

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-226				Issued on Date	16/06/2023
Assessment Reference	As Built	Prop Type Ref	J Semi Op			
Property	13, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	89 B	DER	11.68	TER	16.70	
Environmental	90 B	% DER<TER	30.08			
CO ₂ Emissions (t/year)	0.94	DFEE	44.81	TFEE	52.07	
General Requirements Compliance	Pass	% DFEE<TFEE	13.94			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 105 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) 16.70 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.68 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.80 (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: 4.62 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC SYSTEM s18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.20 kWh/day
Permitted by DBSCG 2.03 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 6.17 m², No overhang
Windows facing East: 1.80 m², No overhang
Windows facing South: 7.01 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.6200	
Infiltration rate											0.2310 (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) =	0.2137 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.2724	0.2671	0.2618	0.2350	0.2297	0.2030	0.2030	0.1976	0.2137	0.2297	0.2404	0.2511 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5224	0.5171	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5011 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				59.7744		(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						9888.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.8539 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3491 (36)
Total fabric heat loss	(33) + (36) =						73.1235 (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	45.8444	45.3756	44.9069	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.9693 (38)
Heat transfer coeff	118.9679	118.4991	118.0304	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	117.0929 (39)
Average = Sum(39)m / 12 =												117.3819 (39)
HLP	Jan 1.1292	Feb 1.1247	Mar 1.1203	Apr 1.1105	May 1.1105	Jun 1.1105	Jul 1.1105	Aug 1.1105	Sep 1.1105	Oct 1.1105	Nov 1.1105	Dec 1.1114 (40)
HLP (average)												1.1141 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m												23.7723 (46)
Water storage loss:												170.0000 (47)
Store volume												1.2000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6480 (55)
Enter (49) or (54) in (55)												
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8853	22.1029	17.9753	13.6085	10.1725	8.5880	9.2797	12.0621	16.1897	20.5565	23.9925	25.5770 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	477.1051	474.7523	458.8904	433.2452	406.9599	381.9118	365.8403	372.3889	385.7527	411.6270	441.3108	463.8093 (73)

6. Solar gains

[Jan]			Area	Solar flux		g		FF		Access		Gains
			m2	Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
North			1.6600	10.6334		0.7200		0.7000		0.7700		6.1652 (74)
East			1.8000	19.6403		0.7200		0.7000		0.7700		12.3476 (76)
South			7.0100	46.7521		0.7200		0.7000		0.7700		114.4676 (78)
North			4.5100	10.6334		0.7200		0.7000		0.7700		16.7499 (74)
North			0.8400	16.1759		0.6300		0.7000		1.0000		5.3930 (82)
Solar gains	155.1233	265.6284	371.5651	481.2071	563.2127	571.1869	545.5690	481.6258	408.6147	295.3393	185.9492	132.7158 (83)
Total gains	632.2284	740.3807	830.4556	914.4523	970.1727	953.0987	911.4093	854.0147	794.3673	706.9663	627.2600	596.5251 (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	23.0885	23.1798	23.2719	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4582
alpha	2.5392	2.5453	2.5515	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5639
util living area	0.9621	0.9430	0.9119	0.8538	0.7594	0.6284	0.4995	0.5419	0.7253	0.8784	0.9448	0.9668 (86)
MIT	18.5544	18.8505	19.3018	19.8659	20.3725	20.7323	20.8937	20.8653	20.5871	19.9358	19.1537	18.5173 (87)
Th 2	19.9771	19.9807	19.9843	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9916 (88)
util rest of house	0.9567	0.9350	0.8990	0.8312	0.7195	0.5611	0.4047	0.4481	0.6669	0.8548	0.9357	0.9621 (89)
MIT 2	16.7025	17.1313	17.7817	18.5857	19.2803	19.7409	19.9190	19.8938	19.5746	18.6985	17.5816	16.6566 (90)
Living area fraction	16.8535	17.2715	17.9056	18.6901	19.3694	19.8217	19.9985	19.9730	19.6572	18.7993	17.7097	16.8083 (92)
Temperature adjustment	16.7035	17.1215	17.7556	18.5401	19.2194	19.6717	19.8485	19.8230	19.5072	18.6493	17.5597	-0.1500
adjusted MIT	16.7035	17.1215	17.7556	18.5401	19.2194	19.6717	19.8485	19.8230	19.5072	18.6493	17.5597	16.6583 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9301	0.9023	0.8607	0.7902	0.6835	0.5371	0.3900	0.4307	0.6337	0.8134	0.9033	0.9377	(94)
Useful gains	588.0284	668.0822	714.7574	722.6013	663.1034	511.9379	355.4774	367.8067	503.4062	575.0432	566.6030	559.3819	(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	1475.6150	1448.2349	1328.5032	1127.8781	879.7611	593.3894	380.0701	400.4918	632.6320	941.7658	1223.7806	1458.7799	(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	660.3644	524.2626	456.6269	291.7992	161.1934	0.0000	0.0000	0.0000	0.0000	272.8415	473.1679	669.1521	(98)
Space heating												3509.4081	(98)
Space heating per m2												(98) / (4) =	33.3087 (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 %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3873.5188 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	660.3644	524.2626	456.6269	291.7992	161.1934	0.0000	0.0000	0.0000	0.0000	272.8415	473.1679	669.1521	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	728.8790	578.6563	504.0032	322.0742	177.9176	0.0000	0.0000	0.0000	0.0000	301.1496	522.2603	738.5785	(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	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)
Efficiency of water heater	87.7941	87.5744	87.1572	86.3327	84.8217	79.9000	79.9000	79.9000	79.9000	86.0643	87.2779	87.8731	(217)
Fuel for water heating, kWh/month	235.7741	208.1438	219.1937	197.7397	196.7665	185.9404	177.9028	196.1425	196.0869	205.7150	215.2807	229.6862	(219)
Water heating fuel used												2464.3724	(219)
Annual totals kWh/year													
Space heating fuel - main system												3873.5188	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													74.4310 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													149.4310 (231)
Electricity for lighting (calculated in Appendix L)													439.4826 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1080 * 1.00) =										-854.9835		-854.9835	(233)
Total delivered energy for all uses												6071.8213	(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	3873.5188	0.2160	836.6801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2464.3724	0.2160	532.3044	(264)
Space and water heating			1368.9845	(265)
Pumps and fans	149.4310	0.5190	77.5547	(267)
Energy for lighting	439.4826	0.5190	228.0915	(268)
Energy saving/generation technologies				
PV Unit	-854.9835	0.5190	-443.7364	(269)
Total CO2, kg/year			1230.8942	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.6800	(273)

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

DER			11.6800	ZC1
Total Floor Area		TFA	105.3600	
Assumed number of occupants		N	2.7839	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.8883	ZC2
CO2 emissions from cooking, equation (L16)			1.7636	ZC3
Total CO2 emissions			28.3319	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			28.3319	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (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) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4004 (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) =				0.3704 (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	0.4723	0.4630	0.4537	0.4074	0.3982	0.3519	0.3519	0.3426	0.3704	0.3982	0.4167	0.4352 (22b)
Effective ac	0.6115	0.6072	0.6029	0.5830	0.5793	0.5619	0.5619	0.5587	0.5686	0.5793	0.5868	0.5947 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			14.9800	1.3258	19.8598		(27)
TER Room Window (Uw = 1.70)			0.8400	1.5918	1.3371		(27a)
150mm EPS B&B			41.2000	0.1300	5.3560		(28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1800	16.7904		(29a)
Wall to Void	22.6400		22.6400	0.1800	4.0752		(29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.1800	0.6984		(29a)
400mm Mineral Wool	11.0300		11.0300	0.1300	1.4339		(30)
Sloping	11.1900	0.8400	10.3500	0.1300	1.3455		(30)
C2V	18.2400		18.2400	0.1300	2.3712		(30)
Dormer Roof	2.7600		2.7600	0.1300	0.3588		(30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.7463		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0031 (36)
Total fabric heat loss						(33) + (36) =	66.7494 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	53.6608	53.2808	52.9084	51.1590	50.8317	49.3081	49.3081	49.0259	49.8950	50.8317	51.4939	52.1861 (38)
Average = Sum(39)m / 12 =	120.4102	120.0303	119.6578	117.9085	117.5812	116.0575	116.0575	115.7753	116.6444	117.5812	118.2433	118.9355 (39)
												117.9069 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1428	1.1392	1.1357	1.1191	1.1160	1.1015	1.1015	1.0989	1.1071	1.1160	1.1223	1.1288 (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												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy conte	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1578.3921 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Water storage loss:											
Store volume	170.0000 (47)										
a) If manufacturer declared loss factor is known (kWh/day):	1.5003 (48)										
Temperature factor from Table 2b	0.5400 (49)										
Enter (49) or (54) in (55)	0.8102 (55)										
Total storage loss											
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage											
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month											
212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596 (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)
Output from w/h											
212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596 (64)
Heat gains from water heating, kWh/month											
93.1143	82.5460	87.8099	80.2671	79.7826	72.9030	71.5511	76.3968	75.5986	83.1563	85.9789	91.3974 (65)

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

Metabolic gains (Table 5), Watts											
(66)m	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8853	22.1029	17.9753	13.6085	10.1725	8.5880	9.2797	12.0621	16.1897	20.5565	23.9925 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	125.1536	122.8363	118.0241	111.4820	107.2347	101.2542	96.1709	102.6839	104.9980	111.7693	119.4152 (72)
Total internal gains	482.5108	480.1580	464.2961	438.6509	412.3656	387.3175	371.2460	377.7946	391.1584	417.0327	446.7165 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.1700	10.6334	0.6300	0.7000	0.7700	20.0507 (74)
East	1.8000	19.6403	0.6300	0.7000	0.7700	10.8042 (76)
South	7.0100	46.7521	0.6300	0.7000	0.7700	100.1592 (78)
North	0.8400	16.1759	0.6300	0.7000	1.0000	5.3930 (82)
Solar gains	136.4070	233.7015	327.4409	425.2772	499.0423	506.7097 (83)
Total gains	618.9178	713.8595	791.7371	863.9281	911.4080	894.0272 (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	60.7645	60.9568	61.1466	62.0538	62.2265	63.0435	63.0435	63.1971	62.7263	62.2265	61.8781 (86)
alpha	5.0510	5.0638	5.0764	5.1369	5.1484	5.2029	5.2029	5.2131	5.1818	5.1484	5.1252 (87)
util living area	0.9982	0.9959	0.9898	0.9686	0.9032	0.7524	0.5801	0.6341	0.8655	0.9782	0.9961 (88)
MIT	19.7566	19.9090	20.1497	20.4712	20.7576	20.9369	20.9868	20.9795	20.8614	20.4971	20.0721 (89)
Th 2	19.9660	19.9689	19.9718	19.9853	19.9878	19.9996	19.9996	20.0018	19.9950	19.9878	19.9773 (90)
util rest of house	0.9976	0.9945	0.9860	0.9561	0.8640	0.6638	0.4570	0.5104	0.7988	0.9672	0.9945 (91)
MIT 2	18.3072	18.5316	18.8836	19.3537	19.7421	19.9559	19.9945	19.9930	19.8802	19.3979	18.7802 (92)
Living area fraction	18.4254	18.6439	18.9868	19.4448	19.8249	20.0359	20.0754	20.0734	19.9602	19.4875	18.8855 (93)
Temperature adjustment	18.4254	18.6439	18.9868	19.4448	19.8249	20.0359	20.0754	20.0734	19.9602	19.4875	18.8855 (94)
adjusted MIT	18.4254	18.6439	18.9868	19.4448	19.8249	20.0359	20.0754	20.0734	19.9602	19.4875	18.8855 (95)

8. Space heating requirement

Utilisation	0.9961	0.9918	0.9809	0.9473	0.8564	0.6674	0.4667	0.5198	0.7960	0.9595	0.9918 (96)
Useful gains	616.5267	707.9985	776.6053	818.4299	780.5359	596.6678	399.0342	417.9033	598.2883	649.5893	605.2343 (97)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000 (98)
Heat loss rate W	1700.8372	1649.6814	1494.1478	1243.3230	955.3369	630.8750	403.3501	425.2911	683.5614	1045.0015	1393.5557 (99)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000 (100)
Space heating kWh	806.7270	632.8109	533.8516	305.9230	130.0519	0.0000	0.0000	0.0000	0.0000	294.1867	567.5914 (101)
Space heating											4093.2907 (102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2

(98) / (4) = 38.8505 (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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4377.8511 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	806.7270	632.8109	533.8516	305.9230	130.0519	0.0000	0.0000	0.0000	0.0000	294.1867	567.5914	822.1482	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	862.8096	676.8031	570.9643	327.1904	139.0930	0.0000	0.0000	0.0000	0.0000	314.6381	607.0496	879.3029	(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	212.0232	186.8214	196.0703	175.5791	171.9279	153.4315	147.1716	161.7452	161.5386	182.0745	192.7576	206.8596	(64)
Efficiency of water heater (217)m	88.0431	87.8161	87.3537	86.2814	84.0813	79.8000	79.8000	79.8000	79.8000	86.0871	87.5248	79.8000	(216)
Fuel for water heating, kWh/month	240.8176	212.7416	224.4556	203.4960	204.4782	192.2701	184.4256	202.6882	202.4293	211.5003	220.2319	234.7354	(219)
Water heating fuel used												2534.2697	(219)
Annual totals kWh/year													
Space heating fuel - main system												4377.8511	(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)												439.4826	(232)
Total delivered energy for all uses												7426.6033	(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	4377.8511	0.2160	945.6158 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2534.2697	0.2160	547.4022 (264)
Space and water heating			1493.0181 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.4826	0.5190	228.0915 (268)
Total CO2, kg/m2/year			1760.0345 (272)
Emissions per m2 for space and water heating			14.1706 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1649 (272b)
Emissions per m2 for pumps and fans			0.3694 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1706 * 1.00) + 2.1649 + 0.3694, rounded to 2 d.p.			16.7000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (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) =					Air changes per hour 40.0000 / (5) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					4.6200
Infiltration rate					0.3814 (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) =		0.3528 (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	0.4498	0.4410	0.4322	0.3881	0.3793	0.3352	0.3352	0.3264	0.3528	0.3793	0.3969	0.4146 (22b)
Effective ac	0.6012	0.5973	0.5934	0.5753	0.5719	0.5562	0.5562	0.5533	0.5622	0.5719	0.5788	0.5859 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.7744		(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber PF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			9.0000	370.8000 (32e)
Internal Ceiling 2			22.9600			9.0000	206.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9311.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							88.3733 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3491 (36)
Total fabric heat loss						(33) + (36) =	73.1235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.7542	52.4095	52.0715	50.4842	50.1873	48.8048	48.8048	48.5488	49.3373	50.1873	50.7880	51.4161 (38)
Average = Sum(39)m / 12 =	125.8778	125.5330	125.1951	123.6078	123.3108	121.9283	121.9283	121.6723	122.4608	123.3108	123.9116	124.5397 (39)
												123.6063 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1947	1.1915	1.1883	1.1732	1.1704	1.1573	1.1573	1.1548	1.1623	1.1704	1.1761	1.1820 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Energy content (annual)	Total = Sum(45)m =											1578.3921 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8853	22.1029	17.9753	13.6085	10.1725	8.5880	9.2797	12.0621	16.1897	20.5565	23.9925	25.5770 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653 (72)
Total internal gains	401.0974	399.5809	385.4557	362.1715	337.4192	314.5294	300.2925	304.4904	317.0191	340.4497	367.3741	388.6344 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.6600	10.6334	0.7200	0.7000	0.7700	6.1652 (74)			
East				1.8000	19.6403	0.7200	0.7000	0.7700	12.3476 (76)			
South				7.0100	46.7521	0.7200	0.7000	0.7700	114.4676 (78)			
North				4.5100	10.6334	0.7200	0.7000	0.7700	16.7499 (74)			
North				0.8400	16.1759	0.6300	0.7000	1.0000	5.3930 (82)			
Solar gains	155.1233	265.6284	371.5651	481.2071	563.2127	571.1869	545.5690	481.6258	408.6147	295.3393	185.9492	132.7158 (83)
Total gains	556.2206	665.2092	757.0209	843.3786	900.6319	885.7163	845.8615	786.1163	725.6337	635.7890	553.3233	521.3501 (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	20.5469	20.6033	20.6589	20.9242	20.9746	21.2124	21.2124	21.2570	21.1202	20.9746	20.8729	20.7676
alpha	2.3698	2.3736	2.3773	2.3949	2.3983	2.4142	2.4142	2.4171	2.4080	2.3983	2.3915	2.3845
util living area	0.9681	0.9509	0.9231	0.8710	0.7853	0.6611	0.5363	0.5806	0.7582	0.8968	0.9541	0.9724 (86)
MIT	18.1959	18.5069	18.9930	19.6242	20.2047	20.6459	20.8493	20.8121	20.4650	19.7112	18.8433	18.1438 (87)
Th 2	19.9242	19.9268	19.9294	19.9415	19.9438	19.9543	19.9543	19.9563	19.9503	19.9438	19.9392	19.9344 (88)
util rest of house	0.9635	0.9438	0.9115	0.8501	0.7471	0.5937	0.4364	0.4833	0.7021	0.8758	0.9463	0.9684 (89)
MIT 2	17.3583	17.6672	18.1476	18.7705	19.3219	19.7234	19.8818	19.8602	19.5746	18.8665	18.0120	17.3135 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.4266	17.7356	18.2165	18.8401	19.3939	19.7986	19.9607	19.9378	19.6472	18.9354	18.0798	17.3812 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.4266	17.7356	18.2165	18.8401	19.3939	19.7986	19.9607	19.9378	19.6472	18.9354	18.0798	17.3812 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9484	0.9243	0.8875	0.8234	0.7239	0.5824	0.4370	0.4813	0.6829	0.8502	0.9276	0.9548 (94)
Useful gains	527.5353	614.8257	671.8797	694.4672	651.9375	515.8316	369.6661	378.3831	495.5570	540.5387	513.2492	497.7771 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1652.3490	1611.2946	1466.8483	1228.6727	948.7425	633.8585	409.7645	430.4529	679.3133	1027.8442	1360.5226	1641.5840 (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	836.8614	669.6271	591.4567	384.6280	220.8230	0.0000	0.0000	0.0000	0.0000	362.5553	610.0369	850.9924 (98)
Space heating	4526.9806 (98)											

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Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 42.9668 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1146.1260	902.2694	924.7093	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7035	0.7694	0.7414	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	806.2456	694.2254	685.6071	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1134.3847	1086.2455	1020.7685	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	236.2601	291.6629	249.3601	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													777.2832 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
	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	59.0650	72.9157	62.3400	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													194.3208 (107)
Space cooling per m2													1.8444 (108)
Energy for space heating													42.9668 (99)
Energy for space cooling													1.8444 (108)
Total													44.8111 (109)
Dwelling Fabric Energy Efficiency (DFEE)													44.8 (109)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (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) = 0.1504 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4004 (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) =				0.3704 (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	0.4723	0.4630	0.4537	0.4074	0.3982	0.3519	0.3519	0.3426	0.3704	0.3982	0.4167	0.4352 (22b)
Effective ac	0.6115	0.6072	0.6029	0.5830	0.5793	0.5619	0.5619	0.5587	0.5686	0.5793	0.5868	0.5947 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			14.9800	1.3258	19.8598		(27)
TER Room Window (Uw = 1.70)			0.8400	1.5918	1.3371		(27a)
150mm EPS B&B			41.2000	0.1300	5.3560		(28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1800	16.7904		(29a)
Wall to Void	22.6400		22.6400	0.1800	4.0752		(29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.1800	0.6984		(29a)
400mm Mineral Wool	11.0300		11.0300	0.1300	1.4339		(30)
Sloping	11.1900	0.8400	10.3500	0.1300	1.3455		(30)
C2V	18.2400		18.2400	0.1300	2.3712		(30)
Dormer Roof	2.7600		2.7600	0.1300	0.3588		(30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.7463		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0031 (36)
Total fabric heat loss						(33) + (36) =	66.7494 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.6608	53.2808	52.9084	51.1590	50.8317	49.3081	49.3081	49.0259	49.8950	50.8317	51.4939	52.1861 (38)
Heat transfer coeff	120.4102	120.0303	119.6578	117.9085	117.5812	116.0575	116.0575	115.7753	116.6444	117.5812	118.2433	118.9355 (39)
Average = Sum(39)m / 12 =												117.9069 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1428	1.1392	1.1357	1.1191	1.1160	1.1015	1.1015	1.0989	1.1071	1.1160	1.1223	1.1288 (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												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1578.3921 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8853	22.1029	17.9753	13.6085	10.1725	8.5880	9.2797	12.0621	16.1897	20.5565	23.9925	25.5770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	(71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653	(72)
Total internal gains	401.0974	399.5809	385.4557	362.1715	337.4192	314.5294	300.2925	304.4904	317.0191	340.4497	367.3741	388.6344	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.1700	10.6334		0.6300		0.7000		0.7700		20.0507 (74)
East				1.8000	19.6403		0.6300		0.7000		0.7700		10.8042 (76)
South				7.0100	46.7521		0.6300		0.7000		0.7700		100.1592 (78)
North				0.8400	16.1759		0.6300		0.7000		1.0000		5.3930 (82)
Solar gains	136.4070	233.7015	327.4409	425.2772	499.0423	506.7097	483.7343	426.1231	360.4659	259.9653	163.5307	116.6948	(83)
Total gains	537.5043	633.2824	712.8967	787.4487	836.4615	821.2391	784.0268	730.6136	677.4850	600.4150	530.9048	505.3291	(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	60.7645	60.9568	61.1466	62.0538	62.2265	63.0435	63.0435	63.1971	62.7263	62.2265	61.8781	61.5179	
alpha	5.0510	5.0638	5.0764	5.1369	5.1484	5.2029	5.2029	5.2131	5.1818	5.1484	5.1252	5.1012	
util living area	0.9991	0.9976	0.9935	0.9783	0.9267	0.7939	0.6251	0.6847	0.9011	0.9868	0.9979	0.9993	(86)
MIT	19.6845	19.8383	20.0824	20.4116	20.7145	20.9184	20.9815	20.9709	20.8254	20.4346	20.0022	19.6639	(87)
Th 2	19.9660	19.9689	19.9718	19.9853	19.9878	19.9996	19.9996	20.0018	19.9950	19.9878	19.9827	19.9773	(88)
util rest of house	0.9987	0.9968	0.9911	0.9692	0.8941	0.7086	0.4961	0.5572	0.8444	0.9797	0.9971	0.9991	(89)
MIT 2	18.7615	18.9173	19.1626	19.4977	19.7845	19.9594	19.9946	19.9928	19.8912	19.5253	19.0922	18.7500	(90)
Living area fraction	18.8367	18.9924	19.2375	19.5722	19.8603	20.0376	20.0750	20.0726	19.9674	19.5995	19.1664	18.8245	(91)
MIT	18.8367	18.9924	19.2375	19.5722	19.8603	20.0376	20.0750	20.0726	19.9674	19.5995	19.1664	18.8245	(92)
Temperature adjustment	18.8367	18.9924	19.2375	19.5722	19.8603	20.0376	20.0750	20.0726	19.9674	19.5995	19.1664	18.8245	(93)
adjusted MIT	18.8367	18.9924	19.2375	19.5722	19.8603	20.0376	20.0750	20.0726	19.9674	19.5995	19.1664	18.8245	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	536.5460	630.5382	704.8012	759.3453	743.6092	584.9502	397.0379	414.2428	570.7524	585.9267	528.7987	504.6740	(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	1750.3728	1691.5108	1524.1471	1258.3477	959.5009	631.0687	403.3030	425.1946	684.3970	1058.1660	1426.7692	1739.3715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	903.0872	712.9736	609.5933	359.2817	160.6234	0.0000	0.0000	0.0000	0.0000	351.3461	646.5388	918.6149	(98)
Space heating												4662.0590	(98)
Space heating per m2												44.2489	(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 Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1090.9405	858.8255	879.8926	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8261	0.8997	0.8717	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	901.2011	772.6949	766.9982	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1059.0217	1013.9711	955.8953	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	113.6308	179.5095	140.5394	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			433.6797 (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	28.4077	44.8774	35.1349	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												108.4199 (107)
Energy for space heating												1.0290 (108)
Energy for space cooling												44.2489 (99)
Total												1.0290 (108)
Target Fabric Energy Efficiency (TFEE)												45.2779 (109)
												52.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =					0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes	
Measured/design AP50											4.6200	
Infiltration rate											0.2310 (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) =	0.2137 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Adj infilt rate	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
	0.2350	0.2190	0.2190	0.2083	0.2083	0.1976	0.1976	0.1870	0.1870	0.2030	0.1976	0.2083 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				59.7744		(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9888.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 93.8539 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3491 (36)
Total fabric heat loss (33) + (36) = 73.1235 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991 (39)
Average = Sum(39)m / 12 =												116.9991 (39)
HLP	Jan 1.1105	Feb 1.1105	Mar 1.1105	Apr 1.1105	May 1.1105	Jun 1.1105	Jul 1.1105	Aug 1.1105	Sep 1.1105	Oct 1.1105	Nov 1.1105	Dec 1.1105 (40)
HLP (average)												1.1105 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1578.3921 (45)											
Water storage loss:	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Store volume	170.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.2000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.6480 (55)											
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 2089.8081 (64)											
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2133	55.2573	44.9383	34.0212	25.4312	21.4701	23.1992	30.1552	40.4742	51.3914	59.9813	63.9424 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	690.2212	685.0477	659.5851	620.1314	579.5300	543.4941	522.7073	532.0765	555.0411	594.7239	638.7238	672.2101 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.6600	13.4839	0.7200	0.7000	0.7700	7.8178 (74)		
East					1.8000	25.1925	0.7200	0.7000	0.7700	15.8383 (76)		
South					7.0100	56.7559	0.7200	0.7000	0.7700	138.9609 (78)		
North					4.5100	13.4839	0.7200	0.7000	0.7700	21.2401 (74)		
North					0.8400	20.3432	0.6300	0.7000	1.0000	6.7823 (82)		

Solar gains	190.6394	278.4213	395.1253	520.0356	579.8569	646.4979	595.0893	545.1762	457.2852	330.3891	227.8752	154.3511 (83)
Total gains	880.8606	963.4690	1054.7103	1140.1670	1159.3869	1189.9919	1117.7965	1077.2526	1012.3262	925.1130	866.5990	826.5612 (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	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770
alpha	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651
util living area	0.9137	0.8915	0.8435	0.7616	0.6341	0.4549	0.3303	0.3414	0.5592	0.7644	0.8758	0.9228 (86)
MIT	19.1775	19.3786	19.7888	20.2522	20.6622	20.9011	20.9698	20.9673	20.8200	20.3822	19.7225	19.1232 (87)
Th 2	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923 (88)
util rest of house	0.9021	0.8771	0.8224	0.7285	0.5806	0.3781	0.2352	0.2436	0.4841	0.7234	0.8565	0.9121 (89)
MIT 2	17.6046	17.8897	18.4684	19.1067	19.6437	19.9169	19.9785	19.9773	19.8381	19.2966	18.3859	17.5287 (90)
Living area fraction	17.7329	18.0111	18.5760	19.2001	19.7267	19.9972	20.0593	20.0580	19.9181	19.3851	18.4949	17.6587 (92)
MIT	17.5829	17.8611	18.4260	19.0501	19.5767	19.8472	19.9093	19.9080	19.7681	19.2351	18.3449	17.5087 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8645	0.8375	0.7818	0.6924	0.5561	0.3664	0.2271	0.2351	0.4658	0.6869	0.8157	0.8757	(94)
Useful gains	761.4904	806.8784	824.5709	789.4573	644.7835	436.0016	253.8184	253.2655	471.5032	635.4379	706.8625	723.7910	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1425.3870	1399.4413	1266.6382	1058.8489	757.7688	461.8135	258.4889	258.3361	522.7683	846.5063	1163.5391	1405.0030	(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													
	493.9391	398.2023	328.8981	193.9619	84.0610	0.0000	0.0000	0.0000	0.0000	157.0349	328.8071	506.8217	(98)
Space heating													
RHI space heating demand												2491.7261	(98)
												2492	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							0 * 10 =	0.0000	(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) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50								4.6200				
Infiltration rate								0.2310	(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) =	0.2137	(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												
	0.2724	0.2671	0.2618	0.2350	0.2297	0.2030	0.2030	0.1976	0.2137	0.2297	0.2404	0.2511 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5224	0.5171	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5011 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				59.7744		(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						9888.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.8539 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3491 (36)
Total fabric heat loss	(33) + (36) =						73.1235 (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	45.8444	45.3756	44.9069	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.9693 (38)
Heat transfer coeff	118.9679	118.4991	118.0304	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	117.0929 (39)
Average = Sum(39)m / 12 =												117.3819 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1292	1.1247	1.1203	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1114 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m												1578.3921 (45)
Water storage loss:	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2133	55.2573	44.9383	34.0212	25.4312	21.4701	23.1992	30.1552	40.4742	51.3914	59.9813	63.9424 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	690.2212	685.0477	659.5851	620.1314	579.5300	543.4941	522.7073	532.0765	555.0411	594.7239	638.7238	672.2101 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6600	10.6334	0.7200		0.7000		0.7700		6.1652 (74)
East				1.8000	19.6403	0.7200		0.7000		0.7700		12.3476 (76)
South				7.0100	46.7521	0.7200		0.7000		0.7700		114.4676 (78)
North				4.5100	10.6334	0.7200		0.7000		0.7700		16.7499 (74)
North				0.8400	16.1759	0.6300		0.7000		1.0000		5.3930 (82)
Solar gains	155.1233	265.6284	371.5651	481.2071	563.2127	571.1869	545.5690	481.6258	408.6147	295.3393	185.9492	132.7158 (83)
Total gains	845.3445	950.6761	1031.1502	1101.3385	1142.7427	1114.6810	1068.2763	1013.7023	963.6557	890.0632	824.6730	804.9258 (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	23.0885	23.1798	23.2719	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4582
alpha	2.5392	2.5453	2.5515	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5639
util living area	0.9310	0.9069	0.8693	0.8028	0.7017	0.5669	0.4404	0.4761	0.6533	0.8208	0.9052	0.9377 (86)
MIT	18.8716	19.1419	19.5492	20.0507	20.4887	20.7912	20.9209	20.9007	20.6826	20.1316	19.4286	18.8351 (87)
Th 2	19.9771	19.9807	19.9843	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9916 (88)
util rest of house	0.9219	0.8949	0.8520	0.7757	0.6585	0.5003	0.3526	0.3881	0.5917	0.7905	0.8910	0.9294 (89)
MIT 2	17.1560	17.5439	18.1255	18.8321	19.4227	19.8008	19.9393	19.9220	19.6804	18.9582	17.9685	17.1122 (90)
Living area fraction	17.2959	17.6742	18.2416	18.9315	19.5096	19.8815	20.0193	20.0018	19.7621	19.0538	18.0875	17.2527 (92)
Temperature adjustment	17.1459	17.5242	18.0916	18.7815	19.3596	19.7315	19.8693	19.8518	19.6121	18.9038	17.9375	-0.1500
adjusted MIT	17.1459	17.5242	18.0916	18.7815	19.3596	19.7315	19.8693	19.8518	19.6121	18.9038	17.9375	17.1027 (93)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8867	0.8562	0.8111	0.7367	0.6277	0.4815	0.3411	0.3749	0.5654	0.7502	0.8521	0.8960	(94)
Useful gains	749.5801	813.9851	836.3542	811.4008	717.3140	536.7233	364.4221	380.0347	544.8770	667.7677	702.7277	721.2011	(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													
	1528.2444	1495.9572	1368.1621	1156.1235	896.1623	600.3832	382.5049	403.8538	644.9103	971.5421	1267.9818	1510.8112	(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													
	579.3263	458.2853	395.6650	248.2003	133.0631	0.0000	0.0000	0.0000	0.0000	226.0081	406.9830	587.4699	(98)
Space heating													3035.0010 (98)
Space heating per m2													(98) / (4) = 28.8060 (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 %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3349.8907	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	579.3263	458.2853	395.6650	248.2003	133.0631	0.0000	0.0000	0.0000	0.0000	226.0081	406.9830	587.4699	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	639.4330	505.8336	436.7164	273.9518	146.8688	0.0000	0.0000	0.0000	0.0000	249.4571	449.2086	648.4215	(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	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)	
Efficiency of water heater													79.9000	(216)
(217)m	87.5148	87.2742	86.8144	85.9115	84.3173	79.9000	79.9000	79.9000	79.9000	85.5666	86.9233	87.6002	(217)	
Fuel for water heating, kWh/month	236.5267	208.8597	220.0592	198.7091	197.9434	185.9404	177.9028	196.1425	196.0869	206.9117	216.1589	230.4016	(219)	
Water heating fuel used												2471.6429	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3349.8907	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)													74.4310	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													149.4310	(231)
Electricity for lighting (calculated in Appendix L)													439.4826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1080 * 1.00) =										-854.9835		-854.9835	(233)	
Total delivered energy for all uses												5555.4637	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3349.8907	3.4800	116.5762	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2471.6429	3.4800	86.0132	(247)
Mechanical ventilation fans	74.4310	13.1900	9.8174	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	439.4826	13.1900	57.9678	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-854.9835	13.1900	-112.7723	(252)
Total energy cost			287.4947	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8031	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.7973	
SAP rating (Section 12)		89	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3349.8907	0.2160	723.5764 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2471.6429	0.2160	533.8749 (264)
Space and water heating			1257.4513 (265)
Pumps and fans	149.4310	0.5190	77.5547 (267)
Energy for lighting	439.4826	0.5190	228.0915 (268)
Energy saving/generation technologies			
PV Unit	-854.9835	0.5190	-443.7364 (269)
Total kg/year			1119.3610 (272)
CO2 emissions per m2			10.6200 (273)
EI value			90.0243
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8429 = 4.128$, stars = 4
Water heating environmental impact	$0.216 / 0.8429 = 0.2562$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.6200	
Infiltration rate											0.2310 (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) =	0.2137 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2350	0.2190	0.2190	0.2083	0.2083	0.1976	0.1976	0.1870	0.1870	0.2030	0.1976	0.2083 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)					
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)					
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)					
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)					
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)					
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)					
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)					
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)					
Total net area of external elements Aum(A, m2)			221.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.7744			(33)					
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)					
Timber GF			69.8900			9.0000	629.0100 (32c)					
Timber FF			98.3300			9.0000	884.9700 (32c)					
Timber 2F			30.4100			9.0000	273.6900 (32c)					
Internal Floor			41.2000			18.0000	741.6000 (32d)					
Internal Floor 2			22.9600			18.0000	413.2800 (32d)					
Internal Ceiling			41.2000			18.0000	741.6000 (32e)					
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	9888.4500		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.8539 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3491 (36)					
Total fabric heat loss				(33) + (36) =			73.1235 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.8756	Feb 43.8756	Mar 43.8756	Apr 43.8756	May 43.8756	Jun 43.8756	Jul 43.8756	Aug 43.8756	Sep 43.8756	Oct 43.8756	Nov 43.8756	Dec 43.8756 (38)
Heat transfer coeff	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991 (39)
Average = Sum(39)m / 12 =												116.9991 (39)
HLP	Jan 1.1105	Feb 1.1105	Mar 1.1105	Apr 1.1105	May 1.1105	Jun 1.1105	Jul 1.1105	Aug 1.1105	Sep 1.1105	Oct 1.1105	Nov 1.1105	Dec 1.1105 (40)
HLP (average)												1.1105 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1578.3921 (45)
Water storage loss:	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323 (64)
Heat gains from water heating, kWh/month	89.0924	78.9134	83.7881	76.3750	75.7608	69.0109	67.5293	72.3750	71.7065	79.1345	82.0868	87.3756 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2133	55.2573	44.9383	34.0212	25.4312	21.4701	23.1992	30.1552	40.4742	51.3914	59.9813	63.9424 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	119.7479	117.4306	112.6184	106.0763	101.8290	95.8485	90.7652	97.2782	99.5923	106.3636	114.0095	117.4403 (72)
Total internal gains	690.2212	685.0477	659.5851	620.1314	579.5300	543.4941	522.7073	532.0765	555.0411	594.7239	638.7238	672.2101 (73)

6. Solar gains

[Jan]			Area		Solar flux		g		FF		Access		Gains
			m2		Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North			1.6600		13.4839		0.7200		0.7000		0.7700		7.8178 (74)
East			1.8000		25.1925		0.7200		0.7000		0.7700		15.8383 (76)
South			7.0100		56.7559		0.7200		0.7000		0.7700		138.9609 (78)
North			4.5100		13.4839		0.7200		0.7000		0.7700		21.2401 (74)
North			0.8400		20.3432		0.6300		0.7000		1.0000		6.7823 (82)
Solar gains	190.6394	278.4213	395.1253	520.0356	579.8569	646.4979	595.0893	545.1762	457.2852	330.3891	227.8752	154.3511	(83)
Total gains	880.8606	963.4690	1054.7103	1140.1670	1159.3869	1189.9919	1117.7965	1077.2526	1012.3262	925.1130	866.5990	826.5612	(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	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770
alpha	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651
util living area	0.9137	0.8915	0.8435	0.7616	0.6341	0.4549	0.3303	0.3414	0.5592	0.7644	0.8758	0.9228 (86)
MIT	19.1775	19.3786	19.7888	20.2522	20.6622	20.9011	20.9698	20.9673	20.8200	20.3822	19.7225	19.1232 (87)
Th 2	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923 (88)
util rest of house	0.9021	0.8771	0.8224	0.7285	0.5806	0.3781	0.2352	0.2436	0.4841	0.7234	0.8565	0.9121 (89)
MIT 2	17.6046	17.8897	18.4684	19.1067	19.6437	19.9169	19.9785	19.9773	19.8381	19.2966	18.3859	17.5287 (90)
Living area fraction	17.7329	18.0111	18.5760	19.2001	19.7267	19.9972	20.0593	20.0580	19.9181	19.3851	18.4949	17.6587 (92)
Temperature adjustment	17.5829	17.8611	18.4260	19.0501	19.5767	19.8472	19.9093	19.9080	19.7681	19.2351	18.3449	-0.1500
adjusted MIT	17.5829	17.8611	18.4260	19.0501	19.5767	19.8472	19.9093	19.9080	19.7681	19.2351	18.3449	17.5087 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8645	0.8375	0.7818	0.6924	0.5561	0.3664	0.2271	0.2351	0.4658	0.6869	0.8157	0.8757	(94)
Useful gains	761.4904	806.8784	824.5709	789.4573	644.7835	436.0016	253.8184	253.2655	471.5032	635.4379	706.8625	723.7910	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1425.3870	1399.4413	1266.6382	1058.8489	757.7688	461.8135	258.4889	258.3361	522.7683	846.5063	1163.5391	1405.0030	(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	493.9391	398.2023	328.8981	193.9619	84.0610	0.0000	0.0000	0.0000	0.0000	157.0349	328.8071	506.8217	(98)
Space heating												2491.7261	(98)
Space heating per m2												(98) / (4) =	23.6496 (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 %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2750.2496 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	493.9391	398.2023	328.8981	193.9619	84.0610	0.0000	0.0000	0.0000	0.0000	157.0349	328.8071	506.8217	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	545.1866	439.5169	363.0222	214.0860	92.7826	0.0000	0.0000	0.0000	0.0000	173.3277	362.9217	559.4059	(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	206.9959	182.2806	191.0430	170.7140	166.9006	148.5664	142.1443	156.7179	156.6734	177.0472	187.8925	201.8323	(64)
Efficiency of water heater	87.1533	86.9438	86.3511	85.2553	83.1909	79.9000	79.9000	79.9000	79.9000	84.5962	86.3929	79.9000	(216)
(217)m	237.5078	209.6533	221.2399	200.2385	200.6235	185.9404	177.9028	196.1425	196.0869	209.2850	217.4861	231.2698	(219)
Fuel for water heating, kWh/month	237.5078	209.6533	221.2399	200.2385	200.6235	185.9404	177.9028	196.1425	196.0869	209.2850	217.4861	2483.3766	(219)
Water heating fuel used												2483.3766	(219)
Annual totals kWh/year													
Space heating fuel - main system												2750.2496	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													74.4310 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													149.4310 (231)
Electricity for lighting (calculated in Appendix L)													439.4826 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1201 * 1.00) =										-950.8692		-950.8692	(233)
Total delivered energy for all uses												4871.6706	(238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2750.2496	9.7400	267.8743	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2483.3766	9.7400	241.8809	(247)
Mechanical ventilation fans	74.4310	36.8500	27.4278	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	439.4826	36.8500	161.9493	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-950.8692	36.8500	-350.3953	(252)
Total energy cost			480.3745	(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	2750.2496	0.2160	594.0539	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2483.3766	0.2160	536.4093	(264)
Space and water heating			1130.4633	(265)
Pumps and fans	149.4310	0.5190	77.5547	(267)
Energy for lighting	439.4826	0.5190	228.0915	(268)
Energy saving/generation technologies				

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PV Unit	-950.8692	0.5190	-493.5011 (269)
Total kg/year			942.6083 (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	2750.2496	1.2200	3355.3045 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2483.3766	1.2200	3029.7194 (264)
Space and water heating			6385.0239 (265)
Pumps and fans	149.4310	3.0700	458.7532 (267)
Energy for lighting	439.4826	3.0700	1349.2116 (268)
Energy saving/generation technologies			
PV Unit	-950.8692	3.0700	-2919.1685 (269)
Primary energy kWh/year			5273.8202 (272)
Primary energy kWh/m2/year			50.0552 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 89
Current environmental impact rating:	B 90

(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	Already installed
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	+ 1.5	-£ 111	-261 kg (27.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£111 2.48 kg/m²	B 90	A 92
Total Savings	£111 2.48 kg/m²		

Potential energy efficiency rating:	B 90
Potential environmental impact rating:	A 92

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£217	£235	-£18
Mains gas	£614	£484	£130
Space heating	£427	£429	-£2
Water heating	£242	£129	£113
Lighting	£162	£162	£0
Generated (PV)	-£350	-£350	£0
Total cost of fuels	£481	£369	£112
Total cost of uses	£481	£370	£111
Delivered energy	46 kWh/m²	34 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.3 tonnes
CO2 emissions per m ²	9 kg/m ²	6 kg/m ²	2 kg/m ²
Primary energy	50 kWh/m ²	36 kWh/m ²	14 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (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					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6200
Infiltration rate					0.2310 (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) =				0.2137 (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	0.2724	0.2671	0.2618	0.2350	0.2297	0.2030	0.2030	0.1976	0.2137	0.2297	0.2404	0.2511 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5224	0.5171	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5011 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	59.7744	(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =											9888.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												93.8539 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												13.3491 (36)
Total fabric heat loss	(33) + (36) =											73.1235 (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	45.8444	45.3756	44.9069	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.9693 (38)
Heat transfer coeff	118.9679	118.4991	118.0304	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	117.0929 (39)
Average = Sum(39)m / 12 =												117.3819 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1292	1.1247	1.1203	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1105	1.1114 (40)
HLP (average)												1.1141 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7839 (42)
Average daily hot water use (litres/day)													100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498	(44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1578.3921 (45)
Water storage loss:	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723	(46)
Store volume													190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2924 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6979 (55)
Total storage loss	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341	(56)
If cylinder contains dedicated solar storage	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	200.0023	175.9638	182.6536	157.1923	147.1126	129.1917	122.1237	137.6278	144.5025	168.6578	181.1244	194.8387	(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													1.1490 (H8)
Utilisation factor													0.5812 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													109.5000 (H13)
Daily hot water demand													100.3180 (H14)
Volume ratio Veff/V													1.0915 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-926.7967 (H17)
Solar input	-26.8753	-44.8471	-76.3797	-102.3639	-126.4619	-124.3322	-122.6891	-107.1941	-83.9545	-57.3310	-31.8779	-22.4900	(63)
Output from w/h	173.1270	131.1167	106.2739	54.8285	20.6507	4.8594	0.0000	30.4337	60.5480	111.3268	149.2465	172.3487	(64)
Heat gains from water heating, kWh/month	83.4975	73.8599	77.0766	65.5576	59.9304	53.5111	51.5128	57.1029	61.9697	72.4230	76.6724	81.7806	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2133	55.2573	44.9383	34.0212	25.4312	21.4701	23.1992	30.1552	40.4742	51.3914	59.9813	63.9424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	(71)
Water heating gains (Table 5)	112.2279	109.9105	103.5976	91.0523	80.5516	74.3209	69.2377	76.7513	86.0691	97.3427	106.4894	109.9202	(72)
Total internal gains	682.7012	677.5277	650.5642	605.1073	558.2526	521.9665	501.1798	511.5495	541.5178	585.7031	631.2038	664.6900	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6600	10.6334		0.7200		0.7000		0.7700		6.1652 (74)
East				1.8000	19.6403		0.7200		0.7000		0.7700		12.3476 (76)
South				7.0100	46.7521		0.7200		0.7000		0.7700		114.4676 (78)
North				4.5100	10.6334		0.7200		0.7000		0.7700		16.7499 (74)
North				0.8400	16.1759		0.6300		0.7000		1.0000		5.3930 (82)
Solar gains	155.1233	265.6284	371.5651	481.2071	563.2127	571.1869	545.5690	481.6258	408.6147	295.3393	185.9492	132.7158	(83)
Total gains	837.8244	943.1561	1022.1293	1086.3144	1121.4653	1093.1535	1046.7488	993.1753	950.1325	881.0424	817.1530	797.4058	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	23.0885	23.1798	23.2719	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4582
alpha	2.5392	2.5453	2.5515	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5639
util living area	0.9323	0.9083	0.8712	0.8070	0.7086	0.5746	0.4478	0.4838	0.6588	0.8237	0.9069	0.9388 (86)
MIT	18.8610	19.1321	19.5389	20.0371	20.4758	20.7844	20.9178	20.8969	20.6760	20.1228	19.4188	18.8242 (87)
Th 2	19.9771	19.9807	19.9843	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9916 (88)
util rest of house	0.9233	0.8964	0.8541	0.7801	0.6657	0.5078	0.3590	0.3950	0.5972	0.7937	0.8928	0.9307 (89)
MIT 2	17.1409	17.5301	18.1113	18.8142	19.4071	19.7939	19.9370	19.9190	19.6733	18.9468	17.9548	17.0967 (90)
Living area fraction									fLA = Living area / (4) =			0.0815 (91)
MIT	17.2811	17.6607	18.2277	18.9139	19.4942	19.8747	20.0169	19.9987	19.7550	19.0427	18.0742	17.2375 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1311	17.5107	18.0777	18.7639	19.3442	19.7247	19.8669	19.8487	19.6050	18.8927	17.9242	17.0875 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8883	0.8579	0.8133	0.7409	0.6343	0.4884	0.3472	0.3813	0.5705	0.7533	0.8541	0.8976 (94)
Useful gains	744.2338	809.1160	831.2914	804.8624	711.2990	533.8582	363.3999	378.7335	542.0311	663.6535	697.9271	715.7130 (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	1526.4924	1494.3624	1366.5182	1154.0667	894.3693	599.5858	382.2289	403.4999	644.0837	970.2364	1266.4212	1509.0341 (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	582.0004	460.4856	398.2087	251.4271	136.2043	0.0000	0.0000	0.0000	0.0000	228.0977	409.3158	590.2309 (98)
Space heating												3055.9704 (98)
Space heating per m2										(98) / (4) =		29.0050 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3373.0358 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	582.0004	460.4856	398.2087	251.4271	136.2043	0.0000	0.0000	0.0000	0.0000	228.0977	409.3158	590.2309 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	642.3846	508.2622	439.5240	277.5133	150.3359	0.0000	0.0000	0.0000	0.0000	251.7635	451.7834	651.4690 (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	173.1270	131.1167	106.2739	54.8285	20.6507	4.8594	0.0000	30.4337	60.5480	111.3268	149.2465	172.3487 (64)
Efficiency of water heater	87.9012	87.9885	88.1142	88.4787	89.0303	79.9000	79.9000	79.9000	79.9000	86.7880	87.4701	79.9000 (216)
Fuel for water heating, kWh/month	196.9564	149.0157	120.6092	61.9680	23.1951	6.0819	0.0000	38.0897	75.7798	128.2744	170.6257	195.9879 (219)
Water heating fuel used												1166.5839 (219)
Annual totals kWh/year												
Space heating fuel - main system												3373.0358 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												74.4310 (230a)
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												199.4310 (231)
Electricity for lighting (calculated in Appendix L)												439.4826 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1080 * 1.00) =									-854.9835			-854.9835 (233)
Total delivered energy for all uses												4323.5498 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3373.0358	3.4800	117.3816 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1166.5839	3.4800	40.5971 (247)
Mechanical ventilation fans	74.4310	13.1900	9.8174 (249)
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	439.4826	13.1900	57.9678 (250)
Additional standing charges			120.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-854.9835	13.1900	-112.7723 (252)
Total energy cost			249.4791 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6969 (257)
SAP value		90.2787
SAP rating (Section 12)		90 (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	3373.0358	0.2160	728.5757 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1166.5839	0.2160	251.9821 (264)
Space and water heating			980.5578 (265)
Pumps and fans	199.4310	0.5190	103.5047 (267)
Energy for lighting	439.4826	0.5190	228.0915 (268)
Energy saving/generation technologies			
PV Unit	-854.9835	0.5190	-443.7364 (269)
Total kg/year			868.4176 (272)
CO2 emissions per m2			8.2400 (273)
EI value			92.2607
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.2000 (1b)	x 2.4100 (2b)	= 99.2920 (1b) - (3b)
First floor	41.2000 (1c)	x 2.6900 (2c)	= 110.8280 (1c) - (3c)
Second floor	22.9600 (1d)	x 2.4300 (2d)	= 55.7928 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.9128 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (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) =								0.0000 / (5) =	0.0000 (8)			
Pressure test								Yes				
Measured/design AP50								4.6200				
Infiltration rate								0.2310	(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) =	0.2137 (21)			
Wind speed	Jan 4.4000	Feb 4.1000	Mar 4.1000	Apr 3.9000	May 3.9000	Jun 3.7000	Jul 3.7000	Aug 3.5000	Sep 3.5000	Oct 3.8000	Nov 3.7000	Dec 3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2350	0.2190	0.2190	0.2083	0.2083	0.1976	0.1976	0.1870	0.1870	0.2030	0.1976	0.2083 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			10.4700	1.3258	13.8807		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
Roof Window (Uw = 1.80)			0.8400	1.6791	1.4104		(27a)
150mm EPS B&B			41.2000	0.1700	7.0040	75.0000	3090.0000 (28a)
140mm Timber Frame	109.0700	15.7900	93.2800	0.1900	17.7232	9.0000	839.5200 (29a)
Wall to Void	22.6400		22.6400	0.1400	3.1696	9.0000	203.7600 (29a)
Dormer Cheek	5.1900	1.3100	3.8800	0.3200	1.2416	9.0000	34.9200 (29a)
400mm Mineral Wool	11.0300		11.0300	0.1100	1.2133	9.0000	99.2700 (30)
Sloping	11.1900	0.8400	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	18.2400		18.2400	0.1400	2.5536	9.0000	164.1600 (30)
Dormer Roof	2.7600		2.7600	0.2800	0.7728	9.0000	24.8400 (30)
Total net area of external elements Aum(A, m ²)			221.3200				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				59.7744		(33)
Timebr Frame			62.0700	0.0000	0.0000	20.0000	1241.4000 (32)
Timber GF			69.8900			9.0000	629.0100 (32c)
Timber FF			98.3300			9.0000	884.9700 (32c)
Timber 2F			30.4100			9.0000	273.6900 (32c)
Internal Floor			41.2000			18.0000	741.6000 (32d)
Internal Floor 2			22.9600			18.0000	413.2800 (32d)
Internal Ceiling			41.2000			18.0000	741.6000 (32e)
Internal Ceiling 2			22.9600			18.0000	413.2800 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						9888.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.8539 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3491 (36)
Total fabric heat loss	(33) + (36) =						73.1235 (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	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756	43.8756 (38)
Heat transfer coeff	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991	116.9991 (39)
Average = Sum(39)m / 12 =												116.9991 (39)
HLP	Jan 1.1105	Feb 1.1105	Mar 1.1105	Apr 1.1105	May 1.1105	Jun 1.1105	Jul 1.1105	Aug 1.1105	Sep 1.1105	Oct 1.1105	Nov 1.1105	Dec 1.1105 (40)
HLP (average)												1.1105 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (46)
Water storage loss:												
Store volume	190.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.2924 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.6979 (55)											
Total storage loss	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)
If cylinder contains dedicated solar storage	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.0023	175.9638	182.6536	157.1923	147.1126	129.1917	122.1237	137.6278	144.5025	168.6578	181.1244	194.8387 (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	1200.5924 (H5)											
Overshading factor	0.8000 (H6)											
Solar energy available	2016.9953 (H7)											
Adjustment factor for showers	1.0000 (H7a)											
Solar-to-load ratio	1.2779 (H8)											
Utilisation factor	0.5428 (H9)											
Collector performance factor	0.8793 (H10)											
Dedicated solar storage volume	75.0000 (H11)											
Effective solar volume	109.5000 (H13)											
Daily hot water demand	100.3180 (H14)											
Volume ratio Veff/V	1.0915 (H15)											
Solar storage volume factor	1.0000 (H16)											
Solar input	-962.6010 (H17)											
Solar input	-31.6001	-44.9333	-77.2295	-104.2005	-121.7839	-131.3050	-124.9921	-113.9221	-89.0189	-61.2190	-37.3746	-25.0221 (63)
Output from w/h	168.4022	131.0305	105.4241	52.9918	25.3287	0.0000	0.0000	23.7057	55.4836	107.4388	143.7499	169.8166 (64)
Heat gains from water heating, kWh/month	83.4975	73.8599	77.0766	65.5576	59.9304	53.5111	51.5128	57.1029	61.9697	72.4230	76.6724	81.7806 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2133	55.2573	44.9383	34.0212	25.4312	21.4701	23.1992	30.1552	40.4742	51.3914	59.9813	63.9424 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	112.2279	109.9105	103.5976	91.0523	80.5516	74.3209	69.2377	76.7513	86.0691	97.3427	106.4894	109.9202 (72)
Total internal gains	682.7012	677.5277	650.5642	605.1073	558.2526	521.9665	501.1798	511.5495	541.5178	585.7031	631.2038	664.6900 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6600	13.4839		0.7200		0.7000		0.7700		7.8178 (74)
East				1.8000	25.1925		0.7200		0.7000		0.7700		15.8383 (76)
South				7.0100	56.7559		0.7200		0.7000		0.7700		138.9609 (78)
North				4.5100	13.4839		0.7200		0.7000		0.7700		21.2401 (74)
North				0.8400	20.3432		0.6300		0.7000		1.0000		6.7823 (82)
Solar gains	190.6394	278.4213	395.1253	520.0356	579.8569	646.4979	595.0893	545.1762	457.2852	330.3891	227.8752		154.3511 (83)
Total gains	873.3406	955.9490	1045.6895	1125.1429	1138.1095	1168.4644	1096.2690	1056.7257	998.8030	916.0921	859.0790		819.0411 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770	23.4770
alpha	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651	2.5651
util living area	0.9151	0.8931	0.8458	0.7660	0.6413	0.4616	0.3361	0.3474	0.5645	0.7676	0.8777	0.9242 (86)
MIT	19.1675	19.3693	19.7793	20.2406	20.6528	20.8976	20.9685	20.9660	20.8159	20.3752	19.7137	19.1128 (87)
Th 2	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923	19.9923 (88)
util rest of house	0.9037	0.8788	0.8248	0.7331	0.5879	0.3842	0.2396	0.2481	0.4892	0.7269	0.8586	0.9136 (89)
MIT 2	17.5905	17.8767	18.4556	19.0918	19.6331	19.9141	19.9779	19.9766	19.8342	19.2880	18.3738	17.5140 (90)
Living area fraction									fLA = Living area / (4) =			0.0815 (91)
MIT	17.7190	17.9984	18.5635	19.1855	19.7162	19.9943	20.0586	20.0573	19.9143	19.3766	18.4830	17.6443 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5690	17.8484	18.4135	19.0355	19.5662	19.8443	19.9086	19.9073	19.7643	19.2266	18.3330	17.4943 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8662	0.8393	0.7842	0.6967	0.5628	0.3721	0.2313	0.2394	0.4704	0.6901	0.8178	0.8774 (94)
Useful gains	756.5042	802.2955	819.9860	783.9251	640.5003	434.7372	253.5326	252.9607	469.8790	632.1927	702.5861	718.6304 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1423.7670	1397.9548	1265.1706	1057.1451	756.5384	461.4744	258.4099	258.2519	522.3167	845.5053	1162.1550	1403.3271 (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	496.4436	400.2830	331.2173	196.7184	86.3324	0.0000	0.0000	0.0000	0.0000	158.7045	330.8896	509.4143 (98)
Space heating												2510.0032 (98)
Space heating per m2										(98) / (4) =		23.8231 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2770.4229 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	496.4436	400.2830	331.2173	196.7184	86.3324	0.0000	0.0000	0.0000	0.0000	158.7045	330.8896	509.4143 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	547.9510	441.8135	365.5820	217.1285	95.2896	0.0000	0.0000	0.0000	0.0000	175.1705	365.2203	562.2674 (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	168.4022	131.0305	105.4241	52.9918	25.3287	0.0000	0.0000	23.7057	55.4836	107.4388	143.7499	169.8166 (64)
Efficiency of water heater	87.6276	87.7035	87.7623	88.0964	87.9290	79.9000	79.9000	79.9000	79.9000	85.9533	87.0686	79.9000 (216)
Fuel for water heating, kWh/month	192.1793	149.4017	120.1245	60.1521	28.8059	0.0000	0.0000	29.6692	69.4413	124.9967	165.0995	193.7111 (219)
Water heating fuel used												1133.5812 (219)
Annual totals kWh/year												
Space heating fuel - main system												2770.4229 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												74.4310 (230a)
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												199.4310 (231)
Electricity for lighting (calculated in Appendix L)												439.4826 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1201 * 1.00) =										-950.8692		-950.8692 (233)
Total delivered energy for all uses												3592.0486 (238)

10a. Fuel costs - using BEDF prices (\$19)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2770.4229	9.7400	269.8392 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1133.5812	9.7400	110.4108 (247)
Mechanical ventilation fans	74.4310	36.8500	27.4278 (249)
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	439.4826	36.8500	161.9493 (250)
Additional standing charges			104.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-950.8692	36.8500	-350.3953 (252)
Total energy cost			369.2944 (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	2770.4229	0.2160	598.4113 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1133.5812	0.2160	244.8535 (264)
Space and water heating			843.2649 (265)
Pumps and fans	199.4310	0.5190	103.5047 (267)
Energy for lighting	439.4826	0.5190	228.0915 (268)
Energy saving/generation technologies			
PV Unit	-950.8692	0.5190	-493.5011 (269)
Total kg/year			681.3599 (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	2770.4229	1.2200	3379.9160 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1133.5812	1.2200	1382.9691 (264)
Space and water heating			4762.8851 (265)
Pumps and fans	199.4310	3.0700	612.2532 (267)
Energy for lighting	439.4826	3.0700	1349.2116 (268)
Energy saving/generation technologies			
PV Unit	-950.8692	3.0700	-2919.1685 (269)
Primary energy kWh/year			3805.1814 (272)
Primary energy kWh/m2/year			36.1160 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	93.9 (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	351.00 (P1)
Transmission heat loss coefficient	73.12 (37)
Summer heat loss coefficient	424.13 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
North	1.000	1.00	1.000	1.000 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	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	1.6600	87.1704	0.7200	0.7000	0.9000	59.0735
East	1.8000	125.2818	0.7200	0.7000	0.9000	92.0611
South	7.0100	118.5567	0.7200	0.7000	0.9000	339.2810
North	4.5100	87.1704	0.7200	0.7000	0.9000	160.4949
North	0.8400	181.9946	0.6300	0.7000	1.0000	60.6763
total:						711.5868

Jun

Jul

Aug

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Solar gains	764	712	639	(P3)
Internal gains	540	520	529	
Total summer gains	1304	1231	1168	(P5)
Summer gain/loss ratio	3.08	2.90	2.75	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 93.9)	1.34	1.34	1.34	
Threshold temperature	19.82	21.55	21.40	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			