

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-570				Issued on Date	22/03/2023
Assessment Reference	Plot 570	Prop Type Ref	Badlesmere-OP-SEMI			
Property	Plot 570, 2 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.13	TER	18.50	
Environmental	87 B	% DER<TER	7.39			
CO ₂ Emissions (t/year)	1.14	DFEE	45.46	TFEE	52.50	
General Requirements Compliance	Pass	% DFEE<TFEE	13.42			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.50 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North East: 5.06 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 7.51 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.037 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
Effective ac	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

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Energy content (annual)												Total = Sum(45)m = 1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)
Total per year (kWh/year) = Sum(64)m =												1622.0849 (64)

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					5.0600	11.2829	0.4600	0.0000	0.7700		20.2219 (75)	
Southeast					0.7200	36.7938	0.4600	0.0000	0.7700		9.3833 (77)	
Southwest					3.0000	36.7938	0.4600	0.0000	0.7700		39.0971 (79)	
Southwest					4.5100	36.7938	0.4600	0.0000	0.7700		58.7760 (79)	
Solar gains	127.4783	223.8596	324.1358	431.5246	510.6391	518.9529	495.3294	434.4709	361.0362	252.2230	153.9129	108.3034 (83)
Total gains	501.7960	596.0450	682.7893	768.3890	825.3948	812.4274	775.0047	720.1572	657.9433	571.1308	498.0725	471.3869 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9855	0.9740	0.9509	0.8979	0.7991	0.6491	0.5059	0.5555	0.7703	0.9269	0.9760	0.9881 (86)
MIT	19.0539	19.3053	19.6926	20.1870	20.5976	20.8620	20.9553	20.9386	20.7405	20.1985	19.5433	19.0198 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9824	0.9685	0.9401	0.8746	0.7522	0.5680	0.3958	0.4449	0.7012	0.9053	0.9700	0.9855 (89)
MIT 2	17.3019	17.6680	18.2272	18.9348	19.4865	19.8143	19.9026	19.8936	19.6841	18.9672	18.0269	17.2608 (90)
Living area fraction	17.6638	18.0062	18.5299	19.1934	19.7160	20.0308	20.1201	20.1095	19.9023	19.2216	18.3402	17.6241 (92)
MIT	17.6638	18.0062	18.5299	19.1934	19.7160	20.0308	20.1201	20.1095	19.9023	19.2216	18.3402	17.6241 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.5138	17.8562	18.3799	19.0434	19.5660	19.8808	19.9701	19.9595	19.7523	19.0716	18.1902	17.4741 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9722	0.9539	0.9202	0.8516	0.7350	0.5642	0.4006	0.4483	0.6887	0.8832	0.9561	0.9767	(94)
Ext temp.	487.8506	568.5514	628.2746	654.3955	606.6454	458.3773	310.4638	322.8400	453.1393	504.4096	476.1904	460.4068	(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	1311.6001	1281.3217	1170.6567	982.5845	759.5146	502.2037	320.4977	337.5504	540.7093	817.9827	1077.8438	1298.8792	(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	612.8696	478.9817	403.5323	236.2961	113.7347	0.0000	0.0000	0.0000	0.0000	233.2984	433.1904	623.8235	(98)
Space heating per m2												3135.7266 (98)	
												39.3047 (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													3464.8913 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.8696	478.9817	403.5323	236.2961	113.7347	0.0000	0.0000	0.0000	0.0000	233.2984	433.1904	623.8235	(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)	677.2040	529.2615	445.8920	261.1007	125.6737	0.0000	0.0000	0.0000	0.0000	257.7882	478.6635	689.3077	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.8012	89.7363	89.6082	89.3241	88.7767	87.3000	87.3000	87.3000	87.3000	89.2867	89.6617	87.3000	(216)
Fuel for water heating, kWh/month	183.9216	161.4077	167.8259	148.2455	144.2176	128.1956	120.4190	135.8687	136.8056	153.9293	165.4366	178.5512	(219)
Water heating fuel used												1824.8242	(219)
Annual totals kWh/year													
Space heating fuel - main system												3464.8913	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.9126	(232)
Total delivered energy for all uses												5721.6282	(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	3464.8913	0.2160	748.4165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.8242	0.2160	394.1620 (264)
Space and water heating			1142.5786 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/year			1366.7412 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1300 (273)

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

DER		17.1300	ZC1
Total Floor Area	TFA	79.7800	
Assumed number of occupants	N	2.4587	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2651	ZC2
CO2 emissions from cooking, equation (L16)		2.2312	ZC3
Total CO2 emissions		35.6263	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.6263	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1455 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3658 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298	(22b)				
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan 101.8528	Feb 98.1491	Mar 94.4454	Apr 90.7416	May 87.0379	Jun 83.3341	Jul 83.3341	Aug 87.0379	Sep 90.7416	Oct 94.4454	Nov 98.1491	Dec 101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)										Total = Sum(45)m =		1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.1755	48.1283	44.7493	44.3536	41.0963	42.4662	44.3536	44.7493	48.1283	48.4023	50.9589 (61)
Solar input	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (64)
	62.9621	55.2187	57.3586	50.7041	49.0056	42.9938	40.9362	45.8806	46.3951	53.0633	56.8894	61.3774 (65)

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

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

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	5.0600				11.2829		0.6300		0.7000		0.7700		17.4480 (75)	
Southeast	0.7200				36.7938		0.6300		0.7000		0.7700		8.0962 (77)	
Southwest	7.5100				36.7938		0.6300		0.7000		0.7700		84.4475 (79)	
Solar gains	109.9916	193.1519	279.6728	372.3307	440.5928	447.7661	427.3832	374.8728	311.5114	217.6246	132.8000	93.4470	(83)	
Total gains	496.6883	577.4054	649.7721	720.0207	765.5497	750.8193	716.6442	670.7669	619.2540	547.9880	489.0334	468.9134	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226	
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482	
util living area	0.9976	0.9946	0.9863	0.9578	0.8778	0.7162	0.5472	0.6020	0.8433	0.9732	0.9950	0.9982	(86)
MIT	19.7307	19.8940	20.1528	20.4915	20.7785	20.9445	20.9884	20.9817	20.8690	20.4959	20.0534	19.7062	(87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420	(88)
util rest of house	0.9968	0.9928	0.9813	0.9417	0.8320	0.6242	0.4255	0.4781	0.7704	0.9599	0.9930	0.9976	(89)
MIT 2	18.2444	18.4844	18.8617	19.3529	19.7344	19.9270	19.9597	19.9586	19.8544	19.3683	18.7275	18.2165	(90)
Living area fraction	18.5514	18.7756	19.1284	19.5881	19.9501	20.1372	20.1722	20.1699	20.0640	19.6013	19.0014	18.5243	(91)
MIT	18.5514	18.7756	19.1284	19.5881	19.9501	20.1372	20.1722	20.1699	20.0640	19.6013	19.0014	18.5243	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5514	18.7756	19.1284	19.5881	19.9501	20.1372	20.1722	20.1699	20.0640	19.6013	19.0014	18.5243	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9953	0.9899	0.9762	0.9348	0.8319	0.6408	0.4507	0.5037	0.7788	0.9539	0.9903	0.9964	(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	1349.1222	1309.5523	1188.2896	991.5654	763.3452	505.9492	326.4037	343.6666	547.5953	832.8467	1107.1433	1340.0354	(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	635.9579	495.9139	412.1841	229.3359	94.1020	0.0000	0.0000	0.0000	0.0000	230.7191	448.4513	649.3737	(98)
Space heating												3196.0378	(98)
Space heating per m2												40.0606	(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												3421.8820 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	635.9579	495.9139	412.1841	229.3359	94.1020	0.0000	0.0000	0.0000	0.0000	230.7191	448.4513	649.3737 (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)	680.8971	530.9570	441.3106	245.5417	100.7516	0.0000	0.0000	0.0000	0.0000	247.0226	480.1406	695.2609 (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	202.0037	177.2803	184.4486	163.5966	158.3904	139.5014	133.6530	148.9918	150.6372	171.5305	183.1054	197.2378 (64)
Efficiency of water heater (217)m	87.7397	87.5017	87.0164	85.9015	83.7889	80.3000	80.3000	80.3000	80.3000	85.7982	87.2194	80.3000 (216)
Fuel for water heating, kWh/month	230.2308	202.6021	211.9699	190.4467	189.0350	173.7253	166.4421	185.5439	187.5930	199.9232	209.9365	224.5768 (219)
Water heating fuel used												2372.0253 (219)
Annual totals kWh/year												
Space heating fuel - main system												3421.8820 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												356.9126 (232)
Total delivered energy for all uses												6225.8200 (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	3421.8820	0.2160	739.1265 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2372.0253	0.2160	512.3575 (264)
Space and water heating			1251.4840 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total CO2, kg/m2/year			1475.6466 (272)
Emissions per m2 for space and water heating			15.6867 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3219 (272b)
Emissions per m2 for pumps and fans			0.4879 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6867 * 1.00) + 2.3219 + 0.4879, rounded to 2 d.p.			18.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	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) = 0.1455 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3960 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3663 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4670	0.4578	0.4487	0.4029	0.3937	0.3480	0.3480	0.3388	0.3663	0.3937	0.4121	0.4304 (22b)
Effective ac	0.6090	0.6048	0.6007	0.5812	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2200	1.2164	1.2128	1.1962	1.1931	1.1786	1.1786	1.1759	1.1842	1.1931	1.1994	1.2060 (40)
HLP (average)												1.1962 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1456.8563 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.0970	28.0723	28.9681	25.2551	24.2328	20.9111	19.3772	22.2356	22.5012	26.2230	28.6244	31.0843 (65)

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

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

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			5.0600		11.2829		0.4600		0.0000		0.7700		20.2219 (75)
Southeast			0.7200		36.7938		0.4600		0.0000		0.7700		9.3833 (77)
Southwest			3.0000		36.7938		0.4600		0.0000		0.7700		39.0971 (79)
Southwest			4.5100		36.7938		0.4600		0.0000		0.7700		58.7760 (79)
Solar gains	127.4783	223.8596	324.1358	431.5246	510.6391	518.9529	495.3294	434.4709	361.0362	252.2230	153.9129	108.3034	(83)
Total gains	469.6896	564.7166	653.0758	740.8688	799.2992	788.3357	752.6134	695.5841	632.5928	543.5107	467.8893	440.0531	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.3436	34.4456	34.5462	35.0264	35.1178	35.5493	35.5493	35.6304	35.3818	35.1178	34.9335	34.7429
alpha	3.2896	3.2964	3.3031	3.3351	3.3412	3.3700	3.3700	3.3754	3.3588	3.3412	3.3289	3.3162
util living area	0.9880	0.9774	0.9556	0.9045	0.8073	0.6584	0.5142	0.5668	0.7820	0.9343	0.9798	0.9902 (86)
MIT	19.0446	19.2972	19.6861	20.1789	20.5931	20.8592	20.9545	20.9364	20.7329	20.1825	19.5245	19.0049 (87)
Th 2	19.9040	19.9069	19.9097	19.9230	19.9255	19.9371	19.9371	19.9393	19.9327	19.9255	19.9205	19.9152 (88)
util rest of house	0.9854	0.9726	0.9457	0.8824	0.7616	0.5779	0.4039	0.4560	0.7148	0.9146	0.9746	0.9881 (89)
MIT 2	18.1262	18.3782	18.7629	19.2484	19.6302	19.8585	19.9205	19.9139	19.7647	19.2633	18.6158	18.0950 (90)
Living area fraction	18.3159	18.5681	18.9536	19.4406	19.8291	20.0652	20.1340	20.1252	19.9647	19.4532	18.8035	18.2829 (92)
Temperature adjustment	18.3159	18.5681	18.9536	19.4406	19.8291	20.0652	20.1340	20.1252	19.9647	19.4532	18.8035	18.2829 (93)
adjusted MIT	18.3159	18.5681	18.9536	19.4406	19.8291	20.0652	20.1340	20.1252	19.9647	19.4532	18.8035	18.2829 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9647	0.9348	0.8706	0.7570	0.5884	0.4254	0.4767	0.7171	0.9036	0.9674	0.9837	(94)
Useful gains	460.3625	544.7766	610.4725	645.0206	605.0715	463.8812	320.1586	331.5642	453.6449	491.1290	452.6307	432.8642	(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	1364.1780	1326.3849	1205.0110	1005.9283	773.7709	513.8881	332.3052	349.4786	554.0635	842.6905	1119.8784	1354.9522	(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	672.4388	525.2408	442.3366	259.8536	125.5124	0.0000	0.0000	0.0000	0.0000	261.5617	480.4183	686.0335	(98)
Space heating	3453.3956 (98)												
Space heating per m2	(98) / (4) = 43.2865 (99)												

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	883.8794	695.8199	712.9996	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8208	0.8794	0.8534	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	725.4729	611.9355	608.5042	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1013.3648	969.7378	904.7039	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	207.2822	266.2049	220.3726	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			693.8597 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	51.8205	66.5512	55.0932	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												173.4649 (107)
Energy for space heating												2.1743 (108)
Energy for space cooling												43.2865 (99)
Total												2.1743 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.4608 (109)
												45.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1455 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3955 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3658 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298	(22b)				
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			13.2900	1.3258	17.6193		(27)					
GF B&B J150 P/A=0.40			39.8900	0.1300	5.1857		(28a)					
EW Brick AAC015	92.3400	15.4200	76.9200	0.1800	13.8456		(29a)					
Plane Ceiling	39.8900		39.8900	0.1300	5.1857		(30)					
Total net area of external elements Aum(A, m2)			172.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.9663		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2689 (36)					
Total fabric heat loss						(33) + (36) =	53.2352 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.4304	Feb 41.1430	Mar 40.8612	Apr 39.5379	May 39.2903	Jun 38.1377	Jul 38.1377	Aug 37.9242	Sep 38.5817	Oct 39.2903	Nov 39.7912	Dec 40.3148 (38)
Heat transfer coeff	94.6656	94.3782	94.0965	92.7731	92.5255	91.3729	91.3729	91.1595	91.8169	92.5255	93.0264	93.5500 (39)
Average = Sum(39)m / 12 =												92.7719 (39)
HLP	Jan 1.1866	Feb 1.1830	Mar 1.1794	Apr 1.1629	May 1.1598	Jun 1.1453	Jul 1.1453	Aug 1.1426	Sep 1.1509	Oct 1.1598	Nov 1.1660	Dec 1.1726 (40)
HLP (average)												1.1628 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)
Energy content (annual)											Total = Sum(45)m =	1456.8563 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			5.0600		11.2829		0.6300		0.7000		0.7700		17.4480 (75)
Southeast			0.7200		36.7938		0.6300		0.7000		0.7700		8.0962 (77)
Southwest			7.5100		36.7938		0.6300		0.7000		0.7700		84.4475 (79)
Solar gains	109.9916	193.1519	279.6728	372.3307	440.5928	447.7661	427.3832	374.8728	311.5114	217.6246	132.8000	93.4470	(83)
Total gains	452.2029	534.0089	608.6129	681.6749	729.2529	717.1489	684.6671	635.9860	583.0680	508.9123	446.7765	425.1967	(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 (see Table 9a)												
tau	58.5247	58.7029	58.8787	59.7186	59.8784	60.6337	60.6337	60.7757	60.3405	59.8784	59.5560	59.2226
alpha	4.9016	4.9135	4.9252	4.9812	4.9919	5.0422	5.0422	5.0517	5.0227	4.9919	4.9704	4.9482
util living area	0.9985	0.9962	0.9895	0.9655	0.8939	0.7395	0.5700	0.6296	0.8666	0.9800	0.9967	0.9989 (86)
MIT	19.6793	19.8444	20.1076	20.4546	20.7548	20.9358	20.9861	20.9777	20.8490	20.4553	20.0049	19.6554 (87)
Th 2	19.9307	19.9336	19.9365	19.9498	19.9523	19.9640	19.9640	19.9662	19.9595	19.9523	19.9473	19.9420 (88)
util rest of house	0.9979	0.9949	0.9857	0.9519	0.8517	0.6482	0.4445	0.5026	0.7987	0.9696	0.9953	0.9985 (89)
MIT 2	18.7281	18.8950	19.1585	19.5080	19.7849	19.9342	19.9605	19.9597	19.8744	19.5153	19.0664	18.7132 (90)
Living area fraction									fLA = Living area / (4) =			0.2066 (91)
MIT	18.9246	19.0911	19.3545	19.7035	19.9853	20.1411	20.1723	20.1700	20.0757	19.7095	19.2603	18.9078 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9246	19.0911	19.3545	19.7035	19.9853	20.1411	20.1723	20.1700	20.0757	19.7095	19.2603	18.9078 (93)

8. Space heating requirement

Utilisation	0.9972	0.9934	0.9828	0.9479	0.8532	0.6651	0.4707	0.5290	0.8076	0.9664	0.9940	0.9979 (94)
Useful gains	450.9374	530.4905	598.1683	646.1725	622.1983	477.0035	322.2893	336.4477	470.8958	491.8343	444.0959	424.3159 (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	1384.4456	1339.3349	1209.5657	1002.2755	766.5973	506.3064	326.4131	343.6723	548.6728	842.8616	1131.2257	1375.9188 (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	694.5301	543.5435	454.8797	256.3942	107.4329	0.0000	0.0000	0.0000	0.0000	261.1644	494.7334	707.9925 (98)
Space heating												3520.6706 (98)
Space heating per m2										(98) / (4) =		44.1297 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	858.9053	676.1595	692.8119	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8659	0.9259	0.9020	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.7160	626.0361	624.9430	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	930.1594	890.3200	835.0439	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	134.2393	196.6272	156.3150	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												487.1815 (104)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.5598	49.1568	39.0788	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												121.7954 (107)
Space cooling per m2												1.5266 (108)
Energy for space heating												44.1297 (99)
Energy for space cooling												1.5266 (108)
Total												45.6564 (109)
Target Fabric Energy Efficiency (TFEE)												52.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 206.2313 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1456.8563 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301 (61)
Total heat required for water heating calculated for each month											
165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332 (64)
Total per year (kWh/year) = Sum(64)m =	1622.0849 (64)										
RHI water heating demand	1622 (64)										
Heat gains from water heating, kWh/month											
53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)

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

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

6. Solar gains

[Jan]												Gains					
			Area			Solar flux			g			FF			Access	factor	Gains
			m2			Table 6a			Specific data			Specific data			factor	Table 6d	W
						W/m2			or Table 6b			or Table 6c					
Northeast			5.0600			12.9236			0.4600			0.0000			0.7700		23.1623 (75)
Southeast			0.7200			40.4699			0.4600			0.0000			0.7700		10.3208 (77)
Southwest			3.0000			40.4699			0.4600			0.0000			0.7700		43.0033 (79)
Southwest			4.5100			40.4699			0.4600			0.0000			0.7700		64.6483 (79)
Solar gains	141.1347	223.4224	320.9017	442.7854	512.5197	558.2244	526.7372	471.0504	388.3102	269.1356	174.6459	118.7073	(83)				
Total gains	695.1272	773.0124	849.1112	937.8820	973.7426	989.1125	939.9098	892.5043	828.8335	742.9833	685.5104	657.5493	(84)				

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area												
	0.9588	0.9409	0.9004	0.8124	0.6665	0.4534	0.3061	0.3300	0.5918	0.8336	0.9322	0.9641 (86)
MIT	19.5403	19.7373	20.0918	20.5065	20.8139	20.9648	20.9933	20.9915	20.9086	20.5457	20.0018	19.5106 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house												
	0.9504	0.9292	0.8804	0.7755	0.6031	0.3651	0.2031	0.2235	0.5040	0.7920	0.9166	0.9568 (89)
MIT 2	18.0210	18.3050	18.8046	19.3727	19.7555	19.9181	19.9350	19.9391	19.8720	19.4422	18.6960	17.9866 (90)
Living area fraction												
	18.3348	18.6009	19.0705	19.6069	19.9741	20.1343	20.1536	20.1565	20.0861	19.6701	18.9657	18.3014 (92)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.1848	18.4509	18.9205	19.4569	19.8241	19.9843	20.0036	20.0065	19.9361	19.5201	18.8157	18.1514 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9323	0.9085	0.8576	0.7567	0.5963	0.3690	0.2097	0.2301	0.5037	0.7729	0.8954	0.9400 (94)
Useful gains	648.0862	702.2970	728.2164	709.7379	580.6720	364.9863	197.0559	205.3780	417.4608	574.2153	613.7720	618.0852 (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	1259.4265	1229.3309	1102.0656	906.2914	647.1345	373.8261	197.8770	206.5054	444.3604	746.9735	1020.0689	1241.1988 (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	454.8372	354.1668	278.1438	141.5185	49.4481	0.0000	0.0000	0.0000	0.0000	128.5322	292.5338	463.5965 (98)
Space heating												2162.7768 (98)
RHI space heating demand												2163 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)	
								Total per year (kWh/year) = Sum(64)m =					1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

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

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			5.0600		11.2829		0.4600		0.0000		0.7700		20.2219 (75)
Southeast			0.7200		36.7938		0.4600		0.0000		0.7700		9.3833 (77)
Southwest			3.0000		36.7938		0.4600		0.0000		0.7700		39.0971 (79)
Southwest			4.5100		36.7938		0.4600		0.0000		0.7700		58.7760 (79)
Solar gains	127.4783	223.8596	324.1358	431.5246	510.6391	518.9529	495.3294	434.4709	361.0362	252.2230	153.9129	108.3034	(83)
Total gains	681.4708	773.4495	852.3453	926.6212	971.8621	949.8411	908.5021	855.9248	801.5595	726.0707	664.7774	647.1454	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9663	0.9485	0.9159	0.8484	0.7366	0.5800	0.4413	0.4820	0.6896	0.8741	0.9484	0.9709 (86)
MIT	19.3283	19.5617	19.9129	20.3492	20.6927	20.9021	20.9703	20.9599	20.8183	20.3763	19.7864	19.2930 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9596	0.9385	0.8993	0.8182	0.6846	0.5007	0.3415	0.3806	0.6152	0.8423	0.9366	0.9651 (89)
MIT 2	17.6965	18.0326	18.5332	19.1474	19.5964	19.8496	19.9112	19.9069	19.7628	19.2009	18.3711	17.6547 (90)
Living area fraction	18.0336	18.3485	18.8182	19.3957	19.8229	20.0670	20.1300	20.1244	19.9808	19.4437	18.6635	17.9931 (91)
MIT	18.0336	18.3485	18.8182	19.3957	19.8229	20.0670	20.1300	20.1244	19.9808	19.4437	18.6635	17.9931 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8836	18.1985	18.6682	19.2457	19.6729	19.9170	19.9800	19.9744	19.8308	19.2937	18.5135	17.8431 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9428	0.9182	0.8761	0.7966	0.6719	0.5000	0.3466	0.3851	0.6083	0.8202	0.9165	0.9497	(94)
Useful gains	642.5043	710.1888	746.7080	738.1416	652.9838	474.9301	314.9243	329.6037	487.6052	595.5046	609.2634	614.6050	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1348.3029	1315.1753	1199.0636	1002.1757	769.8336	505.6501	321.4354	338.9656	548.2193	839.4354	1109.2654	1334.9856	(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	525.1142	406.5509	336.5526	190.1046	86.9363	0.0000	0.0000	0.0000	0.0000	181.4845	360.0015	535.9632	(98)
Space heating												2622.7077	(98)
Space heating per m2												(98) / (4) =	32.8743 (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												2898.0196 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	525.1142	406.5509	336.5526	190.1046	86.9363	0.0000	0.0000	0.0000	0.0000	181.4845	360.0015	535.9632 (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)	580.2367	449.2275	371.8813	210.0603	96.0622	0.0000	0.0000	0.0000	0.0000	200.5354	397.7917	592.2245 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)
Efficiency of water heater (217)m	89.7132	89.6369	89.4870	89.1582	88.5665	87.3000	87.3000	87.3000	87.3000	89.0927	89.5422	87.3000 (216)
Fuel for water heating, kWh/month	184.1022	161.5866	168.0534	148.5213	144.5599	128.1956	120.4190	135.8687	136.8056	154.2646	165.6572	178.7189 (219)
Water heating fuel used												1826.7529 (219)
Annual totals kWh/year												
Space heating fuel - main system												2898.0196 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												356.9126 (232)
Total delivered energy for all uses												5156.6851 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2898.0196	3.4800	100.8511 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1826.7529	3.4800	63.5710 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	356.9126	13.1900	47.0768 (250)
Additional standing charges			120.0000 (251)
Total energy cost			341.3914 (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] =	1.1491 (257)
SAP value		83.9701
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2898.0196	0.2160	625.9722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.7529	0.2160	394.5786 (264)
Space and water heating			1020.5509 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1244.7135 (272)
CO2 emissions per m2			15.6000 (273)
EI value			86.6331
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 206.2313 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (64)	
								Total per year (kWh/year) = Sum(64)m =					1622.0849 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				5.0600	12.9236	0.4600	0.0000	0.7700		23.1623 (75)		
Southeast				0.7200	40.4699	0.4600	0.0000	0.7700		10.3208 (77)		
Southwest				3.0000	40.4699	0.4600	0.0000	0.7700		43.0033 (79)		
Southwest				4.5100	40.4699	0.4600	0.0000	0.7700		64.6483 (79)		
Solar gains	141.1347	223.4224	320.9017	442.7854	512.5197	558.2244	526.7372	471.0504	388.3102	269.1356	174.6459	118.7073 (83)
Total gains	695.1272	773.0124	849.1112	937.8820	973.7426	989.1125	939.9098	892.5043	828.8335	742.9833	685.5104	657.5493 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9588	0.9409	0.9004	0.8124	0.6665	0.4534	0.3061	0.3300	0.5918	0.8336	0.9322	0.9641 (86)
MIT	19.5403	19.7373	20.0918	20.5065	20.8139	20.9648	20.9933	20.9915	20.9086	20.5457	20.0018	19.5106 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9504	0.9292	0.8804	0.7755	0.6031	0.3651	0.2031	0.2235	0.5040	0.7920	0.9166	0.9568 (89)
MIT 2	18.0210	18.3050	18.8046	19.3727	19.7555	19.9181	19.9350	19.9391	19.8720	19.4422	18.6960	17.9866 (90)
Living area fraction	18.3348	18.6009	19.0705	19.6069	19.9741	20.1343	20.1536	20.1565	20.0861	19.6701	18.9657	18.3014 (92)
MIT	18.3348	18.6009	19.0705	19.6069	19.9741	20.1343	20.1536	20.1565	20.0861	19.6701	18.9657	18.3014 (92)
Temperature adjustment	18.1848	18.4509	18.9205	19.4569	19.8241	19.9843	20.0036	20.0065	19.9361	19.5201	18.8157	-0.1500
adjusted MIT	18.1848	18.4509	18.9205	19.4569	19.8241	19.9843	20.0036	20.0065	19.9361	19.5201	18.8157	18.1514 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9323	0.9085	0.8576	0.7567	0.5963	0.3690	0.2097	0.2301	0.5037	0.7729	0.8954	0.9400 (94)
Useful gains	648.0862	702.2970	728.2164	709.7379	580.6720	364.9863	197.0559	205.3780	417.4608	574.2153	613.7720	618.0852 (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	1259.4265	1229.3309	1102.0656	906.2914	647.1345	373.8261	197.8770	206.5054	444.3604	746.9735	1020.0689	1241.1988 (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	454.8372	354.1668	278.1438	141.5185	49.4481	0.0000	0.0000	0.0000	0.0000	128.5322	292.5338	463.5965 (98)
Space heating												2162.7768 (98)
Space heating per m2												(98) / (4) = 27.1093 (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													2389.8086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	454.8372	354.1668	278.1438	141.5185	49.4481	0.0000	0.0000	0.0000	0.0000	128.5322	292.5338	463.5965	(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)	502.5825	391.3445	307.3412	156.3740	54.6388	0.0000	0.0000	0.0000	0.0000	142.0245	323.2417	512.2614	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865	(64)
Efficiency of water heater (217)m	89.6248	89.5473	89.3506	88.9244	88.1686	87.3000	87.3000	87.3000	87.3000	88.8177	89.3975	87.3000	(216)
Fuel for water heating, kWh/month	184.2836	161.7484	168.3098	148.9119	145.2123	128.1956	120.4190	135.8687	136.8056	154.7422	165.9255	178.8924	(219)
Water heating fuel used												1829.3149	(219)
Annual totals kWh/year													
Space heating fuel - main system												2389.8086	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.9126	(232)
Total delivered energy for all uses												4651.0361	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2389.8086	9.7400	232.7674 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.3149	9.7400	178.1753 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	356.9126	36.8500	131.5223 (250)
Additional standing charges			104.0000 (251)
Total energy cost			674.1024 (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	2389.8086	0.2160	516.1987 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.3149	0.2160	395.1320 (264)
Space and water heating			911.3307 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Total kg/year			1135.4933 (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	2389.8086	1.2200	2915.5665 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.3149	1.2200	2231.7642 (264)
Space and water heating			5147.3307 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Primary energy kWh/year			6473.3025 (272)
Primary energy kWh/m2/year			81.1394 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 75	-181 kg (16.0%)
U Solar photovoltaic panels	+ 10.7	-£ 672	-947 kg (99.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£75	2.27 kg/m²	B 85 B 89
Solar photovoltaic panels	£672	11.87 kg/m²	A 96 A 98
Total Savings	£747	14.14 kg/m²	

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

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

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

	Current	Potential	Saving
Electricity	£159	£178	-£18
Mains gas	£515	£421	£94
Space heating	£364	£364	£0
Water heating	£178	£103	£75
Lighting	£132	£132	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£674	-£73	£748
Total cost of uses	£674	-£73	£747
Delivered energy	58 kWh/m²	24 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	14 kg/m²
Primary energy	81 kWh/m²	-2 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5242	0.5139	0.5036	0.4522	0.4420	0.3906	0.3906	0.3803	0.4111	0.4420	0.4625	0.4831 (22b)
	0.6374	0.6320	0.6268	0.6023	0.5977	0.5763	0.5763	0.5723	0.5845	0.5977	0.6070	0.6167 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss							(33) + (36) = 55.8816 (37)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2442	1.2396	1.2352	1.2142	1.2103	1.1920	1.1920	1.1887	1.1991	1.2103	1.2182	1.2265 (40)
HLP (average)												1.2142 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4587 (42)
Average daily hot water use (litres/day)	92.5935 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1456.8563 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)	
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1079.5246 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1813.6014 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2449 (H8)	
Utilisation factor												0.5521 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												92.5935 (H14)	
Volume ratio Veff/V												0.8100 (H15)	
Solar storage volume factor												0.9579 (H16)	
Solar input												-843.3953 (H17)	
Solar input	-24.4568	-40.8113	-69.5064	-93.1523	-115.0818	-113.1437	-111.6485	-97.5478	-76.3995	-52.1719	-29.0093	-20.4662 (63)	
												Solar input (sum of months) = Sum(63)m =	-843.3953 (63)
Output from w/h	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203 (64)	
												Total per year (kWh/year) = Sum(64)m =	786.4412 (64)
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)	

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Northeast				5.0600	11.2829	0.4600		0.0000		0.7700	20.2219 (75)	
Southeast				0.7200	36.7938	0.4600		0.0000		0.7700	9.3833 (77)	
Southwest				3.0000	36.7938	0.4600		0.0000		0.7700	39.0971 (79)	
Southwest				4.5100	36.7938	0.4600		0.0000		0.7700	58.7760 (79)	

Solar gains	127.4783	223.8596	324.1358	431.5246	510.6391	518.9529	495.3294	434.4709	361.0362	252.2230	153.9129	108.3034 (83)
Total gains	681.4708	773.4495	852.3453	926.6212	971.8621	949.8411	908.5021	855.9248	801.5595	726.0707	664.7774	647.1454 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.6763	33.7999	33.9220	34.5073	34.6191	35.1491	35.1491	35.2490	34.9430	34.6191	34.3937	34.1612
alpha	3.2451	3.2533	3.2615	3.3005	3.3079	3.3433	3.3433	3.3499	3.3295	3.3079	3.2929	3.2774
util living area	0.9663	0.9485	0.9159	0.8484	0.7366	0.5800	0.4413	0.4820	0.6896	0.8741	0.9484	0.9709 (86)
MIT	19.3283	19.5617	19.9129	20.3492	20.6927	20.9021	20.9703	20.9599	20.8183	20.3763	19.7864	19.2930 (87)
Th 2	19.8848	19.8884	19.8920	19.9087	19.9118	19.9264	19.9264	19.9291	19.9207	19.9118	19.9055	19.8989 (88)
util rest of house	0.9596	0.9385	0.8993	0.8182	0.6846	0.5007	0.3415	0.3806	0.6152	0.8423	0.9366	0.9651 (89)
MIT 2	17.6965	18.0326	18.5332	19.1474	19.5964	19.8496	19.9112	19.9069	19.7628	19.2009	18.3711	17.6547 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	18.0336	18.3485	18.8182	19.3957	19.8229	20.0670	20.1300	20.1244	19.9808	19.4437	18.6635	17.9931 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8836	18.1985	18.6682	19.2457	19.6729	19.9170	19.9800	19.9744	19.8308	19.2937	18.5135	17.8431 (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	0.9428	0.9182	0.8761	0.7966	0.6719	0.5000	0.3466	0.3851	0.6083	0.8202	0.9165	0.9497	(94)
Useful gains	642.5043	710.1888	746.7080	738.1416	652.9838	474.9301	314.9243	329.6037	487.6052	595.5046	609.2634	614.6050	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1348.3029	1315.1753	1199.0636	1002.1757	769.8336	505.6501	321.4354	338.9656	548.2193	839.4354	1109.2654	1334.9856	(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	525.1142	406.5509	336.5526	190.1046	86.9363	0.0000	0.0000	0.0000	0.0000	181.4845	360.0015	535.9632	(98)
Space heating												2622.7077	(98)
Space heating per m2												32.8743	(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													2898.0196 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	525.1142	406.5509	336.5526	190.1046	86.9363	0.0000	0.0000	0.0000	0.0000	181.4845	360.0015	535.9632	(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)	580.2367	449.2275	371.8813	210.0603	96.0622	0.0000	0.0000	0.0000	0.0000	200.5354	397.7917	592.2245	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	140.7071	104.0299	80.8795	39.2667	12.9499	0.0000	0.0000	21.0655	43.0318	85.2666	119.3239	139.9203	(64)
Efficiency of water heater	89.8043	89.8291	89.8618	89.9356	90.0720	87.3000	87.3000	87.3000	87.3000	89.4519	89.6817	87.3000	(216)
(217)m	89.8043	89.8291	89.8618	89.9356	90.0720	87.3000	87.3000	87.3000	87.3000	89.4519	89.6817	89.8184	(217)
Fuel for water heating, kWh/month	156.6818	115.8087	90.0043	43.6609	14.3772	0.0000	0.0000	24.1300	49.2919	95.3211	133.0528	155.7813	(219)
Water heating fuel used												878.1101	(219)
Annual totals kWh/year													
Space heating fuel - main system												2898.0196	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.9126	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												2530.8029	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2898.0196	3.4800	100.8511	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	878.1101	3.4800	30.5582	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	356.9126	13.1900	47.0768	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			87.1507	(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] =	0.2933 (257)
SAP value			95.9079
SAP rating (Section 12)			96 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2898.0196	0.2160	625.9722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	878.1101	0.2160	189.6718 (264)
Space and water heating			815.6440 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	356.9126	0.5190	185.2377 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			169.3194 (272)
CO2 emissions per m2			2.1200 (273)
EI value			98.1817
EI rating			98 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.8900 (1b)	x 2.5400 (2b)	= 101.3206 (1b) - (3b)
First floor	39.8900 (1c)	x 2.6300 (2c)	= 104.9107 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.2313 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1940 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4445 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4111 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4317	0.4111	0.4111	0.3803	0.3803	0.3392	0.3495	0.3289	0.3392	0.3597	0.3597	0.3906 (22b)
Effective ac	0.5932	0.5845	0.5845	0.5723	0.5723	0.5575	0.5611	0.5541	0.5575	0.5647	0.5647	0.5763 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			8.7800	1.2357	10.8498		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.8900	0.1200	4.7868	75.0000	2991.7500 (28a)
EW Brick AAC015	92.3400	15.4200	76.9200	0.2500	19.2300	52.3000	4022.9160 (29a)
Plane Ceiling	39.8900		39.8900	0.1600	6.3824	9.0000	359.0100 (30)
Total net area of external elements Aum(A, m ²)			172.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5912		(33)
E-WM-30			45.7500	0.0000	0.0000	45.0000	2058.7500 (32)
GF Timber			76.9600			9.0000	692.6400 (32c)
1F Timber			92.4000			9.0000	831.6000 (32c)
Internal Floor			39.8900			18.0000	718.0200 (32d)
Internal Ceiling			39.8900			9.0000	359.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12033.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.8360 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2904 (36)
Total fabric heat loss						(33) + (36) =	55.8816 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.3692	39.7797	39.7797	38.9493	38.9493	37.9428	38.1836	37.7091	37.9428	38.4317	38.4317	39.2189 (38)
Heat transfer coeff	96.2508	95.6613	95.6613	94.8309	94.8309	93.8244	94.0653	93.5908	93.8244	94.3133	94.3133	95.1005 (39)
Average = Sum(39)m / 12 =												94.6889 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2065	1.1991	1.1991	1.1887	1.1887	1.1760	1.1791	1.1731	1.1760	1.1822	1.1822	1.1920 (40)
HLP (average)												1.1869 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4587 (42)
Average daily hot water use (litres/day)												92.5935 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.8528	98.1491	94.4454	90.7416	87.0379	83.3341	83.3341	87.0379	90.7416	94.4454	98.1491	101.8528 (44)
Energy conte	151.0448	132.1048	136.3203	118.8473	114.0368	98.4051	91.1868	104.6382	105.8879	123.4022	134.7031	146.2789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1456.8563 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	22.6567	19.8157	20.4480	17.8271	17.1055	14.7608	13.6780	15.6957	15.8832	18.5103	20.2055	21.9418 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1191	12.7365	14.0656	13.5716	13.9948	13.5096	13.9389	13.9751	13.5434	14.0363	13.6301	14.1076 (61)
Total heat required for water heating calculated for each month	165.1639	144.8412	150.3858	132.4190	128.0316	111.9147	105.1258	118.6133	119.4313	137.4384	148.3332	160.3865 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3147 (H8)
Utilisation factor												0.5326 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.5935 (H14)
Volume ratio Veff/V												0.8100 (H15)
Solar storage volume factor												0.9579 (H16)
Solar input												-859.2180 (H17)
Solar input	-26.4463	-39.7487	-66.9419	-92.5342	-111.4423	-117.2882	-114.4719	-102.2241	-79.7862	-54.2771	-32.1462	-21.9109 (63)
	Solar input (sum of months) = Sum(63)m = -859.2180 (63)											
Output from w/h	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756 (64)
	Total per year (kWh/year) = Sum(64)m = 777.5864 (64)											
Heat gains from water heating, kWh/month	53.7522	47.1090	48.8429	42.9096	41.4159	36.0971	33.8044	38.2860	38.5936	44.5403	48.1963	52.1646 (65)

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

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

6. Solar gains

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

Northeast				5.0600	12.9236	0.4600		0.0000		0.7700	23.1623 (75)	
Southeast				0.7200	40.4699	0.4600		0.0000		0.7700	10.3208 (77)	
Southwest				3.0000	40.4699	0.4600		0.0000		0.7700	43.0033 (79)	
Southwest				4.5100	40.4699	0.4600		0.0000		0.7700	64.6483 (79)	

Solar gains	141.1347	223.4224	320.9017	442.7854	512.5197	558.2244	526.7372	471.0504	388.3102	269.1356	174.6459	118.7073 (83)
Total gains	695.1272	773.0124	849.1112	937.8820	973.7426	989.1125	939.9098	892.5043	828.8335	742.9833	685.5104	657.5493 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.7290	34.9430	34.9430	35.2490	35.2490	35.6271	35.5359	35.7161	35.6271	35.4424	35.4424	35.1491
alpha	3.3153	3.3295	3.3295	3.3499	3.3499	3.3751	3.3691	3.3811	3.3751	3.3628	3.3628	3.3433
util living area	0.9588	0.9409	0.9004	0.8124	0.6665	0.4534	0.3061	0.3300	0.5918	0.8336	0.9322	0.9641 (86)
MIT	19.5403	19.7373	20.0918	20.5065	20.8139	20.9648	20.9933	20.9915	20.9086	20.5457	20.0018	19.5106 (87)
Th 2	19.9148	19.9207	19.9207	19.9291	19.9291	19.9392	19.9368	19.9416	19.9392	19.9343	19.9343	19.9264 (88)
util rest of house	0.9504	0.9292	0.8804	0.7755	0.6031	0.3651	0.2031	0.2235	0.5040	0.7920	0.9166	0.9568 (89)
MIT 2	18.0210	18.3050	18.8046	19.3727	19.7555	19.9181	19.9350	19.9391	19.8720	19.4422	18.6960	17.9866 (90)
Living area fraction	fLA = Living area / (4) =											0.2066 (91)
MIT	18.3348	18.6009	19.0705	19.6069	19.9741	20.1343	20.1536	20.1565	20.0861	19.6701	18.9657	18.3014 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1848	18.4509	18.9205	19.4569	19.8241	19.9843	20.0036	20.0065	19.9361	19.5201	18.8157	18.1514 (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	0.9323	0.9085	0.8576	0.7567	0.5963	0.3690	0.2097	0.2301	0.5037	0.7729	0.8954	0.9400	(94)
Useful gains	648.0862	702.2970	728.2164	709.7379	580.6720	364.9863	197.0559	205.3780	417.4608	574.2153	613.7720	618.0852	(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	1259.4265	1229.3309	1102.0656	906.2914	647.1345	373.8261	197.8770	206.5054	444.3604	746.9735	1020.0689	1241.1988	(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	454.8372	354.1668	278.1438	141.5185	49.4481	0.0000	0.0000	0.0000	0.0000	128.5322	292.5338	463.5965	(98)
Space heating												2162.7768	(98)
Space heating per m2												27.1093	(99)

(98) / (4) = 27.1093 (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													2389.8086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	454.8372	354.1668	278.1438	141.5185	49.4481	0.0000	0.0000	0.0000	0.0000	128.5322	292.5338	463.5965	(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)	502.5825	391.3445	307.3412	156.3740	54.6388	0.0000	0.0000	0.0000	0.0000	142.0245	323.2417	512.2614	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7176	105.0925	83.4439	39.8847	16.5893	0.0000	0.0000	16.3893	39.6451	83.1613	116.1870	138.4756	(64)
Efficiency of water heater	89.7313	89.7472	89.7409	89.7765	89.6743	87.3000	87.3000	87.3000	87.3000	89.2153	89.5667	87.3000	(216)
(217)m	89.7313	89.7472	89.7409	89.7765	89.6743	87.3000	87.3000	87.3000	87.3000	89.2153	89.5667	89.7434	(217)
Fuel for water heating, kWh/month	154.5922	117.0983	92.9832	44.4267	18.4995	0.0000	0.0000	18.7735	45.4125	93.2142	129.7212	154.3016	(219)
Water heating fuel used												869.0230	(219)
Annual totals kWh/year													
Space heating fuel - main system												2389.8086	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													356.9126 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1824.1596		-1824.1596	(233)
Total delivered energy for all uses												1916.5846	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2389.8086	9.7400	232.7674	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	869.0230	9.7400	84.6428	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	356.9126	36.8500	131.5223	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			-73.2078	(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	2389.8086	0.2160	516.1987	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	869.0230	0.2160	187.7090	(264)
Space and water heating			703.9076	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	356.9126	0.5190	185.2377	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			7.2814 (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	2389.8086	1.2200	2915.5665 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	869.0230	1.2200	1060.2081 (264)
Space and water heating			3975.7746 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	356.9126	3.0700	1095.7218 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-144.9237 (272)
Primary energy kWh/m2/year			-1.8165 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	150.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	272.23 (P1)
Transmission heat loss coefficient	55.88 (37)
Summer heat loss coefficient	328.11 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.0600	98.8453	0.4600	0.0000	0.9000	207.0650
South East	0.7200	119.9223	0.4600	0.0000	0.9000	35.7465
South West	3.0000	119.9223	0.4600	0.0000	0.9000	148.9436
South West	4.5100	119.9223	0.4600	0.0000	0.9000	223.9118
total:						615.6668

	Jun	Jul	Aug	
Solar gains	652	616	551	(P4)
Internal gains	428	410	418	
Total summer gains	1080	1026	969	(P5)
Summer gain/loss ratio	3.29	3.13	2.95	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 150.8)	0.94	0.94	0.94	
Threshold temperature	20.24	21.97	21.70	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			