.4403	0.2434	0.2626	0.5698	0.8399	0.9412	0.9713 (89)
MIT 2	17.9045	18.1677	18.6372	19.1977	19.6350	19.8514	19.8779	19.8819	19.7980	19.3262	18.5729	17.8740 (90)
Living area fraction	18.1463	18.3969	18.8452	19.3815	19.8041	20.0179	20.0470	20.0501	fLA = Living area / (4) = 19.9630	19.5033	18.7821	0.1521 (91)
MIT	18.1463	18.3969	18.8452	19.3815	19.8041	20.0179	20.0470	20.0501	19.9630	19.5033	18.7821	18.1163 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9963	18.2469	18.6952	19.2315	19.6541	19.8679	19.8970	19.9001	19.8130	19.3533	18.6321	17.9663 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9518	0.9337	0.8959	0.8191	0.6790	0.4388	0.2454	0.2645	0.5631	0.8178	0.9220	0.9579	(94)
Useful gains	750.8409	815.1734	841.5082	821.4934	687.8725	445.1716	237.5356	248.2390	507.8827	681.8274	717.7544	714.6628	(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	1576.6128	1537.1410	1372.8443	1124.8300	802.0956	461.5430	238.8811	250.0034	550.4533	929.7538	1274.9691	1555.1015	(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	614.3743	485.1622	395.3141	218.4023	84.9820	0.0000	0.0000	0.0000	0.0000	184.4573	401.1947	625.2864	(98)
Space heating												3009.1733	(98)
Space heating per m2										(98) / (4) =		31.4405	(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													3325.0534 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	614.3743	485.1622	395.3141	218.4023	84.9820	0.0000	0.0000	0.0000	0.0000	184.4573	401.1947	625.2864	(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)	678.8666	536.0909	436.8111	241.3286	93.9028	0.0000	0.0000	0.0000	0.0000	203.8202	443.3090	690.9242	(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	89.7725	89.7119	89.5595	89.2242	88.5090	87.3000	87.3000	87.3000	87.3000	89.0632	89.5783	89.7986	(216)
Fuel for water heating, kWh/month	194.2518	170.4474	177.2296	156.5599	152.5342	135.0886	126.8064	143.1997	144.2255	162.7924	174.7771	188.5512	(219)
Water heating fuel used												1926.4638	(219)
Annual totals kWh/year													
Space heating fuel - main system												3325.0534	(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													5742.5965 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3325.0534	9.7400	323.8602 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1926.4638	9.7400	187.6376 (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			796.4605 (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	3325.0534	0.2160	718.2115 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.4638	0.2160	416.1162 (264)
Space and water heating			1134.3277 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	416.0794	0.5190	215.9452 (268)
Total kg/year			1389.1979 (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	3325.0534	1.2200	4056.5651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.4638	1.2200	2350.2858 (264)
Space and water heating			6406.8509 (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			7914.4645 (272)
Primary energy kWh/m2/year			82.6921 (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 (13.5%)
U Solar photovoltaic panels	+ 9.5	-£ 672	-947 kg (78.8%)

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	£615	£519	£97
Space heating	£455	£455	£0
Water heating	£188	£110	£78
Lighting	£153	£153	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£796	£46	£751
Total cost of uses	£796	£46	£750
Delivered energy	60 kWh/m²	31 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	13 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
North				5.0600	10.6334		0.4600		0.0000		0.7700		19.0577 (74)
East				0.7200	19.6403		0.4600		0.0000		0.7700		5.0087 (76)
South				4.3100	46.7521		0.4600		0.0000		0.7700		71.3718 (78)
West				0.7200	19.6403		0.4600		0.0000		0.7700		5.0087 (80)
South				3.3300	46.7521		0.4600		0.0000		0.7700		55.1434 (78)
Solar gains	155.5904	263.2159	358.0944	444.7776	502.4434	501.5545	482.3456	438.3274	387.6537	290.0901	185.9644	133.4461	(83)
Total gains	773.5919	876.2181	946.8805	996.1008	1015.3269	980.2535	941.2850	906.3842	877.4794	817.6031	755.2474	734.4099	(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	0.9781	0.9656	0.9440	0.8997	0.8174	0.6773	0.5283	0.5635	0.7579	0.9096	0.9653	0.9814 (86)
MIT	19.2921	19.5088	19.8313	20.2431	20.6028	20.8591	20.9557	20.9437	20.7773	20.3199	19.7408	19.2595 (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	0.9731	0.9578	0.9308	0.8746	0.7688	0.5903	0.4077	0.4444	0.6819	0.8819	0.9561	0.9771 (89)
MIT 2	17.5944	17.9083	18.3721	18.9614	19.4443	19.7602	19.8484	19.8430	19.6723	19.0800	18.2576	17.5560 (90)
Living area fraction	17.8526	18.1518	18.5940	19.1564	19.6206	19.9274	20.0169	20.0104	19.8404	19.2686	18.4833	17.8152 (91)
MIT	17.8526	18.1518	18.5940	19.1564	19.6206	19.9274	20.0169	20.0104	19.8404	19.2686	18.4833	17.8152 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7026	18.0018	18.4440	19.0064	19.4706	19.7774	19.8669	19.8604	19.6904	19.1186	18.3333	17.6652 (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	0.9597	0.9407	0.9098	0.8514	0.7495	0.5823	0.4073	0.4430	0.6684	0.8588	0.9389	0.9651	(94)
Useful gains	742.4384	824.2328	861.4337	848.0820	760.9945	570.8089	383.4147	401.5335	586.4672	702.1978	709.1077	708.7896	(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	1687.1449	1643.5383	1493.1797	1243.0760	952.8409	625.7694	394.8557	417.1245	679.4706	1044.5713	1386.0139	1672.1364	(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	702.8616	550.5733	470.0190	284.3956	142.7337	0.0000	0.0000	0.0000	0.0000	254.7259	487.3725	716.7300	(98)
Space heating												3609.4117	(98)
Space heating per m2											(98) / (4) =	37.7120	(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													3988.3002	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	702.8616	550.5733	470.0190	284.3956	142.7337	0.0000	0.0000	0.0000	0.0000	254.7259	487.3725	716.7300	(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)	776.6427	608.3683	519.3580	314.2493	157.7168	0.0000	0.0000	0.0000	0.0000	281.4651	538.5331	791.9668	(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	89.9225	89.9466	89.9827	90.0566	90.1494	87.3000	87.3000	87.3000	87.3000	89.6320	89.8203	89.9348	(216)	
(217)m	89.9225	89.9466	89.9827	90.0566	90.1494	87.3000	87.3000	87.3000	87.3000	89.6320	89.8203	89.9348	(217)	
Fuel for water heating, kWh/month	166.0256	123.4545	97.1510	48.9960	18.7951	2.1281	0.0000	28.5666	54.4449	102.0449	141.1727	164.9196	(219)	
Water heating fuel used												947.6990	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3988.3002	(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												3749.8392	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3988.3002	3.4800	138.7928	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	947.6990	3.4800	32.9799	(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			135.3183	(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] =	0.4039	(257)
SAP value		94.3655	
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	3988.3002	0.2160	861.4728	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	947.6990	0.2160	204.7030	(264)
Space and water heating			1066.1758	(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			450.5588	(272)
CO2 emissions per m2			4.7100	(273)
EI value			95.7093	
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)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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
North				5.0600	11.9814		0.4600	0.0000		0.7700		21.4738 (74)
East				0.7200	22.3313		0.4600	0.0000		0.7700		5.6950 (76)
South				4.3100	50.9848		0.4600	0.0000		0.7700		77.8335 (78)
West				0.7200	22.3313		0.4600	0.0000		0.7700		5.6950 (80)
South				3.3300	50.9848		0.4600	0.0000		0.7700		60.1359 (78)
Solar gains	170.8332	260.0819	350.4714	451.5532	500.1267	535.7859	509.0778	470.6161	412.1760	306.2298	209.1605	145.1308 (83)
Total gains	788.8347	873.0841	939.2574	1002.8764	1013.0103	1014.4848	968.0173	938.6728	902.0018	833.7428	778.4435	746.0945 (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	0.9730	0.9606	0.9336	0.8734	0.7573	0.5467	0.3747	0.3955	0.6661	0.8777	0.9537	0.9768 (86)
MIT	19.4935	19.6746	20.0043	20.4057	20.7464	20.9457	20.9896	20.9875	20.8822	20.4906	19.9482	19.4669 (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	0.9666	0.9515	0.9176	0.8414	0.6932	0.4403	0.2434	0.2626	0.5698	0.8399	0.9412	0.9713 (89)
MIT 2	17.9045	18.1677	18.6372	19.1977	19.6350	19.8514	19.8779	19.8819	19.7980	19.3262	18.5729	17.8740 (90)
Living area fraction	18.1463	18.3969	18.8452	19.3815	19.8041	20.0179	20.0470	20.0501	19.9630	19.5033	18.7821	18.1163 (92)
Temperature adjustment	17.9963	18.2469	18.6952	19.2315	19.6541	19.8679	19.8970	19.9001	19.8130	19.3533	18.6321	17.9663 (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	0.9518	0.9337	0.8959	0.8191	0.6790	0.4388	0.2454	0.2645	0.5631	0.8178	0.9220	0.9579	(94)
Useful gains	750.8409	815.1734	841.5082	821.4934	687.8725	445.1716	237.5356	248.2390	507.8827	681.8274	717.7544	714.6628	(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	1576.6128	1537.1410	1372.8443	1124.8300	802.0956	461.5430	238.8811	250.0034	550.4533	929.7538	1274.9691	1555.1015	(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	614.3743	485.1622	395.3141	218.4023	84.9820	0.0000	0.0000	0.0000	0.0000	184.4573	401.1947	625.2864	(98)
Space heating												3009.1733	(98)
Space heating per m2											(98) / (4) =	31.4405	(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													3325.0534 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	614.3743	485.1622	395.3141	218.4023	84.9820	0.0000	0.0000	0.0000	0.0000	184.4573	401.1947	625.2864	(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)	678.8666	536.0909	436.8111	241.3286	93.9028	0.0000	0.0000	0.0000	0.0000	203.8202	443.3090	690.9242	(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	89.8632	89.8817	89.8891	89.9402	89.8582	87.3000	87.3000	87.3000	87.3000	89.4311	89.7256	89.8736	(216)
(217)m	89.8632	89.8817	89.8891	89.9402	89.8582	87.3000	87.3000	87.3000	87.3000	89.4311	89.7256	89.8736	(217)
Fuel for water heating, kWh/month	163.8349	124.7131	100.1058	49.6632	22.8892	0.0000	0.0000	22.9562	50.3751	99.7995	137.6997	163.3587	(219)
Water heating fuel used												935.3955	(219)
Annual totals kWh/year													
Space heating fuel - main system												3325.0534	(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												2977.3686	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3325.0534	9.7400	323.8602	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	935.3955	9.7400	91.1075	(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			46.1526	(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	3325.0534	0.2160	718.2115	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	935.3955	0.2160	202.0454	(264)
Space and water heating			920.2570	(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			254.3383 (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	3325.0534	1.2200	4056.5651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	935.3955	1.2200	1141.1825 (264)
Space and water heating			5197.7476 (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			1258.6912 (272)
Primary energy kWh/m2/year			13.1511 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	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	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.0600	81.1852	0.4600	0.0000	0.9000	170.0700
East	0.7200	117.5071	0.4600	0.0000	0.9000	35.0265
South	4.3100	112.2060	0.4600	0.0000	0.9000	200.2137
West	0.7200	117.5071	0.4600	0.0000	0.9000	35.0265
South	3.3300	112.2060	0.4600	0.0000	0.9000	154.6894

total: 595.0261

Solar gains	Jun 626	Jul 595	Aug 550	(P4)
Internal gains	476	456	465	
Total summer gains	1102	1051	1015	(P5)

Summer gain/loss ratio	2.75	2.63	2.54	(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	19.57	21.34	21.15	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight