

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-596				Issued on Date	22/03/2023
Assessment Reference	Plot 596	Prop Type Ref	4D-As-SEMI			
Property	Plot 595, 4 Bed, K, WC, Ut, B, En, Staggered					
SAP Rating	85 B	DER	15.86	TER	17.38	
Environmental	86 B	% DER<TER	8.76			
CO ₂ Emissions (t/year)	1.40	DFEE	45.73	TFEE	53.12	
General Requirements Compliance	Pass	% DFEE<TFEE	13.91			
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 106 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) 17.38 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.86 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 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	1.31 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 5.44 m², No overhang
Windows facing South: 5.57 m², No overhang
Windows facing West: 2.88 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 0.036 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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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) =		0.3326 (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	0.4241	0.4158	0.4074	0.3659	0.3576	0.3160	0.3160	0.3077	0.3326	0.3576	0.3742	0.3908 (22b)
Effective ac	0.5899	0.5864	0.5830	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5700	0.5764 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.5437	53.2268	52.9161	51.4570	51.1840	49.9132	49.9132	49.6779	50.4027	51.1840	51.7363	52.3137 (38)
Heat transfer coeff	121.2347	120.9178	120.6071	119.1481	118.8751	117.6043	117.6043	117.3689	118.0938	118.8751	119.4273	120.0047 (39)
Average = Sum(39)m / 12 =												119.1468 (39)
HLP	1.1394	1.1364	1.1335	1.1198	1.1172	1.1053	1.1053	1.1031	1.1099	1.1172	1.1224	1.1279 (40)
HLP (average)												1.1198 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Energy content (annual)										Total =	Sum (45)m =	1581.1899 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	23.8144 (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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month												
	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (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												
	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1746.8695 (64)
	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (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	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.8619	22.9703	18.6807	14.1425	10.5717	8.9251	9.6438	12.5354	16.8250	21.3632	24.9340	26.5807 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	266.2787	269.0418	262.0788	247.2553	228.5434	210.9568	199.2079	196.4447	203.4078	218.2312	236.9431	254.5297 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570 (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)												
	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560 (71)
Water heating gains (Table 5)												
	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030 (72)
Total internal gains												
	438.0305	435.5764	419.4944	393.5656	367.0164	341.7783	325.6475	332.3149	345.8935	372.0521	402.0081	424.6844 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.4400	10.6334	0.4600	0.0000	0.7700	20.4889 (74)			
South				5.5700	46.7521	0.4600	0.0000	0.7700	92.2369 (78)			
West				2.8800	19.6403	0.4600	0.0000	0.7700	20.0350 (80)			
Solar gains	132.7608	229.4082	323.5032	418.4870	485.9597	490.3158	469.4197	417.6829	356.0738	256.0474	159.5891	113.2575 (83)
Total gains	570.7912	664.9846	742.9976	812.0526	852.9761	832.0941	795.0672	749.9978	701.9673	628.0995	561.5972	537.9419 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.7496	35.8433	35.9356	36.3757	36.4592	36.8532	36.8532	36.9271	36.7004	36.4592	36.2906	36.1160
alpha	3.3833	3.3896	3.3957	3.4250	3.4306	3.4569	3.4569	3.4618	3.4467	3.4306	3.4194	3.4077
util living area												
	0.9901	0.9826	0.9678	0.9336	0.8626	0.7352	0.5904	0.6358	0.8291	0.9493	0.9836	0.9918 (86)
MIT	19.0808	19.2979	19.6438	20.0963	20.5109	20.8130	20.9363	20.9163	20.6913	20.1532	19.5367	19.0444 (87)
Th 2	19.9688	19.9712	19.9735	19.9847	19.9868	19.9965	19.9965	19.9983	19.9928	19.9868	19.9826	19.9781 (88)
util rest of house												
	0.9880	0.9789	0.9607	0.9176	0.8265	0.6615	0.4781	0.5266	0.7717	0.9340	0.9795	0.9901 (89)
MIT 2	17.3963	17.7132	18.2157	18.8702	19.4440	19.8328	19.9590	19.9450	19.6934	18.9613	18.0700	17.3490 (90)
Living area fraction									fLA =	Living area / (4) =		0.1941 (91)
MIT	17.7232	18.0208	18.4929	19.1082	19.6511	20.0230	20.1487	20.1335	19.8871	19.1926	18.3547	17.6780 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5732	17.8708	18.3429	18.9582	19.5011	19.8730	19.9987	19.9835	19.7371	19.0426	18.2047	17.5280 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9804	0.9678	0.9447	0.8965	0.8055	0.6512	0.4784	0.5248	0.7541	0.9143	0.9688	0.9837 (94)
Useful gains	559.6235	643.5898	701.9310	728.0009	687.0789	541.8459	380.3498	393.6108	529.3756	574.2726	544.0567	529.1593 (95)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1609.1729	1568.3973	1428.3356	1198.4140	927.3538	620.1293	399.6962	420.5973	665.7068	1003.6185	1326.2029	1599.4253 (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												
	780.8648	621.4707	540.4450	338.6974	178.7645	0.0000	0.0000	0.0000	0.0000	319.4334	563.1453	796.2779 (98)
Space heating												4139.0990 (98)
Space heating per m2										(98) / (4) =		38.9013 (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													4573.5901 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	780.8648	621.4707	540.4450	338.6974	178.7645	0.0000	0.0000	0.0000	0.0000	319.4334	563.1453	796.2779	(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)	862.8340	686.7079	597.1768	374.2513	197.5299	0.0000	0.0000	0.0000	0.0000	352.9650	622.2600	879.8651	(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	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004	(64)
Efficiency of water heater (217)m	89.8881	89.8387	89.7411	89.5277	89.0786	87.3000	87.3000	87.3000	87.3000	89.4617	89.7724	87.3000	(216)
Fuel for water heating, kWh/month	198.1192	173.8097	180.5928	159.2892	154.7019	137.8557	129.3705	146.1426	147.2042	165.4471	178.0757	192.2995	(219)
Water heating fuel used												1962.9081	(219)
Annual totals kWh/year													
Space heating fuel - main system												4573.5901	(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)												456.7289	(232)
Total delivered energy for all uses												7068.2271	(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	4573.5901	0.2160	987.8955 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1962.9081	0.2160	423.9881 (264)
Space and water heating			1411.8836 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7289	0.5190	237.0423 (268)
Total CO2, kg/year			1687.8509 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8600 (273)

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

DER		15.8600	ZC1
Total Floor Area	TFA	106.4000	
Assumed number of occupants	N	2.7914	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.8300	ZC2
CO2 emissions from cooking, equation (L16)		1.7481	ZC3
Total CO2 emissions		32.4381	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		32.4381	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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3954 (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	0.4572	0.4481	0.4024	0.3932	0.3475	0.3475	0.3383	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6087	0.6045	0.6004	0.5809	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148		(27)
GF B&B J150 P/A=0.40			53.2000	0.1300	6.9160		(28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.1800	15.9462		(29a)
Plane Ceiling	53.2000		53.2000	0.1300	6.9160		(30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.9030		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8928 (36)
Total fabric heat loss						(33) + (36) =	63.7958 (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	55.2526	54.8693	54.4936	52.7290	52.3989	50.8620	50.8620	50.5774	51.4540	52.3989	53.0668	53.7650 (38)
Heat transfer coeff	119.0484	118.6651	118.2894	116.5248	116.1947	114.6578	114.6578	114.3731	115.2498	116.1947	116.8626	117.5608 (39)
Average = Sum(39)m / 12 =												116.5232 (39)
HLP	1.1189	1.1153	1.1117	1.0952	1.0921	1.0776	1.0776	1.0749	1.0832	1.0921	1.0983	1.1049 (40)
HLP (average)												1.0951 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)
Energy content (annual)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	23.8144 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.5684	48.1389	44.6036	46.0904	48.1389	48.5684	50.9589	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	214.8945	189.4065	198.9133	177.5586	171.9080	151.4070	145.0594	161.7073	163.4932	184.8927	195.5142	209.7217	209.7217	209.7217	(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	0.0000	0.0000	(63)
Output from w/h	214.8945	189.4065	198.9133	177.5586	171.9080	151.4070	145.0594	161.7073	163.4932	184.8927	195.5142	209.7217	209.7217	209.7217	(64)
Heat gains from water heating, kWh/month	67.2483	59.1804	61.9346	55.0313	53.1880	46.6630	44.4298	49.7962	50.3546	57.2727	60.9400	65.5284	65.5284	65.5284	(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	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8619	22.9703	18.6807	14.1425	10.5717	8.9251	9.6438	12.5354	16.8250	21.3632	24.9340	26.5807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2787	269.0418	262.0788	247.2553	228.5434	210.9568	199.2079	196.4447	203.4078	218.2312	236.9431	254.5297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	(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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	(71)
Water heating gains (Table 5)	90.3875	88.0661	83.2454	76.4324	71.4892	64.8098	59.7175	66.9304	69.9369	76.9794	84.6389	88.0758	(72)
Total internal gains	450.3991	447.9492	431.8759	405.7012	378.4753	352.5626	336.4402	343.7816	358.0407	384.4449	414.3871	437.0572	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North			5.4400		10.6334		0.6300		0.7000		0.7700		17.6784 (74)
South			5.5700		46.7521		0.6300		0.7000		0.7700		79.5844 (78)
West			2.8800		19.6403		0.6300		0.7000		0.7700		17.2867 (80)
Solar gains	114.5494	197.9394	279.1270	361.0815	419.2987	423.0573	405.0275	360.3877	307.2297	220.9243	137.6976	97.7215	(83)
Total gains	564.9485	645.8886	711.0028	766.7827	797.7740	775.6199	741.4677	704.1693	665.2704	605.3692	552.0847	534.7787	(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	62.0663	62.2667	62.4645	63.4104	63.5906	64.4430	64.4430	64.6034	64.1120	63.5906	63.2272	62.8516	
alpha	5.1378	5.1511	5.1643	5.2274	5.2394	5.2962	5.2962	5.3069	5.2741	5.2394	5.2151	5.1901	
util living area	0.9989	0.9975	0.9938	0.9807	0.9372	0.8170	0.6494	0.6993	0.9053	0.9865	0.9976	0.9992	(86)
MIT	19.7361	19.8752	20.1035	20.4134	20.7030	20.9104	20.9794	20.9699	20.8276	20.4547	20.0433	19.7178	(87)
Th 2	19.9854	19.9884	19.9913	20.0048	20.0073	20.0192	20.0192	20.0214	20.0146	20.0073	20.0022	19.9968	(88)
util rest of house	0.9985	0.9966	0.9914	0.9725	0.9081	0.7357	0.5200	0.5732	0.8507	0.9793	0.9966	0.9989	(89)
MIT 2	18.2910	18.4964	18.8313	19.2888	19.6927	19.9527	20.0107	20.0075	19.8631	19.3537	18.7525	18.2724	(90)
Living area fraction	18.5715	18.7640	19.0782	19.5071	19.8887	20.1386	20.1987	20.1943	20.0503	19.5674	19.0030	18.5529	(92)
Temperature adjustment	18.5715	18.7640	19.0782	19.5071	19.8887	20.1386	20.1987	20.1943	20.0503	19.5674	19.0030	18.5529	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9951	0.9884	0.9670	0.9038	0.7469	0.5451	0.5973	0.8531	0.9748	0.9951	0.9982	(94)
Ext temp.	563.6297	642.7016	702.7215	741.4914	721.0066	579.3018	404.2016	420.5706	567.5368	590.1093	549.3881	533.8390	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1698.9977	1645.1766	1487.8706	1235.9872	951.4887	635.0389	412.6221	433.9624	685.7723	1041.9638	1391.0186	1687.3433	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	844.7137	673.6632	584.1509	356.0370	171.4787	0.0000	0.0000	0.0000	0.0000	336.1797	605.9739	858.2072	(98)
												4430.4044	(98)
												41.6391	(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													4743.4736 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	844.7137	673.6632	584.1509	356.0370	171.4787	0.0000	0.0000	0.0000	0.0000	336.1797	605.9739	858.2072	(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)	904.4044	721.2668	625.4292	381.1959	183.5961	0.0000	0.0000	0.0000	0.0000	359.9355	648.7943	918.8514	(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	214.8945	189.4065	198.9133	177.5586	171.9080	151.4070	145.0594	161.7073	163.4932	184.8927	195.5142	209.7217	(64)
Efficiency of water heater (217)m	88.1514	87.9717	87.6011	86.7684	85.0449	80.3000	80.3000	80.3000	80.3000	86.5378	87.7089	88.2209	(216)
Fuel for water heating, kWh/month	243.7789	215.3038	227.0670	204.6351	202.1379	188.5517	180.6469	201.3789	203.6029	213.6554	222.9127	237.7234	(219)
Water heating fuel used												2541.3946	(219)
Annual totals kWh/year													
Space heating fuel - main system												4743.4736	(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)												456.7289	(232)
Total delivered energy for all uses												7816.5971	(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	4743.4736	0.2160	1024.5903 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2541.3946	0.2160	548.9412 (264)
Space and water heating			1573.5315 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7289	0.5190	237.0423 (268)
Total CO2, kg/m2/year			1849.4988 (272)
Emissions per m2 for space and water heating			14.7888 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2278 (272b)
Emissions per m2 for pumps and fans			0.3658 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7888 * 1.00) + 2.2278 + 0.3658, rounded to 2 d.p.			17.3800 (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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3959 (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) =	0.3662 (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	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
Effective ac	0.6090	0.6048	0.6006	0.5811	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)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (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	55.2776	54.8933	54.5167	52.7476	52.4166	50.8759	50.8759	50.5905	51.4693	52.4166	53.0862	53.7862 (38)
Heat transfer coeff	122.9686	122.5844	122.2077	120.4387	120.1077	118.5669	118.5669	118.2816	119.1604	120.1077	120.7773	121.4773 (39)
Average = Sum(39)m / 12 =												120.4371 (39)
HLP	1.1557	1.1521	1.1486	1.1319	1.1288	1.1144	1.1144	1.1117	1.1199	1.1288	1.1351	1.1417 (40)
HLP (average)												1.1319 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (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	1581.1899 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.8363	30.4681	31.4403	27.4104	26.3010	22.6957	21.0309	24.1333	24.4215	28.4609	31.0673	33.7371 (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	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8619	22.9703	18.6807	14.1425	10.5717	8.9251	9.6438	12.5354	16.8250	21.3632	24.9340	26.5807 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2787	269.0418	262.0788	247.2553	228.5434	210.9568	199.2079	196.4447	203.4078	218.2312	236.9431	254.5297 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570 (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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560 (71)
Water heating gains (Table 5)	46.8230	45.3394	42.2585	38.0700	35.3507	31.5218	28.2674	32.4372	33.9188	38.2539	43.1491	45.3456 (72)
Total internal gains	403.8345	402.2225	387.8890	364.3389	339.3368	316.2747	301.9901	306.2884	319.0226	342.7194	369.8973	391.3270 (73)

6. Solar gains

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

North	5.4400	10.6334	0.4600	0.0000	0.7700	20.4889 (74)
South	5.5700	46.7521	0.4600	0.0000	0.7700	92.2369 (78)
West	2.8800	19.6403	0.4600	0.0000	0.7700	20.0350 (80)

Solar gains	132.7608	229.4082	323.5032	418.4870	485.9597	490.3158	469.4197	417.6829	356.0738	256.0474	159.5891	113.2575 (83)
Total gains	536.5953	631.6307	711.3921	782.8258	825.2965	806.5905	771.4098	723.9713	675.0963	598.7667	529.4864	504.5845 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.2455	35.3560	35.4649	35.9859	36.0850	36.5540	36.5540	36.6422	36.3719	36.0850	35.8850	35.6782
alpha	3.3497	3.3571	3.3643	3.3991	3.4057	3.4369	3.4369	3.4428	3.4248	3.4057	3.3923	3.3785
util living area	0.9917	0.9851	0.9717	0.9401	0.8735	0.7504	0.6070	0.6544	0.8435	0.9557	0.9863	0.9933 (86)
MIT	19.0082	19.2290	19.5823	20.0495	20.4776	20.7967	20.9292	20.9068	20.6659	20.1074	19.4773	18.9767 (87)
Th 2	19.9556	19.9585	19.9614	19.9748	19.9774	19.9891	19.9891	19.9913	19.9846	19.9774	19.9723	19.9669 (88)
util rest of house	0.9900	0.9819	0.9653	0.9253	0.8390	0.6775	0.4928	0.5441	0.7885	0.9419	0.9828	0.9918 (89)
MIT 2	18.1307	18.3522	18.7042	19.1718	19.5794	19.8666	19.9604	19.9504	19.7613	19.2358	18.6106	18.1076 (90)
Living area fraction									fLA = Living area / (4) =			0.1941 (91)
MIT	18.3010	18.5223	18.8747	19.3421	19.7537	20.0471	20.1485	20.1360	19.9368	19.4050	18.7788	18.2762 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3010	18.5223	18.8747	19.3421	19.7537	20.0471	20.1485	20.1360	19.9368	19.4050	18.7788	18.2762 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9861	0.9759	0.9565	0.9139	0.8301	0.6821	0.5123	0.5615	0.7854	0.9319	0.9772	0.9885 (94)
Ext temp.	529.1100	616.3910	680.4451	715.4634	685.0764	550.2133	395.1869	406.4841	530.2159	558.0116	517.4124	498.7988 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1721.6794	1669.8870	1512.2780	1257.6339	967.3158	645.8473	420.7307	441.9002	695.5195	1057.5452	1410.5315	1709.9434 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	887.2716	707.9493	618.8837	390.3628	209.9861	0.0000	0.0000	0.0000	0.0000	371.6530	643.0457	901.0916 (98)
												4730.2438 (98)
										(98) / (4) =		44.4572 (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	1114.5288	877.3950	898.9398	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7518	0.8253	0.7980	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	837.9199	724.1309	717.3230	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1052.1596	1008.7423	955.5455	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	154.2526	211.7509	177.2376	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			543.2411 (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	38.5631	52.9377	44.3094	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												135.8103 (107)
Energy for space heating												1.2764 (108)
Energy for space cooling												44.4572 (99)
Total												1.2764 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.7336 (109)
												45.7 (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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3954 (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	0.4572	0.4481	0.4024	0.3932	0.3475	0.3475	0.3383	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6087	0.6045	0.6004	0.5809	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148		(27)
GF B&B J150 P/A=0.40			53.2000	0.1300	6.9160		(28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.1800	15.9462		(29a)
Plane Ceiling	53.2000		53.2000	0.1300	6.9160		(30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.9030		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8928 (36)
Total fabric heat loss						(33) + (36) =	63.7958 (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	55.2526	54.8693	54.4936	52.7290	52.3989	50.8620	50.8620	50.5774	51.4540	52.3989	53.0668	53.7650 (38)
Heat transfer coeff	119.0484	118.6651	118.2894	116.5248	116.1947	114.6578	114.6578	114.3731	115.2498	116.1947	116.8626	117.5608 (39)
Average = Sum(39)m / 12 =												116.5232 (39)
HLP	1.1189	1.1153	1.1117	1.0952	1.0921	1.0776	1.0776	1.0749	1.0832	1.0921	1.0983	1.1049 (40)
HLP (average)												1.0951 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)
Energy content (annual)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.8363	30.4681	31.4403	27.4104	26.3010	22.6957	21.0309	24.1333	24.4215	28.4609	31.0673	33.7371 (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	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	139.5701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8619	22.9703	18.6807	14.1425	10.5717	8.9251	9.6438	12.5354	16.8250	21.3632	24.9340	26.5807	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	266.2787	269.0418	262.0788	247.2553	228.5434	210.9568	199.2079	196.4447	203.4078	218.2312	236.9431	254.5297	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	36.9570	(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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	(71)
Water heating gains (Table 5)	46.8230	45.3394	42.2585	38.0700	35.3507	31.5218	28.2674	32.4372	33.9188	38.2539	43.1491	45.3456	(72)
Total internal gains	403.8345	402.2225	387.8890	364.3389	339.3368	316.2747	301.9901	306.2884	319.0226	342.7194	369.8973	391.3270	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.4400	10.6334	0.6300	0.7000	0.7700	17.6784 (74)			
South				5.5700	46.7521	0.6300	0.7000	0.7700	79.5844 (78)			
West				2.8800	19.6403	0.6300	0.7000	0.7700	17.2867 (80)			
Solar gains	114.5494	197.9394	279.1270	361.0815	419.2987	423.0573	405.0275	360.3877	307.2297	220.9243	137.6976	97.7215 (83)
Total gains	518.3840	600.1619	667.0159	725.4203	758.6355	739.3320	707.0176	666.6761	626.2523	563.6437	507.5949	489.0485 (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	62.0663	62.2667	62.4645	63.4104	63.5906	64.4430	64.4430	64.6034	64.1120	63.5906	63.2272	62.8516	
alpha	5.1378	5.1511	5.1643	5.2274	5.2394	5.2962	5.2962	5.3069	5.2741	5.2394	5.2151	5.1901	
util living area	0.9993	0.9982	0.9953	0.9847	0.9475	0.8380	0.6747	0.7281	0.9224	0.9901	0.9984	0.9995	(86)
MIT	19.6950	19.8351	20.0655	20.3798	20.6773	20.8978	20.9754	20.9636	20.8056	20.4198	20.0042	19.6773	(87)
Th 2	19.9854	19.9884	19.9913	20.0048	20.0073	20.0192	20.0192	20.0214	20.0146	20.0073	20.0022	19.9968	(88)
util rest of house	0.9990	0.9976	0.9935	0.9781	0.9221	0.7601	0.5433	0.6015	0.8740	0.9847	0.9977	0.9993	(89)
MIT 2	18.7875	18.9298	19.1618	19.4837	19.7703	19.9661	20.0121	20.0095	19.8946	19.5273	19.1099	18.7790	(90)
Living area fraction	18.9636	19.1055	19.3372	19.6576	19.9463	20.1469	20.1991	20.1947	20.0714	19.7005	19.2835	18.9533	(91)
MIT	18.9636	19.1055	19.3372	19.6576	19.9463	20.1469	20.1991	20.1947	20.0714	19.7005	19.2835	18.9533	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9636	19.1055	19.3372	19.6576	19.9463	20.1469	20.1991	20.1947	20.0714	19.7005	19.2835	18.9533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	517.6717	598.2671	661.6390	707.3029	698.0375	570.6077	402.3935	417.3760	549.5149	553.7058	506.0857	488.5563	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1745.6833	1685.6945	1518.5042	1253.5281	958.1743	635.9959	412.6615	434.0113	688.2009	1057.4341	1423.7940	1734.4134	(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	913.6406	730.7512	637.5077	393.2821	193.5418	0.0000	0.0000	0.0000	0.0000	374.7739	660.7500	926.9177	(98)
Space heating												4831.1650	(98)
Space heating per m2												45.4057	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1077.7829	848.4674	869.2359	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7955	0.8785	0.8506	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	857.3771	745.3372	739.3320	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	973.5457	933.4788	888.5771	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	83.6414	139.9773	111.0384	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												334.6571 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	20.9103	34.9943	27.7596	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												83.6643 (107)
Space cooling per m2												0.7863 (108)
Energy for space heating												45.4057 (99)
Energy for space cooling												0.7863 (108)
Total												46.1920 (109)
Target Fabric Energy Efficiency (TFEE)												53.1 (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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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)	=	0.3326 (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	0.3492	0.3326	0.3326	0.3077	0.3077	0.2744	0.2827	0.2661	0.2744	0.2910	0.2910	0.3160 (22b)
Effective ac	0.5610	0.5553	0.5553	0.5473	0.5473	0.5376	0.5400	0.5354	0.5376	0.5423	0.5423	0.5499 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.9173	50.4027	50.4027	49.6779	49.6779	48.7993	49.0096	48.5954	48.7993	49.2261	49.2261	49.9132 (38)
Heat transfer coeff	118.6084	118.0938	118.0938	117.3689	117.3689	116.4904	116.7006	116.2864	116.4904	116.9171	116.9171	117.6043 (39)
Average = Sum(39)m / 12 =												117.2450 (39)
HLP	1.1147	1.1099	1.1099	1.1031	1.1031	1.0948	1.0968	1.0929	1.0948	1.0988	1.0988	1.1053 (40)
HLP (average)												1.1019 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	1581.1899 (45)
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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (64)
RHI water heating demand	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (65)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =												1747 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6547	57.4257	46.7017	35.3562	26.4292	22.3126	24.1096	31.3386	42.0626	53.4081	62.3351	66.4517 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	397.4308	401.5549	391.1623	369.0378	341.1095	314.8609	297.3252	293.2011	303.5937	325.7182	353.6465	379.8951 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398 (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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560 (71)
Water heating gains (Table 5)	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030 (72)
Total internal gains	653.4723	648.0418	622.0958	582.0586	540.9369	504.5668	483.7274	493.3712	516.8138	557.0808	601.6094	635.4176 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g	FF		Access	Gains	
				m2	Table 6a		Specific data	Specific data		factor	W	
					W/m2		or Table 6b	or Table 6c		Table 6d		
North				5.4400	11.9814		0.4600		0.0000	0.7700	23.0864 (74)	
South				5.5700	50.9848		0.4600		0.0000	0.7700	100.5877 (78)	
West				2.8800	22.3313		0.4600		0.0000	0.7700	22.7801 (80)	
Solar gains	146.4541	227.9794	318.7394	427.5459	486.1191	525.9512	497.6705	451.0594	381.1558	271.9707	180.3968	123.7173 (83)
Total gains	799.9264	876.0212	940.8352	1009.6045	1027.0560	1030.5179	981.3979	944.4306	897.9695	829.0514	782.0062	759.1349 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	36.5412	36.7004	36.7004	36.9271	36.9271	37.2056	37.1386	37.2708	37.2056	37.0698	37.0698	36.8532
alpha	3.4361	3.4467	3.4467	3.4618	3.4618	3.4804	3.4759	3.4847	3.4804	3.4713	3.4713	3.4569
util living area	0.9691	0.9565	0.9277	0.8630	0.7399	0.5286	0.3613	0.3846	0.6563	0.8711	0.9490	0.9732 (86)
MIT	19.5296	19.7000	20.0280	20.4269	20.7622	20.9498	20.9904	20.9881	20.8852	20.4990	19.9659	19.4987 (87)
Th 2	19.9888	19.9928	19.9928	19.9983	19.9983	20.0051	20.0034	20.0066	20.0051	20.0018	20.0018	19.9965 (88)
util rest of house	0.9629	0.9479	0.9128	0.8336	0.6827	0.4366	0.2486	0.2696	0.5718	0.8371	0.9372	0.9678 (89)
MIT 2	18.0582	18.3050	18.7728	19.3299	19.7644	19.9726	20.0005	20.0027	19.9149	19.4403	18.6964	18.0190 (90)
Living area fraction	18.3438	18.5757	19.0164	19.5428	19.9580	20.1622	20.1926	20.1940	fLA = Living area / (4) =			0.1941 (91)
MIT	18.1938	18.4257	18.8664	19.3928	19.8080	20.0122	20.0426	20.0440	20.1032	19.6458	18.9428	18.3062 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1938	18.4257	18.8664	19.3928	19.8080	20.0122	20.0426	20.0440	19.9532	19.4958	18.7928	18.1562 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9476	0.9300	0.8915	0.8125	0.6705	0.4373	0.2531	0.2740	0.5670	0.8161	0.9181	0.9537 (94)
Ext temp.	758.0277	814.6921	838.7666	820.2621	688.6357	450.6014	248.4370	258.8010	509.1409	676.5977	717.9802	723.9933 (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	1553.0309	1514.6378	1354.1140	1114.1596	799.0529	467.3853	250.0483	260.9430	553.7003	923.1546	1261.8635	1535.4641 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	591.4824	470.3635	383.4185	211.6062	82.1504	0.0000	0.0000	0.0000	0.0000	183.4383	391.5960	603.7342 (98)
RHI space heating demand												2917.7896 (98)
												2918 (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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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) =	0.3326 (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	0.4241	0.4158	0.4074	0.3659	0.3576	0.3160	0.3160	0.3077	0.3326	0.3576	0.3742	0.3908 (22b)
Effective ac	0.5899	0.5864	0.5830	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5700	0.5764 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.5437	53.2268	52.9161	51.4570	51.1840	49.9132	49.9132	49.6779	50.4027	51.1840	51.7363	52.3137 (38)
Heat transfer coeff	121.2347	120.9178	120.6071	119.1481	118.8751	117.6043	117.6043	117.3689	118.0938	118.8751	119.4273	120.0047 (39)
Average = Sum(39)m / 12 =												119.1468 (39)
HLP	1.1394	1.1364	1.1335	1.1198	1.1172	1.1053	1.1053	1.1031	1.1099	1.1172	1.1224	1.1279 (40)
HLP (average)												1.1198 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Energy content (annual)	Total = Sum (45)m =											1581.1899 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	23.8144 (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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (64)
Heat gains from water heating, kWh/month	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (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	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6547	57.4257	46.7017	35.3562	26.4292	22.3126	24.1096	31.3386	42.0626	53.4081	62.3351	66.4517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	397.4308	401.5549	391.1623	369.0378	341.1095	314.8609	297.3252	293.2011	303.5937	325.7182	353.6465	379.8951	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	(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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	(71)
Water heating gains (Table 5)	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030	(72)
Total internal gains	653.4723	648.0418	622.0958	582.0586	540.9369	504.5668	483.7274	493.3712	516.8138	557.0808	601.6094	635.4176	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			5.4400	10.6334	0.4600	0.0000	0.7700	20.4889 (74)				
South			5.5700	46.7521	0.4600	0.0000	0.7700	92.2369 (78)				
West			2.8800	19.6403	0.4600	0.0000	0.7700	20.0350 (80)				
Solar gains	132.7608	229.4082	323.5032	418.4870	485.9597	490.3158	469.4197	417.6829	356.0738	256.0474	159.5891	113.2575 (83)
Total gains	786.2330	877.4500	945.5990	1000.5456	1026.8966	994.8825	953.1471	911.0542	872.8875	813.1281	761.1985	748.6751 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.7496	35.8433	35.9356	36.3757	36.4592	36.8532	36.8532	36.9271	36.7004	36.4592	36.2906	36.1160
alpha	3.3833	3.3896	3.3957	3.4250	3.4306	3.4569	3.4569	3.4618	3.4467	3.4306	3.4194	3.4077
util living area	0.9747	0.9620	0.9390	0.8907	0.8020	0.6579	0.5107	0.5489	0.7477	0.9036	0.9611	0.9782 (86)
MIT	19.3454	19.5488	19.8661	20.2722	20.6269	20.8697	20.9593	20.9471	20.7850	20.3365	19.7735	19.3066 (87)
Th 2	19.9688	19.9712	19.9735	19.9847	19.9868	19.9965	19.9965	19.9983	19.9928	19.9868	19.9826	19.9781 (88)
util rest of house	0.9697	0.9546	0.9267	0.8676	0.7579	0.5815	0.4068	0.4456	0.6806	0.8785	0.9523	0.9740 (89)
MIT 2	17.7786	18.0731	18.5293	19.1082	19.5861	19.8874	19.9737	19.9665	19.7952	19.2088	18.4083	17.7287 (90)
Living area fraction	fLA = Living area / (4) =											0.1941 (91)
MIT	18.0827	18.3595	18.7887	19.3341	19.7881	20.0780	20.1650	20.1568	19.9873	19.4276	18.6732	18.0350 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9327	18.2095	18.6387	19.1841	19.6381	19.9280	20.0150	20.0068	19.8373	19.2776	18.5232	17.8850 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9558	0.9374	0.9060	0.8452	0.7405	0.5758	0.4088	0.4465	0.6689	0.8563	0.9349	0.9614 (94)
Useful gains	751.5166	822.5556	856.6899	845.7080	760.4333	572.8321	389.6510	406.8305	583.8417	696.3012	711.6786	719.7497 (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	1652.7541	1609.3520	1464.0157	1225.3287	943.6470	626.5965	401.6190	423.3288	677.5370	1031.5554	1364.2452	1642.2595 (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	670.5207	528.7272	451.8504	273.3269	136.3109	0.0000	0.0000	0.0000	0.0000	249.4292	469.8480	686.3472 (98)
Space heating												3466.3606 (98)
Space heating per m2										(98) / (4) =		32.5786 (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												3830.2327 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	670.5207	528.7272	451.8504	273.3269	136.3109	0.0000	0.0000	0.0000	0.0000	249.4292	469.8480	686.3472 (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)	740.9069	584.2290	499.2822	302.0187	150.6198	0.0000	0.0000	0.0000	0.0000	275.6124	519.1690	758.3947 (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	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (64)
Efficiency of water heater	89.8092	89.7499	89.6327	89.3767	88.8625	87.3000	87.3000	87.3000	87.3000	89.2812	89.6656	87.3000 (216)
Fuel for water heating, kWh/month	198.2933	173.9817	180.8113	159.5582	155.0782	137.8557	129.3705	146.1426	147.2042	165.7815	178.2878	192.4594 (219)
Water heating fuel used												1964.8244 (219)
Annual totals kWh/year												
Space heating fuel - main system												3830.2327 (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)												456.7289 (232)
Total delivered energy for all uses												6326.7860 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3830.2327	3.4800	133.2921 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.8244	3.4800	68.3759 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	456.7289	13.1900	60.2425 (250)
Additional standing charges			120.0000 (251)
Total energy cost			391.8030 (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] =	1.0869 (257)
SAP value		84.8377
SAP rating (Section 12)		85 (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	3830.2327	0.2160	827.3303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.8244	0.2160	424.4021 (264)
Space and water heating			1251.7323 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7289	0.5190	237.0423 (268)
Total kg/year			1527.6996 (272)
CO2 emissions per m2			14.3600 (273)
EI value			86.4787
EI rating			86 (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	$3.48 / 0.8878 = 3.920$, stars = 4
Water heating environmental impact	$0.216 / 0.8878 = 0.2433$, 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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 275.0440 (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					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) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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) =	0.3326 (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	0.3492	0.3326	0.3326	0.3077	0.3077	0.2744	0.2827	0.2661	0.2744	0.2910	0.2910	0.3160 (22b)
Effective ac	0.5610	0.5553	0.5553	0.5473	0.5473	0.5376	0.5400	0.5354	0.5376	0.5423	0.5423	0.5499 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.9173	50.4027	50.4027	49.6779	49.6779	48.7993	49.0096	48.5954	48.7993	49.2261	49.2261	49.9132 (38)
Heat transfer coeff	118.6084	118.0938	118.0938	117.3689	117.3689	116.4904	116.7006	116.2864	116.4904	116.9171	116.9171	117.6043 (39)
Average = Sum(39)m / 12 =												117.2450 (39)
HLP	1.1147	1.1099	1.1099	1.1031	1.1031	1.0948	1.0968	1.0929	1.0948	1.0988	1.0988	1.1053 (40)
HLP (average)												1.1019 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Energy content (annual)										Total = Sum (45)m =		1581.1899 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	23.8144 (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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month												
	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (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												
	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum(64)m =				1746.8695 (64)
	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (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	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.6547	57.4257	46.7017	35.3562	26.4292	22.3126	24.1096	31.3386	42.0626	53.4081	62.3351	66.4517 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	397.4308	401.5549	391.1623	369.0378	341.1095	314.8609	297.3252	293.2011	303.5937	325.7182	353.6465	379.8951 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398 (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)												
	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560 (71)
Water heating gains (Table 5)												
	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030 (72)
Total internal gains												
	653.4723	648.0418	622.0958	582.0586	540.9369	504.5668	483.7274	493.3712	516.8138	557.0808	601.6094	635.4176 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				5.4400	11.9814		0.4600	0.0000		0.7700	23.0864 (74)	
South				5.5700	50.9848		0.4600	0.0000		0.7700	100.5877 (78)	
West				2.8800	22.3313		0.4600	0.0000		0.7700	22.7801 (80)	
Solar gains	146.4541	227.9794	318.7394	427.5459	486.1191	525.9512	497.6705	451.0594	381.1558	271.9707	180.3968	123.7173 (83)
Total gains	799.9264	876.0212	940.8352	1009.6045	1027.0560	1030.5179	981.3979	944.4306	897.9695	829.0514	782.0062	759.1349 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.5412	36.7004	36.7004	36.9271	36.9271	37.2056	37.1386	37.2708	37.2056	37.0698	37.0698	36.8532
alpha	3.4361	3.4467	3.4467	3.4618	3.4618	3.4804	3.4759	3.4847	3.4804	3.4713	3.4713	3.4569
util living area												
	0.9691	0.9565	0.9277	0.8630	0.7399	0.5286	0.3613	0.3846	0.6563	0.8711	0.9490	0.9732 (86)
MIT	19.5296	19.7000	20.0280	20.4269	20.7622	20.9498	20.9904	20.9881	20.8852	20.4990	19.9659	19.4987 (87)
Th 2	19.9888	19.9928	19.9928	19.9983	19.9983	20.0051	20.0034	20.0066	20.0051	20.0018	20.0018	19.9965 (88)
util rest of house												
	0.9629	0.9479	0.9128	0.8336	0.6827	0.4366	0.2486	0.2696	0.5718	0.8371	0.9372	0.9678 (89)
MIT 2	18.0582	18.3050	18.7728	19.3299	19.7644	19.9726	20.0005	20.0027	19.9149	19.4403	18.6964	18.0190 (90)
Living area fraction									fLA = Living area / (4) =			0.1941 (91)
MIT	18.3438	18.5757	19.0164	19.5428	19.9580	20.1622	20.1926	20.1940	20.1032	19.6458	18.9428	18.3062 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1938	18.4257	18.8664	19.3928	19.8080	20.0122	20.0426	20.0440	19.9532	19.4958	18.7928	18.1562 (93)

8. Space heating requirement

Utilisation	0.9476	0.9300	0.8915	0.8125	0.6705	0.4373	0.2531	0.2740	0.5670	0.8161	0.9181	0.9537 (94)
Useful gains	758.0277	814.6921	838.7666	820.2621	688.6357	450.6014	248.4370	258.8010	509.1409	676.5977	717.9802	723.9933 (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												
	1553.0309	1514.6378	1354.1140	1114.1596	799.0529	467.3853	250.0483	260.9430	553.7003	923.1546	1261.8635	1535.4641 (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												
	591.4824	470.3635	383.4185	211.6062	82.1504	0.0000	0.0000	0.0000	0.0000	183.4383	391.5960	603.7342 (98)
Space heating												2917.7896 (98)
Space heating per m2										(98) / (4) =		27.4228 (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													3224.0769 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	591.4824	470.3635	383.4185	211.6062	82.1504	0.0000	0.0000	0.0000	0.0000	183.4383	391.5960	603.7342	(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)	653.5717	519.7387	423.6669	233.8191	90.7739	0.0000	0.0000	0.0000	0.0000	202.6943	432.7027	667.1096	(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	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004	(64)
Efficiency of water heater (217)m	89.7388	89.6807	89.5250	89.1839	88.4683	87.3000	87.3000	87.3000	87.3000	89.0425	89.5485	87.3000	(216)
Fuel for water heating, kWh/month	198.4488	174.1160	181.0287	159.9032	155.7691	137.8557	129.3705	146.1426	147.2042	166.2260	178.5211	192.6093	(219)
Water heating fuel used												1967.1952	(219)
Annual totals kWh/year													
Space heating fuel - main system												3224.0769	(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)												456.7289	(232)
Total delivered energy for all uses												5723.0010	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3224.0769	9.7400	314.0251 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1967.1952	9.7400	191.6048 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	456.7289	36.8500	168.3046 (250)
Additional standing charges			104.0000 (251)
Total energy cost			805.5720 (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	3224.0769	0.2160	696.4006 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.1952	0.2160	424.9142 (264)
Space and water heating			1121.3148 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7289	0.5190	237.0423 (268)
Total kg/year			1397.2821 (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	3224.0769	1.2200	3933.3738 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.1952	1.2200	2399.9781 (264)
Space and water heating			6333.3519 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	456.7289	3.0700	1402.1578 (268)
Primary energy kWh/year			7965.7597 (272)
Primary energy kWh/m2/year			74.8662 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 79	-191 kg (13.7%)
U Solar photovoltaic panels	+ 8.8	-£ 672	-947 kg (78.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	1.79 kg/m²	B 86 B 88
Solar photovoltaic panels	£672	8.90 kg/m²	A 95 A 96
Total Savings	£752	10.69 kg/m²	

Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£196	£214	-£18
Mains gas	£610	£512	£98
Space heating	£446	£446	£0
Water heating	£192	£112	£79
Lighting	£168	£168	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£806	£54	£752
Total cost of uses	£806	£54	£751
Delivered energy	54 kWh/m²	28 kWh/m²	26 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	2 kg/m²	11 kg/m²
Primary energy	75 kWh/m²	12 kWh/m²	63 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	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (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) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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) =	0.3326 (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	0.4241	0.4158	0.4074	0.3659	0.3576	0.3160	0.3160	0.3077	0.3326	0.3576	0.3742	0.3908 (22b)
Effective ac	0.5899	0.5864	0.5830	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5700	0.5764 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.5437	53.2268	52.9161	51.4570	51.1840	49.9132	49.9132	49.6779	50.4027	51.1840	51.7363	52.3137 (38)
Heat transfer coeff	121.2347	120.9178	120.6071	119.1481	118.8751	117.6043	117.6043	117.3689	118.0938	118.8751	119.4273	120.0047 (39)
Average = Sum(39)m / 12 =												119.1468 (39)
HLP	1.1394	1.1364	1.1335	1.1198	1.1172	1.1053	1.1053	1.1031	1.1099	1.1172	1.1224	1.1279 (40)
HLP (average)												1.1198 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	1581.1899 (45)
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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (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												1.1470 (H8)
Utilisation factor												0.5818 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.4958 (H14)
Volume ratio Veff/V												0.7463 (H15)
Solar storage volume factor												0.9415 (H16)
Solar input												-873.5247 (H17)
Solar input	-25.3305	-42.2693	-71.9894	-96.4800	-119.1929	-117.1856	-115.6370	-101.0326	-79.1288	-54.0357	-30.0456	-21.1973 (63)
Solar input (sum of months) = Sum (63)m =												-873.5247 (63)
Output from w/h	152.7551	113.8792	90.0766	46.1279	18.6134	3.1624	0.0000	26.5498	49.3804	93.9761	129.8173	151.7031 (64)
Total per year (kWh/year) = Sum (64)m =												876.0414 (64)
Heat gains from water heating, kWh/month	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (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	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6547	57.4257	46.7017	35.3562	26.4292	22.3126	24.1096	31.3386	42.0626	53.4081	62.3351	66.4517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	397.4308	401.5549	391.1623	369.0378	341.1095	314.8609	297.3252	293.2011	303.5937	325.7182	353.6465	379.8951	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	(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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	(71)
Water heating gains (Table 5)	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030	(72)
Total internal gains	653.4723	648.0418	622.0958	582.0586	540.9369	504.5668	483.7274	493.3712	516.8138	557.0808	601.6094	635.4176	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.4400	10.6334	0.4600	0.0000	0.7700	20.4889 (74)			
South				5.5700	46.7521	0.4600	0.0000	0.7700	92.2369 (78)			
West				2.8800	19.6403	0.4600	0.0000	0.7700	20.0350 (80)			
Solar gains	132.7608	229.4082	323.5032	418.4870	485.9597	490.3158	469.4197	417.6829	356.0738	256.0474	159.5891	113.2575 (83)
Total gains	786.2330	877.4500	945.5990	1000.5456	1026.8966	994.8825	953.1471	911.0542	872.8875	813.1281	761.1985	748.6751 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.7496	35.8433	35.9356	36.3757	36.4592	36.8532	36.8532	36.9271	36.7004	36.4592	36.2906	36.1160
alpha	3.3833	3.3896	3.3957	3.4250	3.4306	3.4569	3.4569	3.4618	3.4467	3.4306	3.4194	3.4077
util living area	0.9747	0.9620	0.9390	0.8907	0.8020	0.6579	0.5107	0.5489	0.7477	0.9036	0.9611	0.9782 (86)
MIT	19.3454	19.5488	19.8661	20.2722	20.6269	20.8697	20.9593	20.9471	20.7850	20.3365	19.7735	19.3066 (87)
Th 2	19.9688	19.9712	19.9735	19.9847	19.9868	19.9965	19.9965	19.9983	19.9928	19.9868	19.9826	19.9781 (88)
util rest of house	0.9697	0.9546	0.9267	0.8676	0.7579	0.5815	0.4068	0.4456	0.6806	0.8785	0.9523	0.9740 (89)
MIT 2	17.7786	18.0731	18.5293	19.1082	19.5861	19.8874	19.9737	19.9665	19.7952	19.2088	18.4083	17.7287 (90)
Living area fraction									fLA = Living area / (4) =			0.1941 (91)
MIT	18.0827	18.3595	18.7887	19.3341	19.7881	20.0780	20.1650	20.1568	19.9873	19.4276	18.6732	18.0350 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9327	18.2095	18.6387	19.1841	19.6381	19.9280	20.0150	20.0068	19.8373	19.2776	18.5232	17.8850 (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	0.9558	0.9374	0.9060	0.8452	0.7405	0.5758	0.4088	0.4465	0.6689	0.8563	0.9349	0.9614	(94)
Useful gains	751.5166	822.5556	856.6899	845.7080	760.4333	572.8321	389.6510	406.8305	583.8417	696.3012	711.6786	719.7497	(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	1652.7541	1609.3520	1464.0157	1225.3287	943.6470	626.5965	401.6190	423.3288	677.5370	1031.5554	1364.2452	1642.2595	(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	670.5207	528.7272	451.8504	273.3269	136.3109	0.0000	0.0000	0.0000	0.0000	249.4292	469.8480	686.3472	(98)
Space heating												3466.3606	(98)
Space heating per m2												32.5786	(99)

(98) / (4) =

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													3830.2327 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	670.5207	528.7272	451.8504	273.3269	136.3109	0.0000	0.0000	0.0000	0.0000	249.4292	469.8480	686.3472	(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)	740.9069	584.2290	499.2822	302.0187	150.6198	0.0000	0.0000	0.0000	0.0000	275.6124	519.1690	758.3947	(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	152.7551	113.8792	90.0766	46.1279	18.6134	3.1624	0.0000	26.5498	49.3804	93.9761	129.8173	151.7031	(64)
Efficiency of water heater	89.8886	89.9159	89.9520	90.0235	90.1032	87.3000	87.3000	87.3000	87.3000	89.6012	89.7875	87.3000	(216)
(217)m	89.8886	89.9159	89.9520	90.0235	90.1032	87.3000	87.3000	87.3000	87.3000	89.6012	89.7875	89.9035	(217)
Fuel for water heating, kWh/month	169.9381	126.6508	100.1386	51.2398	20.6579	3.6224	0.0000	30.4122	56.5641	104.8826	144.5828	168.7400	(219)
Water heating fuel used												977.4293	(219)
Annual totals kWh/year													
Space heating fuel - main system												3830.2327	(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)												456.7289	(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												3662.1515	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3830.2327	3.4800	133.2921 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	977.4293	3.4800	34.0145 (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	456.7289	13.1900	60.2425 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			136.2138 (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] =	0.3779 (257)
SAP value			94.7287
SAP rating (Section 12)			95 (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	3830.2327	0.2160	827.3303	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	977.4293	0.2160	211.1247	(264)
Space and water heating			1038.4550	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	456.7289	0.5190	237.0423	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			443.9351	(272)
CO2 emissions per m2			4.1700	(273)
EI value			96.0709	
EI rating			96	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2000 (1b)	x 2.5400 (2b)	= 135.1280 (1b) - (3b)
First floor	53.2000 (1c)	x 2.6300 (2c)	= 139.9160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 275.0440 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1091 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3596 (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) =	0.3326 (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	0.3492	0.3326	0.3326	0.3077	0.3077	0.2744	0.2827	0.2661	0.2744	0.2910	0.2910	0.3160 (22b)
Effective ac	0.5610	0.5553	0.5553	0.5473	0.5473	0.5376	0.5400	0.5354	0.5376	0.5423	0.5423	0.5499 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1500	1.4000	3.0100		(26a)
Window (Uw = 1.30)			13.8900	1.2357	17.1644		(27)
GF B&B J150 P/A=0.40			53.2000	0.1200	6.3840	75.0000	3990.0000 (28a)
EW Brick AAC015	106.7600	18.1700	88.5900	0.2500	22.1475	52.3000	4633.2570 (29a)
Plane Ceiling	53.2000		53.2000	0.1600	8.5120	9.0000	478.8000 (30)
Total net area of external elements Aum(A, m ²)			213.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.9869		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			78.0000			9.0000	702.0000 (32c)
1F Timber			113.0000			9.0000	1017.0000 (32c)
GF Masonry			27.6800			39.0000	1079.5200 (32c)
Internal Floor			53.2000			18.0000	957.6000 (32d)
Internal Ceiling			53.2000			9.0000	478.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15602.7270 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.6422 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7041 (36)
Total fabric heat loss						(33) + (36) =	67.6910 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.9173	50.4027	50.4027	49.6779	49.6779	48.7993	49.0096	48.5954	48.7993	49.2261	49.2261	49.9132 (38)
Heat transfer coeff	118.6084	118.0938	118.0938	117.3689	117.3689	116.4904	116.7006	116.2864	116.4904	116.9171	116.9171	117.6043 (39)
Average = Sum(39)m / 12 =												117.2450 (39)
HLP	1.1147	1.1099	1.1099	1.1031	1.1031	1.0948	1.0968	1.0929	1.0948	1.0988	1.0988	1.1053 (40)
HLP (average)												1.1019 (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												2.7914 (42)
Average daily hot water use (litres/day)												100.4958 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.5454	106.5255	102.5057	98.4859	94.4660	90.4462	90.4462	94.4660	98.4859	102.5057	106.5255	110.5454 (44)

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)	163.9356	143.3791	147.9544	128.9902	123.7692	106.8034	98.9690	113.5684	114.9248	133.9338	146.1992	158.7628 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5903	21.5069	22.1932	19.3485	18.5654	16.0205	14.8454	17.0353	17.2387	20.0901	21.9299	1581.1899 (45)
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	14.1500	12.7694	14.1117	13.6177	14.0372	13.5446	13.9714	14.0140	13.5844	14.0780	13.6637	14.1376 (61)
Total heat required for water heating calculated for each month	178.0856	156.1485	162.0660	142.6079	137.8063	120.3480	112.9404	127.5825	128.5092	148.0118	159.8629	172.9004 (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												1.2113 (H8)
Utilisation factor												0.5620 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.4958 (H14)
Volume ratio Veff/V												0.7463 (H15)
Solar storage volume factor												0.9415 (H16)
Solar input												-891.1033 (H17)
Solar input	-27.4277	-41.2238	-69.4261	-95.9681	-115.5779	-121.6407	-118.7199	-106.0176	-82.7471	-56.2913	-33.3391	-22.7240 (63)
Solar input (sum of months) = Sum (63)m =												-891.1033 (63)
Output from w/h	150.6579	114.9247	92.6399	46.6398	22.2285	0.0000	0.0000	21.5649	45.7622	91.7205	126.5237	150.1764 (64)
Total per year (kWh/year) = Sum (64)m =												862.8384 (64)
Heat gains from water heating, kWh/month	58.0461	50.8659	52.7227	46.2937	44.6625	38.8983	36.4001	41.2650	41.6086	48.0525	52.0271	56.3230 (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	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	167.4841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6547	57.4257	46.7017	35.3562	26.4292	22.3126	24.1096	31.3386	42.0626	53.4081	62.3351	66.4517	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	397.4308	401.5549	391.1623	369.0378	341.1095	314.8609	297.3252	293.2011	303.5937	325.7182	353.6465	379.8951	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	54.5398	(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)	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	-111.6560	(71)
Water heating gains (Table 5)	78.0189	75.6933	70.8639	64.2968	60.0303	54.0254	48.9248	55.4637	57.7897	64.5867	72.2599	75.7030	(72)
Total internal gains	653.4723	648.0418	622.0958	582.0586	540.9369	504.5668	483.7274	493.3712	516.8138	557.0808	601.6094	635.4176	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				5.4400	11.9814		0.4600	0.0000		0.7700	23.0864 (74)	
South				5.5700	50.9848		0.4600	0.0000		0.7700	100.5877 (78)	
West				2.8800	22.3313		0.4600	0.0000		0.7700	22.7801 (80)	
Solar gains	146.4541	227.9794	318.7394	427.5459	486.1191	525.9512	497.6705	451.0594	381.1558	271.9707	180.3968	123.7173 (83)
Total gains	799.9264	876.0212	940.8352	1009.6045	1027.0560	1030.5179	981.3979	944.4306	897.9695	829.0514	782.0062	759.1349 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.5412	36.7004	36.7004	36.9271	36.9271	37.2056	37.1386	37.2708	37.2056	37.0698	37.0698	36.8532
alpha	3.4361	3.4467	3.4467	3.4618	3.4618	3.4804	3.4759	3.4847	3.4804	3.4713	3.4713	3.4569
util living area	0.9691	0.9565	0.9277	0.8630	0.7399	0.5286	0.3613	0.3846	0.6563	0.8711	0.9490	0.9732 (86)
MIT	19.5296	19.7000	20.0280	20.4269	20.7622	20.9498	20.9904	20.9881	20.8852	20.4990	19.9659	19.4987 (87)
Th 2	19.9888	19.9928	19.9928	19.9983	19.9983	20.0051	20.0034	20.0066	20.0051	20.0018	20.0018	19.9965 (88)
util rest of house	0.9629	0.9479	0.9128	0.8336	0.6827	0.4366	0.2486	0.2696	0.5718	0.8371	0.9372	0.9678 (89)
MIT 2	18.0582	18.3050	18.7728	19.3299	19.7644	19.9726	20.0005	20.0027	19.9149	19.4403	18.6964	18.0190 (90)
Living area fraction									fLA = Living area / (4) =			0.1941 (91)
MIT	18.3438	18.5757	19.0164	19.5428	19.9580	20.1622	20.1926	20.1940	20.1032	19.6458	18.9428	18.3062 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1938	18.4257	18.8664	19.3928	19.8080	20.0122	20.0426	20.0440	19.9532	19.4958	18.7928	18.1562 (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	0.9476	0.9300	0.8915	0.8125	0.6705	0.4373	0.2531	0.2740	0.5670	0.8161	0.9181	0.9537	(94)
Useful gains	758.0277	814.6921	838.7666	820.2621	688.6357	450.6014	248.4370	258.8010	509.1409	676.5977	717.9802	723.9933	(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	1553.0309	1514.6378	1354.1140	1114.1596	799.0529	467.3853	250.0483	260.9430	553.7003	923.1546	1261.8635	1535.4641	(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	591.4824	470.3635	383.4185	211.6062	82.1504	0.0000	0.0000	0.0000	0.0000	183.4383	391.5960	603.7342	(98)
Space heating												2917.7896	(98)
Space heating per m2											(98) / (4) =	27.4228	(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													3224.0769 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	591.4824	470.3635	383.4185	211.6062	82.1504	0.0000	0.0000	0.0000	0.0000	183.4383	391.5960	603.7342	(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)	653.5717	519.7387	423.6669	233.8191	90.7739	0.0000	0.0000	0.0000	0.0000	202.6943	432.7027	667.1096	(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	150.6579	114.9247	92.6399	46.6398	22.2285	0.0000	0.0000	21.5649	45.7622	91.7205	126.5237	150.1764	(64)
Efficiency of water heater	89.8315	89.8533	89.8590	89.9048	89.7990	87.3000	87.3000	87.3000	87.3000	89.4076	89.6971	87.3000	(216)
(217)m	89.8315	89.8533	89.8590	89.9048	89.7990	87.3000	87.3000	87.3000	87.3000	89.4076	89.6971	89.8440	(217)
Fuel for water heating, kWh/month	167.7115	127.9026	103.0947	51.8768	24.7536	0.0000	0.0000	24.7021	52.4194	102.5869	141.0567	167.1524	(219)
Water heating fuel used												963.2567	(219)
Annual totals kWh/year													
Space heating fuel - main system												3224.0769	(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)												456.7289	(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												2944.9029	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3224.0769	9.7400	314.0251	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	963.2567	9.7400	93.8212	(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	456.7289	36.8500	168.3046	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			54.0106	(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	3224.0769	0.2160	696.4006	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	963.2567	0.2160	208.0634	(264)
Space and water heating			904.4641	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	456.7289	0.5190	237.0423	(268)
Energy saving/generation technologies				

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PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			259.6425 (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	3224.0769	1.2200	3933.3738 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	963.2567	1.2200	1175.1731 (264)
Space and water heating			5108.5470 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	456.7289	3.0700	1402.1578 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1294.2847 (272)
Primary energy kWh/m2/year			12.1643 (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
Overshading	Average or unknown
Thermal mass parameter	146.6 (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	363.06 (P1)
Transmission heat loss coefficient	67.69 (37)
Summer heat loss coefficient	430.75 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.4400	81.1852	0.4600	0.0000	0.9000	182.8420
South	5.5700	112.2060	0.4600	0.0000	0.9000	258.7448
West	2.8800	117.5071	0.4600	0.0000	0.9000	140.1060
total:						581.6928

	Jun	Jul	Aug	
Solar gains	615	582	527	(P4)
Internal gains	502	481	490	
Total summer gains	1116	1062	1018	(P5)

	2.59	2.47	2.36	
Summer gain/loss ratio				(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 146.6)	0.97	0.97	0.97	
Threshold temperature	19.57	21.34	21.14	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight