

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-571				Issued on Date	22/03/2023
Assessment Reference	Plot 571	Prop Type Ref	Badlesmere-As-SEMI			
Property	Plot 571, 2 Bed, K, WC, Ut, B, En					
SAP Rating		84 B	DER	17.21	TER	18.58
Environmental		87 B	% DER<TER	7.39		
CO ₂ Emissions (t/year)		1.14	DFEE	45.82	TFEE	52.95
General Requirements Compliance		Pass	% DFEE<TFEE	13.46		
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.58 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.21 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.8 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	0.12 (max. 0.25)	0.12 (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 East: 5.06 m², No overhang
Windows facing South West: 7.51 m², No overhang
Windows facing North 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
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.037 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) =	0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4111 (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	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
Effective ac	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

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Energy content (annual)												Total = Sum(45)m = 1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)
Total per year (kWh/year) = Sum(64)m =												1622.0849 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	374.3177	372.1854	358.6535	336.8644	314.7557	293.4745	279.6753	285.6863	296.9071	318.9077	344.1597	363.0836	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d					Gains W
Northeast					5.0600	11.2829	0.4600	0.0000	0.7700					20.2219 (75)
Southwest					3.0000	36.7938	0.4600	0.0000	0.7700					39.0971 (79)
Northwest					0.7200	11.2829	0.4600	0.0000	0.7700					2.8774 (81)
Southwest					4.5100	36.7938	0.4600	0.0000	0.7700					58.7760 (79)

Solar gains	120.9724	213.7335	312.8194	421.7583	503.5840	513.6572	489.5128	426.3704	350.2152	241.7160	146.2944	102.6231	(83)	
Total gains	495.2901	585.9189	671.4729	758.6227	818.3397	807.1316	769.1881	712.0567	647.1223	560.6237	490.4540	465.7066	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9860	0.9752	0.9530	0.9008	0.8022	0.6519	0.5091	0.5605	0.7766	0.9301	0.9771	0.9885 (86)
MIT	19.0436	19.2900	19.6769	20.1759	20.5923	20.8602	20.9545	20.9370	20.7333	20.1851	19.5316	19.0107 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9830	0.9699	0.9425	0.8780	0.7556	0.5708	0.3986	0.4494	0.7083	0.9092	0.9712	0.9860 (89)
MIT 2	17.2870	17.6459	18.2051	18.9199	19.4802	19.8126	19.9021	19.8926	19.6765	18.9491	18.0102	17.2476 (90)
Living area fraction	17.6499	17.9855	18.5091	19.1794	19.7099	20.0290	20.1195	20.1083	fLA = Living area / (4) =	19.8948	19.2045	0.2066 (91)
MIT	17.6499	17.9855	18.5091	19.1794	19.7099	20.0290	20.1195	20.1083	19.8948	19.2045	18.3245	17.6118 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4999	17.8355	18.3591	19.0294	19.5599	19.8790	19.9695	19.9583	19.7448	19.0545	18.1745	17.4618 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9731	0.9557	0.9229	0.8550	0.7381	0.5669	0.4033	0.4526	0.6952	0.8873	0.9576	0.9774	(94)
Useful gains	481.9646	559.9467	619.7107	648.6285	604.0505	457.5857	310.2077	322.3009	449.9111	497.4395	469.6772	455.1897	(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	1310.2163	1279.2793	1168.6054	981.2241	758.9281	502.0370	320.4437	337.4370	539.9932	816.3321	1076.3178	1297.6693	(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	616.2193	483.3915	408.3777	239.4688	115.2289	0.0000	0.0000	0.0000	0.0000	237.2561	436.7812	626.8048	(98)
Space heating												3163.5283	(98)
Space heating per m2												(98) / (4) = 39.6532	(99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3495.6114 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.2193	483.3915	408.3777	239.4688	115.2289	0.0000	0.0000	0.0000	0.0000	237.2561	436.7812	626.8048	(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)	680.9053	534.1343	451.2460	264.6064	127.3248	0.0000	0.0000	0.0000	0.0000	262.1615	482.6312	692.6020	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.8042	89.7416	89.6159	89.3340	88.7871	87.3000	87.3000	87.3000	87.3000	89.2994	89.6668	87.3000	(216)
Fuel for water heating, kWh/month	183.9156	161.3981	167.8116	148.2290	144.2007	128.1956	120.4190	135.8687	136.8056	153.9075	165.4272	178.5462	(219)
Water heating fuel used													1824.7247 (219)
Annual totals kWh/year													
Space heating fuel - main system													3495.6114 (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)													356.9126 (232)
Total delivered energy for all uses													5752.2488 (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	3495.6114	0.2160	755.0521 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.7247	0.2160	394.1405 (264)
Space and water heating			1149.1926 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/year			1373.3553 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2100 (273)

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

DER		17.2100 ZC1
Total Floor Area	TFA	79.7800
Assumed number of occupants	N	2.4587
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2651 ZC2
CO2 emissions from cooking, equation (L16)		2.2312 ZC3
Total CO2 emissions		35.7063 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.7063 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) =	0.1455 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)					
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (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)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)											Total = Sum(45)m =	1456.8563 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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 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	45.1755	48.1283	44.7493	44.3536	41.0963	42.4662	44.3536	44.7493	48.1283	48.4023	50.9589 (61)
Solar input	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (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	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (64)
	62.9621	55.2187	57.3586	50.7041	49.0056	42.9938	40.9362	45.8806	46.3951	53.0633	56.8894	61.3774 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	84.6265	82.1707	77.0949	70.4223	65.8678	59.7136	55.0217	61.6675	64.4376	71.3216	79.0130	82.4966	(72)
Total internal gains	386.6966	384.2535	370.0993	347.6900	324.9569	303.0532	289.2610	295.8941	307.7425	330.3634	356.2333	375.4664	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
Northeast				5.0600	11.2829	0.6300	0.7000	0.7700		17.4480 (75)			
Southwest				7.5100	36.7938	0.6300	0.7000	0.7700		84.4475 (79)			
Northwest				0.7200	11.2829	0.6300	0.7000	0.7700		2.4827 (81)			
Solar gains	104.3782	184.4148	269.9087	363.9040	434.5054	443.1968	422.3644	367.8835	302.1748	208.5588	126.2266	88.5459	(83)
Total gains	491.0748	568.6683	640.0081	711.5940	759.4623	746.2500	711.6255	663.7776	609.9173	538.9222	482.4599	464.0122	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226	
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482	
util living area	0.9978	0.9950	0.9871	0.9596	0.8805	0.7193	0.5507	0.6074	0.8494	0.9749	0.9953	0.9983	(86)
MIT	19.7243	19.8841	20.1421	20.4836	20.7747	20.9434	20.9880	20.9809	20.8641	20.4866	20.0459	19.7005	(87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420	(88)
util rest of house	0.9970	0.9933	0.9824	0.9441	0.8353	0.6274	0.4284	0.4829	0.7776	0.9623	0.9934	0.9977	(89)
MIT 2	18.2350	18.4700	18.8465	19.3420	19.7301	19.9262	19.9596	19.9583	19.8497	19.3556	18.7166	18.2082	(90)
Living area fraction	18.5426	18.7621	19.1141	19.5778	19.9458	20.1363	20.1720	20.1695	20.0592	19.5892	18.9912	18.5165	(91)
MIT	18.5426	18.7621	19.1141	19.5778	19.9458	20.1363	20.1720	20.1695	20.0592	19.5892	18.9912	18.5165	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5426	18.7621	19.1141	19.5778	19.9458	20.1363	20.1720	20.1695	20.0592	19.5892	18.9912	18.5165	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9905	0.9774	0.9371	0.8350	0.6439	0.4537	0.5085	0.7856	0.9564	0.9908	0.9965	(94)
Useful gains	488.8589	563.2682	625.5589	666.8318	634.1592	480.5018	322.8865	337.5593	479.1761	515.4323	478.0287	462.4101	(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	1348.2853	1308.2782	1186.9455	990.6168	762.9505	505.8679	326.3880	343.6283	547.1576	831.7326	1106.1949	1339.3087	(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	639.4132	500.6468	417.6716	233.1252	95.8207	0.0000	0.0000	0.0000	0.0000	235.3274	452.2796	652.4126	(98)
Space heating												3226.6972	(98)
Space heating per m2												40.4449	(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													3454.7079 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	639.4132	500.6468	417.6716	233.1252	95.8207	0.0000	0.0000	0.0000	0.0000	235.3274	452.2796	652.4126	(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)	684.5966	536.0244	447.1859	249.5987	102.5918	0.0000	0.0000	0.0000	0.0000	251.9566	484.2394	698.5145	(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	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378	(64)
Efficiency of water heater (217)m	87.7503	87.5213	87.0461	85.9424	83.8304	80.3000	80.3000	80.3000	80.3000	85.8477	87.2379	80.3000	(216)
Fuel for water heating, kWh/month	230.2030	202.5567	211.8976	190.3561	188.9416	173.7253	166.4421	185.5439	187.5930	199.8079	209.8920	224.5539	(219)
Water heating fuel used												2371.5132	(219)
Annual totals kWh/year													
Space heating fuel - main system												3454.7079	(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)												356.9126	(232)
Total delivered energy for all uses												6258.1338	(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	3454.7079	0.2160	746.2169 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2371.5132	0.2160	512.2469 (264)
Space and water heating			1258.4638 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/m2/year			1482.6264 (272)
Emissions per m2 for space and water heating			15.7742 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3219 (272b)
Emissions per m2 for pumps and fans			0.4879 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7742 * 1.00) + 2.3219 + 0.4879, rounded to 2 d.p.			18.5800 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1455 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3960 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3663 (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	0.4670	0.4578	0.4487	0.4029	0.3937	0.3480	0.3480	0.3388	0.3663	0.3937	0.4121	0.4304 (22b)
Effective ac	0.6090	0.6048	0.6007	0.5812	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4492	41.1610	40.8785	39.5518	39.3036	38.1481	38.1481	37.9341	38.5932	39.3036	39.8058	40.3307 (38)
Heat transfer coeff	97.3308	97.0426	96.7602	95.4335	95.1852	94.0297	94.0297	93.8157	94.4748	95.1852	95.6874	96.2124 (39)
Average = Sum(39)m / 12 =												95.4323 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2200	1.2164	1.2128	1.1962	1.1931	1.1786	1.1786	1.1759	1.1842	1.1931	1.1994	1.2060 (40)
HLP (average)												1.1962 (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	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 = 1456.8563 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.0970	28.0723	28.9681	25.2551	24.2328	20.9111	19.3772	22.2356	22.5012	26.2230	28.6244	31.0843 (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	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	43.1412	41.7742	38.9356	35.0765	32.5710	29.0432	26.0446	29.8866	31.2516	35.2459	39.7561	41.7799	(72)
Total internal gains	342.2113	340.8570	328.9400	309.3442	288.6601	269.3828	257.2839	261.1132	271.5566	291.2876	313.9765	331.7497	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.0600	11.2829	0.4600	0.0000			0.7700			20.2219 (75)
Southwest					3.0000	36.7938	0.4600	0.0000			0.7700			39.0971 (79)
Northwest					0.7200	11.2829	0.4600	0.0000			0.7700			2.8774 (81)
Southwest					4.5100	36.7938	0.4600	0.0000			0.7700			58.7760 (79)
Solar gains	120.9724	213.7335	312.8194	421.7583	503.5840	513.6572	489.5128	426.3704	350.2152	241.7160	146.2944	102.6231	(83)	
Total gains	463.1837	554.5904	641.7594	731.1024	792.2441	783.0400	746.7968	687.4836	621.7718	533.0036	460.2708	434.3728	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.3436	34.4456	34.5462	35.0264	35.1178	35.5493	35.5493	35.6304	35.3818	35.1178	34.9335	34.7429
alpha	3.2896	3.2964	3.3031	3.3351	3.3412	3.3700	3.3700	3.3754	3.3588	3.3412	3.3289	3.3162
util living area	0.9884	0.9785	0.9576	0.9073	0.8104	0.6614	0.5175	0.5719	0.7884	0.9374	0.9807	0.9906 (86)
MIT	19.0341	19.2815	19.6700	20.1675	20.5876	20.8572	20.9536	20.9347	20.7253	20.1687	19.5126	18.9957 (87)
Th 2	19.9040	19.9069	19.9097	19.9230	19.9255	19.9371	19.9371	19.9393	19.9327	19.9255	19.9205	19.9152 (88)
util rest of house	0.9859	0.9739	0.9481	0.8858	0.7651	0.5809	0.4068	0.4606	0.7220	0.9184	0.9757	0.9886 (89)
MIT 2	18.1158	18.3629	18.7474	19.2380	19.6257	19.8572	19.9201	19.9132	19.7592	19.2505	18.6041	18.0858 (90)
Living area fraction	18.3055	18.5527	18.9380	19.4300	19.8244	20.0638	20.1336	20.1242	19.9587	19.4401	18.7918	18.2738 (91)
MIT	18.3055	18.5527	18.9380	19.4300	19.8244	20.0638	20.1336	20.1242	19.9587	19.4401	18.7918	18.2738 (92)
Temperature adjustment	18.3055	18.5527	18.9380	19.4300	19.8244	20.0638	20.1336	20.1242	19.9587	19.4401	18.7918	18.2738 (93)
adjusted MIT	18.3055	18.5527	18.9380	19.4300	19.8244	20.0638	20.1336	20.1242	19.9587	19.4401	18.7918	18.2738 (94)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9809	0.9663	0.9373	0.8739	0.7603	0.5913	0.4283	0.4814	0.7239	0.9075	0.9687	0.9842	(94)	
Useful gains	454.3213	535.8765	601.5326	638.9395	602.3121	463.0150	319.8632	330.9372	450.1003	483.7195	445.8767	427.5238	(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	1363.1691	1324.8891	1203.4986	1004.9116	773.3252	513.7570	332.2611	349.3850	553.5022	841.4504	1118.7557	1354.0695	(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	676.1828	530.2164	447.8628	263.4999	127.2337	0.0000	0.0000	0.0000	0.0000	266.1518	484.4729	689.3500	(98)	
Space heating	3484.9702												(98)	
Space heating per m2	(98) / (4) =												43.6823	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	883.8794	695.8199	712.9996	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8187	0.8776	0.8503	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	723.6325	610.6490	606.2446	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1007.1750	962.9391	895.2359	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	204.1506	262.1038	215.0095	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			681.2639 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	51.0376	65.5260	53.7524	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												170.3160 (107)
Energy for space heating												2.1348 (108)
Energy for space cooling												43.6823 (99)
Total												2.1348 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.8171 (109)
												45.8 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) =	0.1455 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3658 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298	(22b)				
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924	(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)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)										Total = Sum(45)m =	1456.8563 (45)	
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.0970	28.0723	28.9681	25.2551	24.2328	20.9111	19.3772	22.2356	22.5012	26.2230	28.6244	31.0843 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337	122.9337 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.2099	17.9502	14.5981	11.0517	8.2613	6.9745	7.5362	9.7959	13.1480	16.6944	19.4848	20.7716 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.9801	221.2525	215.5263	203.3359	187.9477	173.4850	163.8230	161.5507	167.2769	179.4673	194.8554	209.3181 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934	35.2934 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469 (71)
Water heating gains (Table 5)	43.1412	41.7742	38.9356	35.0765	32.5710	29.0432	26.0446	29.8866	31.2516	35.2459	39.7561	41.7799 (72)
Total internal gains	342.2113	340.8570	328.9400	309.3442	288.6601	269.3828	257.2839	261.1132	271.5566	291.2876	313.9765	331.7497 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				5.0600	11.2829	0.6300	0.7000	0.7700	17.4480 (75)			
Southwest				7.5100	36.7938	0.6300	0.7000	0.7700	84.4475 (79)			
Northwest				0.7200	11.2829	0.6300	0.7000	0.7700	2.4827 (81)			
Solar gains	104.3782	184.4148	269.9087	363.9040	434.5054	443.1968	422.3644	367.8835	302.1748	208.5588	126.2266	88.5459 (83)
Total gains	446.5894	525.2718	598.8488	673.2482	723.1655	712.5796	679.6484	628.9967	573.7314	499.8465	440.2031	420.2956 (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, nilm (see Table 9a)												
tau	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482
util living area	0.9985	0.9965	0.9902	0.9671	0.8965	0.7427	0.5737	0.6353	0.8724	0.9814	0.9969	0.9989 (86)
MIT	19.6728	19.8344	20.0967	20.4463	20.7507	20.9346	20.9857	20.9768	20.8435	20.4457	19.9973	19.6497 (87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420 (88)
util rest of house	0.9980	0.9952	0.9866	0.9540	0.8549	0.6515	0.4477	0.5078	0.8060	0.9717	0.9956	0.9986 (89)
MIT 2	18.7216	18.8851	19.1478	19.5002	19.7816	19.9335	19.9603	19.9594	19.8706	19.5062	19.0589	18.7075 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.9181	19.0812	19.3439	19.6956	19.9817	20.1403	20.1721	20.1696	20.0715	19.7003	19.2527	18.9021 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9181	19.0812	19.3439	19.6956	19.9817	20.1403	20.1721	20.1696	20.0715	19.7003	19.2527	18.9021 (93)

8. Space heating requirement

Utilisation	0.9973	0.9938	0.9839	0.9500	0.8563	0.6684	0.4740	0.5343	0.8145	0.9685	0.9944	0.9980 (94)
Useful gains	445.4046	522.0373	589.1874	639.6046	619.2224	476.2914	322.1453	336.0853	467.2982	484.1171	437.7201	419.4679 (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	1383.8307	1338.3942	1208.5618	1001.5448	766.2731	506.2326	326.3973	343.6335	548.2885	842.0068	1130.5246	1375.3854 (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	698.1891	548.5918	460.8146	260.5969	109.4057	0.0000	0.0000	0.0000	0.0000	266.2699	498.8192	711.2027 (98)
Space heating												3553.8899 (98)
Space heating per m2										(98) / (4) =		44.5461 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	858.9053	676.1595	692.8119	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8637	0.9242	0.8991	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	741.8790	624.9339	622.8739	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	924.8187	884.4540	826.8746	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	131.7166	193.0830	151.7765	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												476.5760 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.9291	48.2707	37.9441	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												119.1440 (107)
Space cooling per m2												1.4934 (108)
Energy for space heating												44.5461 (99)
Energy for space cooling												1.4934 (108)
Total												46.0395 (109)
Target Fabric Energy Efficiency (TFEE)												52.9 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.4111 (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	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
Effective ac	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 = 1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast				5.0600	12.9236		0.4600	0.0000	0.7700	23.1623 (75)		
Southwest				3.0000	40.4699		0.4600	0.0000	0.7700	43.0033 (79)		
Northwest				0.7200	12.9236		0.4600	0.0000	0.7700	3.2958 (81)		
Southwest				4.5100	40.4699		0.4600	0.0000	0.7700	64.6483 (79)		
Solar gains	134.1098	213.6762	310.3322	433.6354	506.2858	553.3328	521.3620	463.1435	377.4603	258.4019	166.2393	112.6188 (83)
Total gains	688.1022	763.2661	838.5417	928.7320	967.5087	984.2209	934.5346	884.5974	817.9836	732.2496	677.1038	651.4608 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9598	0.9427	0.9032	0.8158	0.6693	0.4554	0.3078	0.3328	0.5976	0.8383	0.9343	0.9650 (86)
MIT	19.5302	19.7242	20.0797	20.4992	20.8114	20.9643	20.9932	20.9913	20.9058	20.5363	19.9908	19.5017 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9517	0.9314	0.8836	0.7792	0.6059	0.3668	0.2042	0.2254	0.5095	0.7973	0.9191	0.9578 (89)
MIT 2	18.0067	18.2866	18.7882	19.3636	19.7529	19.9178	19.9350	19.9390	19.8697	19.4307	18.6809	17.9739 (90)
Living area fraction	18.3214	18.5836	19.0549	19.5982	19.9716	20.1340	20.1536	20.1564	20.0837	19.6591	18.9515	18.2894 (92)
MIT	18.3214	18.5836	19.0549	19.5982	19.9716	20.1340	20.1536	20.1564	20.0837	19.6591	18.9515	18.2894 (92)
Temperature adjustment									fLA = Living area / (4) =			0.2066 (91)
adjusted MIT	18.1714	18.4336	18.9049	19.4482	19.8216	19.9840	20.0036	20.0064	19.9337	19.5091	18.8015	-0.1500
												18.1394 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9338	0.9109	0.8608	0.7602	0.5990	0.3707	0.2108	0.2321	0.5090	0.7779	0.8979	0.9412	(94)
Ext temp.	642.5656	695.2505	721.8555	706.0662	579.5482	364.8330	197.0366	205.3373	416.3792	569.5967	607.9852	613.1777	(95)
Heat loss rate W	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)
Month fracti	1258.1298	1227.6769	1100.5784	905.4672	646.8981	373.7948	197.8724	206.4959	444.1374	745.9305	1018.7232	1240.0586	(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)
RHI space heating demand	457.9798	357.7905	281.7699	143.5687	50.1083	0.0000	0.0000	0.0000	0.0000	131.1924	295.7313	466.3993	(98)
												2184.5402	(98)
												2185	(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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (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	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)	
								Total per year (kWh/year) = Sum(64)m =					1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			5.0600		11.2829		0.4600		0.0000		0.7700		20.2219 (75)
Southwest			3.0000		36.7938		0.4600		0.0000		0.7700		39.0971 (79)
Northwest			0.7200		11.2829		0.4600		0.0000		0.7700		2.8774 (81)
Southwest			4.5100		36.7938		0.4600		0.0000		0.7700		58.7760 (79)
Solar gains	120.9724	213.7335	312.8194	421.7583	503.5840	513.6572	489.5128	426.3704	350.2152	241.7160	146.2944	102.6231	(83)
Total gains	674.9649	763.3234	841.0289	916.8548	964.8069	944.5453	902.6854	847.8243	790.7385	715.5636	657.1589	641.4651	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9672	0.9502	0.9184	0.8516	0.7396	0.5825	0.4438	0.4860	0.6954	0.8780	0.9499	0.9716 (86)
MIT	19.3188	19.5478	19.8992	20.3401	20.6887	20.9008	20.9698	20.9589	20.8135	20.3654	19.7759	19.2845 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9606	0.9405	0.9022	0.8218	0.6877	0.5031	0.3435	0.3839	0.6212	0.8468	0.9384	0.9659 (89)
MIT 2	17.6829	18.0130	18.5143	19.1357	19.5919	19.8485	19.9109	19.9063	19.7581	19.1870	18.3564	17.6425 (90)
Living area fraction	18.0208	18.3300	18.8004	19.3845	19.8185	20.0659	20.1296	20.1237	19.9761	19.4304	18.6496	17.9817 (91)
MIT	18.0208	18.3300	18.8004	19.3845	19.8185	20.0659	20.1296	20.1237	19.9761	19.4304	18.6496	17.9817 (92)
Temperature adjustment	17.8708	18.1800	18.6504	19.2345	19.6685	19.9159	19.9796	19.9737	19.8261	19.2804	18.4996	-0.1500
adjusted MIT	17.8708	18.1800	18.6504	19.2345	19.6685	19.9159	19.9796	19.9737	19.8261	19.2804	18.4996	17.8317 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9440	0.9204	0.8791	0.8000	0.6748	0.5023	0.3487	0.3884	0.6140	0.8245	0.9185	0.9507	(94)
Useful gains	637.1879	702.5815	739.3776	733.4790	651.0531	474.4139	314.7756	329.2968	485.4813	589.9940	603.5890	609.8578	(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	1347.0313	1313.3484	1197.3068	1001.0952	769.4100	505.5438	321.4042	338.9016	547.7641	838.1480	1107.9186	1333.8647	(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	528.1235	410.4354	340.6993	192.6837	88.0576	0.0000	0.0000	0.0000	0.0000	184.6265	363.1173	538.6611	(98)
Space heating												2646.4044	(98)
Space heating per m2												(98) / (4) =	33.1713 (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													2924.2037 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	528.1235	410.4354	340.6993	192.6837	88.0576	0.0000	0.0000	0.0000	0.0000	184.6265	363.1173	538.6611	(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)	583.5619	453.5197	376.4634	212.9102	97.3012	0.0000	0.0000	0.0000	0.0000	204.0072	401.2346	595.2056	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater	89.7166	89.6429	89.4954	89.1687	88.5763	87.3000	87.3000	87.3000	87.3000	89.1062	89.5480	87.3000	(216)
Fuel for water heating, kWh/month	184.0952	161.5758	168.0375	148.5039	144.5439	128.1956	120.4190	135.8687	136.8056	154.2412	165.6466	178.7131	(219)
Water heating fuel used												1826.6460	(219)
Annual totals kWh/year													
Space heating fuel - main system												2924.2037	(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)												356.9126	(232)
Total delivered energy for all uses												5182.7623	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2924.2037	3.4800	101.7623 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1826.6460	3.4800	63.5673 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	356.9126	13.1900	47.0768 (250)
Additional standing charges			120.0000 (251)
Total energy cost			342.2988 (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] =	1.1522 (257)
SAP value		83.9275
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	2924.2037	0.2160	631.6280 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.6460	0.2160	394.5555 (264)
Space and water heating			1026.1835 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1250.3462 (272)
CO2 emissions per m2			15.6700 (273)
EI value			86.5727
EI rating			87 (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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 206.2313 (5)
Dwelling volume			

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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (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) = 12033.6960 (34)
150.8360 (35)
6.2904 (36)
(33) + (36) = 55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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)
2.4587 (42)
92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 = 1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
												Total per year (kWh/year) = Sum(64)m = 1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					5.0600	12.9236	0.4600	0.0000	0.7700	23.1623 (75)		
Southwest					3.0000	40.4699	0.4600	0.0000	0.7700	43.0033 (79)		
Northwest					0.7200	12.9236	0.4600	0.0000	0.7700	3.2958 (81)		
Southwest					4.5100	40.4699	0.4600	0.0000	0.7700	64.6483 (79)		
Solar gains	134.1098	213.6762	310.3322	433.6354	506.2858	553.3328	521.3620	463.1435	377.4603	258.4019	166.2393	112.6188 (83)
Total gains	688.1022	763.2661	838.5417	928.7320	967.5087	984.2209	934.5346	884.5974	817.9836	732.2496	677.1038	651.4608 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9598	0.9427	0.9032	0.8158	0.6693	0.4554	0.3078	0.3328	0.5976	0.8383	0.9343	0.9650 (86)
MIT	19.5302	19.7242	20.0797	20.4992	20.8114	20.9643	20.9932	20.9913	20.9058	20.5363	19.9908	19.5017 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9517	0.9314	0.8836	0.7792	0.6059	0.3668	0.2042	0.2254	0.5095	0.7973	0.9191	0.9578 (89)
MIT 2	18.0067	18.2866	18.7882	19.3636	19.7529	19.9178	19.9350	19.9390	19.8697	19.4307	18.6809	17.9739 (90)
Living area fraction	18.3214	18.5836	19.0549	19.5982	19.9716	20.1340	20.1536	20.1564	20.0837	19.6591	18.9515	18.2894 (92)
MIT	18.3214	18.5836	19.0549	19.5982	19.9716	20.1340	20.1536	20.1564	20.0837	19.6591	18.9515	18.2894 (91)
Temperature adjustment									fLA = Living area / (4) =			0.2066 (91)
adjusted MIT	18.1714	18.4336	18.9049	19.4482	19.8216	19.9840	20.0036	20.0064	19.9337	19.5091	18.8015	18.1394 (93)
												-0.1500

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9338	0.9109	0.8608	0.7602	0.5990	0.3707	0.2108	0.2321	0.5090	0.7779	0.8979	0.9412	(94)
Useful gains	642.5656	695.2505	721.8555	706.0662	579.5482	364.8330	197.0366	205.3373	416.3792	569.5967	607.9852	613.1777	(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	1258.1298	1227.6769	1100.5784	905.4672	646.8981	373.7948	197.8724	206.4959	444.1374	745.9305	1018.7232	1240.0586	(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	457.9798	357.7905	281.7699	143.5687	50.1083	0.0000	0.0000	0.0000	0.0000	131.1924	295.7313	466.3993	(98)
Space heating												2184.5402	(98)
Space heating per m2												(98) / (4) = 27.3821	(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													2413.8566 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	457.9798	357.7905	281.7699	143.5687	50.1083	0.0000	0.0000	0.0000	0.0000	131.1924	295.7313	466.3993	(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)	506.0550	395.3487	311.3479	158.6395	55.3683	0.0000	0.0000	0.0000	0.0000	144.9639	326.7749	515.3584	(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	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.6292	89.5541	89.3602	88.9359	88.1770	87.3000	87.3000	87.3000	87.3000	88.8340	89.4053	87.3000	(216)
Fuel for water heating, kWh/month	184.2746	161.7361	168.2918	148.8926	145.1984	128.1956	120.4190	135.8687	136.8056	154.7137	165.9110	178.8849	(219)
Water heating fuel used												1829.1921	(219)
Annual totals kWh/year													
Space heating fuel - main system												2413.8566	(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)												356.9126	(232)
Total delivered energy for all uses												4674.9613	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2413.8566	9.7400	235.1096 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.1921	9.7400	178.1633 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	356.9126	36.8500	131.5223 (250)
Additional standing charges			104.0000 (251)
Total energy cost			676.4327 (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	2413.8566	0.2160	521.3930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.1921	0.2160	395.1055 (264)
Space and water heating			916.4985 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1140.6612 (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	2413.8566	1.2200	2944.9051 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.1921	1.2200	2231.6143 (264)
Space and water heating			5176.5194 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Primary energy kWh/year			6502.4912 (272)
Primary energy kWh/m2/year			81.5053 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 75	-181 kg (15.9%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (98.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£75	2.27 kg/m²	B 85 B 88
Solar photovoltaic panels	£672	11.87 kg/m²	A 96 A 98
Total Savings	£747	14.14 kg/m²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 98

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	£159	£178	-£18
Mains gas	£517	£424	£94
Space heating	£367	£367	£0
Water heating	£178	£103	£75
Lighting	£132	£132	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£676	-£70	£748
Total cost of uses	£677	-£70	£747
Delivered energy	59 kWh/m²	24 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	14 kg/m²
Primary energy	82 kWh/m²	-1 kWh/m²	83 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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (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	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.3780	43.0149	42.6590	40.9875	40.6747	39.2189	39.2189	38.9493	39.7797	40.6747	41.3074	41.9688 (38)
Heat transfer coeff	99.2596	98.8965	98.5406	96.8691	96.5564	95.1005	95.1005	94.8309	95.6613	96.5564	97.1890	97.8505 (39)
Average = Sum(39)m / 12 =												96.8676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (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	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (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												1.2449 (H8)	
Utilisation factor												0.5521 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												92.5935 (H14)	
Volume ratio Veff/V												0.8100 (H15)	
Solar storage volume factor												0.9579 (H16)	
Solar input												-843.3953 (H17)	
Solar input	-24.4568	-40.8113	-69.5064	-93.1523	-115.0818	-113.1437	-111.6485	-97.5478	-76.3995	-52.1719	-29.0093	-20.4662 (63)	
												Solar input (sum of months) = Sum(63)m =	-843.3953 (63)
Output from w/h	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203 (64)	
												Total per year (kWh/year) = Sum(64)m =	786.4412 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					5.0600	11.2829	0.4600	0.0000	0.7700	20.2219 (75)		
Southwest					3.0000	36.7938	0.4600	0.0000	0.7700	39.0971 (79)		
Northwest					0.7200	11.2829	0.4600	0.0000	0.7700	2.8774 (81)		
Southwest					4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (79)		
Solar gains	120.9724	213.7335	312.8194	421.7583	503.5840	513.6572	489.5128	426.3704	350.2152	241.7160	146.2944	102.6231 (83)
Total gains	674.9649	763.3234	841.0289	916.8548	964.8069	944.5453	902.6854	847.8243	790.7385	715.5636	657.1589	641.4651 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9672	0.9502	0.9184	0.8516	0.7396	0.5825	0.4438	0.4860	0.6954	0.8780	0.9499	0.9716 (86)
MIT	19.3188	19.5478	19.8992	20.3401	20.6887	20.9008	20.9698	20.9589	20.8135	20.3654	19.7759	19.2845 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9606	0.9405	0.9022	0.8218	0.6877	0.5031	0.3435	0.3839	0.6212	0.8468	0.9384	0.9659 (89)
MIT 2	17.6829	18.0130	18.5143	19.1357	19.5919	19.8485	19.9109	19.9063	19.7581	19.1870	18.3564	17.6425 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.0208	18.3300	18.8004	19.3845	19.8185	20.0659	20.1296	20.1237	19.9761	19.4304	18.6496	17.9817 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8708	18.1800	18.6504	19.2345	19.6685	19.9159	19.9796	19.9737	19.8261	19.2804	18.4996	17.8317 (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	0.9440	0.9204	0.8791	0.8000	0.6748	0.5023	0.3487	0.3884	0.6140	0.8245	0.9185	0.9507	(94)
Useful gains	637.1879	702.5815	739.3776	733.4790	651.0531	474.4139	314.7756	329.2968	485.4813	589.9940	603.5890	609.8578	(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	1347.0313	1313.3484	1197.3068	1001.0952	769.4100	505.5438	321.4042	338.9016	547.7641	838.1480	1107.9186	1333.8647	(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	528.1235	410.4354	340.6993	192.6837	88.0576	0.0000	0.0000	0.0000	0.0000	184.6265	363.1173	538.6611	(98)
Space heating												2646.4044	(98)
Space heating per m2											(98) / (4) =	33.1713	(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													2924.2037 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	528.1235	410.4354	340.6993	192.6837	88.0576	0.0000	0.0000	0.0000	0.0000	184.6265	363.1173	538.6611	(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)	583.5619	453.5197	376.4634	212.9102	97.3012	0.0000	0.0000	0.0000	0.0000	204.0072	401.2346	595.2056	(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	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203	(64)
Efficiency of water heater	89.8075	89.8341	89.8680	89.9419	90.0767	87.3000	87.3000	87.3000	87.3000	89.4640	89.6869	87.3000	(216)
(217)m	89.8075	89.8341	89.8680	89.9419	90.0767	87.3000	87.3000	87.3000	87.3000	89.4640	89.6869	89.8211	(217)
Fuel for water heating, kWh/month	156.6764	115.8022	89.9980	43.6579	14.3765	0.0000	0.0000	24.1300	49.2919	95.3083	133.0450	155.7766	(219)
Water heating fuel used												878.0628	(219)
Annual totals kWh/year													
Space heating fuel - main system												2924.2037	(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)												356.9126	(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												2556.9398	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2924.2037	3.4800	101.7623	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	878.0628	3.4800	30.5566	(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	356.9126	13.1900	47.0768	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			88.0603	(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] =	0.2964 (257)
SAP value			95.8652
SAP rating (Section 12)			96 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2924.2037	0.2160	631.6280 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	878.0628	0.2160	189.6616 (264)
Space and water heating			821.2896 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			174.9650 (272)
CO2 emissions per m2			2.1900 (273)
EI value			98.1211
EI rating			98 (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	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (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) =	0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4111 (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	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
Effective ac	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (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)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (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												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (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 =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (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	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1140.0998 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1915.3676 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.3147 (H8)	
Utilisation factor												0.5326 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												92.5935 (H14)	
Volume ratio Veff/V												0.8100 (H15)	
Solar storage volume factor												0.9579 (H16)	
Solar input												-859.2180 (H17)	
Solar input	-26.4463	-39.7487	-66.9419	-92.5342	-111.4423	-117.2882	-114.4719	-102.2241	-79.7862	-54.2771	-32.1462	-21.9109 (63)	
	Solar input (sum of months) = Sum(63)m =											-859.2180 (63)	
Output from w/h	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756 (64)	
	Total per year (kWh/year) = Sum(64)m =											777.5864 (64)	
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	147.5204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.5247	44.8756	36.4953	27.6293	20.6532	17.4363	18.8405	24.4896	32.8699	41.7360	48.7120	51.9289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.8360	330.2276	321.6810	303.4864	280.5189	258.9328	244.5119	241.1204	249.6670	267.8616	290.8290	312.4151	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	52.2107	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	-98.3469	(71)
Water heating gains (Table 5)	72.2475	70.1026	65.6490	59.5967	55.6666	50.1349	45.4360	51.4597	53.6022	59.8660	66.9393	70.1137	(72)
Total internal gains	553.9924	549.5899	528.2095	495.0966	461.2229	430.8882	413.1726	421.4539	440.5233	473.8477	510.8645	538.8420	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					5.0600	12.9236	0.4600	0.0000	0.7700	23.1623 (75)		
Southwest					3.0000	40.4699	0.4600	0.0000	0.7700	43.0033 (79)		
Northwest					0.7200	12.9236	0.4600	0.0000	0.7700	3.2958 (81)		
Southwest					4.5100	40.4699	0.4600	0.0000	0.7700	64.6483 (79)		

Solar gains	134.1098	213.6762	310.3322	433.6354	506.2858	553.3328	521.3620	463.1435	377.4603	258.4019	166.2393	112.6188 (83)
Total gains	688.1022	763.2661	838.5417	928.7320	967.5087	984.2209	934.5346	884.5974	817.9836	732.2496	677.1038	651.4608 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9598	0.9427	0.9032	0.8158	0.6693	0.4554	0.3078	0.3328	0.5976	0.8383	0.9343	0.9650 (86)
MIT	19.5302	19.7242	20.0797	20.4992	20.8114	20.9643	20.9932	20.9913	20.9058	20.5363	19.9908	19.5017 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9517	0.9314	0.8836	0.7792	0.6059	0.3668	0.2042	0.2254	0.5095	0.7973	0.9191	0.9578 (89)
MIT 2	18.0067	18.2866	18.7882	19.3636	19.7529	19.9178	19.9350	19.9390	19.8697	19.4307	18.6809	17.9739 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	18.3214	18.5836	19.0549	19.5982	19.9716	20.1340	20.1536	20.1564	20.0837	19.6591	18.9515	18.2894 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1714	18.4336	18.9049	19.4482	19.8216	19.9840	20.0036	20.0064	19.9337	19.5091	18.8015	18.1394 (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	0.9338	0.9109	0.8608	0.7602	0.5990	0.3707	0.2108	0.2321	0.5090	0.7779	0.8979	0.9412	(94)
Useful gains	642.5656	695.2505	721.8555	706.0662	579.5482	364.8330	197.0366	205.3373	416.3792	569.5967	607.9852	613.1777	(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	1258.1298	1227.6769	1100.5784	905.4672	646.8981	373.7948	197.8724	206.4959	444.1374	745.9305	1018.7232	1240.0586	(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	457.9798	357.7905	281.7699	143.5687	50.1083	0.0000	0.0000	0.0000	0.0000	131.1924	295.7313	466.3993	(98)
Space heating												2184.5402	(98)
Space heating per m2											(98) / (4) =	27.3821	(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													2413.8566	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	457.9798	357.7905	281.7699	143.5687	50.1083	0.0000	0.0000	0.0000	0.0000	131.1924	295.7313	466.3993	(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)	506.0550	395.3487	311.3479	158.6395	55.3683	0.0000	0.0000	0.0000	0.0000	144.9639	326.7749	515.3584	(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	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756	(64)	
Efficiency of water heater	89.7353	89.7531	89.7484	89.7845	89.6824	87.3000	87.3000	87.3000	87.3000	89.2311	89.5739	87.3000	(216)	
(217)m	89.7353	89.7531	89.7484	89.7845	89.6824	87.3000	87.3000	87.3000	87.3000	89.2311	89.5739	87.3000	(217)	
Fuel for water heating, kWh/month	154.5853	117.0907	92.9754	44.4228	18.4979	0.0000	0.0000	18.7735	45.4125	93.1977	129.7108	154.2957	(219)	
Water heating fuel used												868.9623	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2413.8566	(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)													356.9126	(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												1940.5719	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2413.8566	9.7400	235.1096	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	868.9623	9.7400	84.6369	(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	356.9126	36.8500	131.5223	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			-70.8715	(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	2413.8566	0.2160	521.3930	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	868.9623	0.2160	187.6959	(264)
Space and water heating			709.0889	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			12.4627 (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	2413.8566	1.2200	2944.9051 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	868.9623	1.2200	1060.1340 (264)
Space and water heating			4005.0391 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-115.6592 (272)
Primary energy kWh/m2/year			-1.4497 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	150.8 (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	272.23 (P1)
Transmission heat loss coefficient	55.88 (37)
Summer heat loss coefficient	328.11 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.0600	98.8453	0.4600	0.0000	0.9000	207.0650
South West	3.0000	119.9223	0.4600	0.0000	0.9000	148.9436
North West	0.7200	98.8453	0.4600	0.0000	0.9000	29.4638
South West	4.5100	119.9223	0.4600	0.0000	0.9000	223.9118
total:						609.3842

	Jun	Jul	Aug	
Solar gains	647	609	541	(P4)
Internal gains	428	410	418	
Total summer gains	1075	1020	960	(P5)
Summer gain/loss ratio	3.28	3.11	2.93	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 150.8)	0.94	0.94	0.94	
Threshold temperature	20.22	21.95	21.67	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			