

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-230			Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	G Det As		
Property	12, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT				
SAP Rating	87 B	DER	13.59	TER	16.96
Environmental	88 B	% DER<TER	19.87		
CO ₂ Emissions (t/year)	1.36	DFEE	48.05	TFEE	57.49
General Requirements Compliance	Pass	% DFEE<TFEE	16.42		
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

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 124 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) 16.96 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.59 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.40 (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 East:	1.96 m ² , No overhang	
Windows facing South East:	6.17 m ² , No overhang	
Windows facing South West:	1.96 m ² , No overhang	
Windows facing North West:	8.77 m ² , No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K	
Roof U-value	0.11 W/m ² K	
Photovoltaic array	0.66 kW	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.4000		
Infiltration rate															0.2200 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2200 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(33)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.0177	Feb 54.4473	Mar 53.8769	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 52.7361 (38)
Heat transfer coeff	144.4652	143.8948	143.3244	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	142.1836 (39)
Average = Sum(39)m / 12 =												142.0237 (39)
HLP	Jan 1.1669	Feb 1.1623	Mar 1.1577	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1485 (40)
HLP (average)												1.1472 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)
Total per year (kWh/year) = Sum (64)m =												2123.5464 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991	(72)
Total internal gains	507.8412	505.4362	488.4130	460.7967	432.3089	405.3032	388.0662	394.7592	409.2294	437.0799	469.0410	493.4409	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					1.9600	11.2829		0.7200	0.7000	0.7700		7.7240 (75)
Southeast					6.1700	36.7938		0.7200	0.7000	0.7700		79.2910 (77)
Southwest					1.9600	36.7938		0.7200	0.7000	0.7700		25.1881 (79)
Northwest					4.2600	11.2829		0.7200	0.7000	0.7700		16.7879 (81)
Northwest					4.5100	11.2829		0.7200	0.7000	0.7700		17.7731 (81)
Solar gains	146.7640	264.0388	398.5764	556.3876	680.2770	700.4636	664.8737	568.6084	452.6218	301.8780	178.3473	123.9443 (83)
Total gains	654.6052	769.4750	886.9894	1017.1843	1112.5859	1105.7668	1052.9399	963.3676	861.8512	738.9579	647.3883	617.3853 (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	20.6961	20.7781	20.8608	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.0282
alpha	2.3797	2.3852	2.3907	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4019
util living area	0.9669	0.9506	0.9207	0.8604	0.7630	0.6330	0.5091	0.5596	0.7490	0.8952	0.9528	0.9709 (86)
MIT	18.2305	18.5288	19.0300	19.6887	20.2691	20.6788	20.8653	20.8258	20.4823	19.7304	18.8831	18.1963 (87)
Th 2	19.9466	19.9503	19.9540	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9614 (88)
util rest of house	0.9622	0.9437	0.9091	0.8389	0.7238	0.5659	0.4128	0.4644	0.6930	0.8744	0.9449	0.9668 (89)
MIT 2	16.2301	16.6635	17.3880	18.3321	19.1322	19.6619	19.8724	19.8368	19.4337	18.4082	17.1909	16.1880 (90)
Living area fraction	16.5403	16.9528	17.6426	18.5425	19.3085	19.8196	20.0264	19.9902	19.5963	18.6133	17.4533	16.4995 (92)
MIT	16.5403	16.9528	17.6426	18.5425	19.3085	19.8196	20.0264	19.9902	19.5963	18.6133	17.4533	16.4995 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3903	16.8028	17.4926	18.3925	19.1585	19.6696	19.8764	19.8402	19.4463	18.4633	17.3033	16.3495 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9372	0.9125	0.8709	0.7969	0.6874	0.5441	0.4035	0.4514	0.6590	0.8332	0.9145	0.9440 (94)
Useful gains	613.5134	702.1424	772.5120	810.5668	764.8086	601.6724	424.8669	434.8328	567.9242	615.6973	592.0121	582.8286 (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	1746.6340	1712.7472	1575.5106	1341.3112	1053.8987	716.3498	462.9658	486.1094	755.4499	1111.0956	1441.7525	1727.4546 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	843.0417	679.1264	597.4309	382.1360	215.0830	0.0000	0.0000	0.0000	0.0000	368.5764	611.8131	851.6017 (98)
Space heating												4548.8093 (98)
Space heating per m2										(98) / (4) =		36.7432 (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												5020.7608 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	843.0417	679.1264	597.4309	382.1360	215.0830	0.0000	0.0000	0.0000	0.0000	368.5764	611.8131	851.6017 (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)	930.5096	749.5876	659.4161	421.7836	237.3985	0.0000	0.0000	0.0000	0.0000	406.8172	675.2904	939.9578 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Efficiency of water heater (217)m	88.2381	88.0704	87.7173	86.9628	85.5487	79.9000	79.9000	79.9000	79.9000	86.7866	87.8014	79.9000 (216)
Fuel for water heating, kWh/month	238.6695	210.5482	221.4997	199.5655	198.2727	188.8772	180.6241	199.2653	199.2469	207.3933	217.6553	232.5185 (219)
Water heating fuel used												2494.1362 (219)
Annual totals kWh/year												
Space heating fuel - main system												5020.7608 (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)												87.9666 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.9666 (231)
Electricity for lighting (calculated in Appendix L)												481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100		-530.1100 (233)
Total delivered energy for all uses												7628.9863 (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	5020.7608	0.2160	1084.4843 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2494.1362	0.2160	538.7334 (264)
Space and water heating			1623.2177 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total CO2, kg/year			1682.4301 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5900 (273)

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

DER			13.5900 ZC1
Total Floor Area		TFA	123.8000
Assumed number of occupants		N	2.8769
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.8850 ZC2
CO2 emissions from cooking, equation (L16)			1.5189 ZC3
Total CO2 emissions			28.9939 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			28.9939 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1273 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3773 (18)					
Number of sides sheltered							0 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			18.8600	1.3258	25.0038			(27)					
150mm EPS B&B			62.6000	0.1300	8.1380			(28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1800	25.8192			(29a)					
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560			(30)					
Bay Plane	1.4000		1.4000	0.1300	0.1820			(30)					
Total net area of external elements Aum(A, m2)			289.6200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.2190		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4572	(36)					
Total fabric heat loss						(33) + (36) =	81.6762	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.8532	Feb 63.3873	Mar 62.9306	Apr 60.7855	May 60.3842	Jun 58.5159	Jul 58.5159	Aug 58.1699	Sep 59.2355	Oct 60.3842	Nov 61.1961	Dec 62.0449	(38)
Heat transfer coeff	145.5294	145.0635	144.6068	142.4617	142.0603	140.1920	140.1920	139.8461	140.9117	142.0603	142.8723	143.7211	(39)
Average = Sum(39)m / 12 =												142.4598	(39)
HLP	Jan 1.1755	Feb 1.1718	Mar 1.1681	Apr 1.1507	May 1.1475	Jun 1.1324	Jul 1.1324	Aug 1.1296	Sep 1.1382	Oct 1.1475	Nov 1.1541	Dec 1.1609	(40)
HLP (average)												1.1507	(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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Daily hot water use	Jan 112.7784	Feb 108.6774	Mar 104.5763	Apr 100.4753	May 96.3743	Jun 92.2732	Jul 92.2732	Aug 96.3743	Sep 100.4753	Oct 104.5763	Nov 108.6774	Dec 112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476 (64)
Heat gains from water heating, kWh/month	94.3118	83.5934	88.8907	81.2093	80.6867	73.6832	72.2741	77.2265	76.4381	84.1347	87.0469	92.5572 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820 (68)
Pumps, fans	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Total internal gains	126.7632	124.3949	119.4768	112.7907	108.4499	102.3378	97.1426	103.7990	106.1640	113.0843	120.8985	124.4048 (72)
	513.2469	510.8419	493.8187	466.2024	437.7146	410.7089	393.4719	400.1649	414.6351	442.4856	474.4467	498.8466 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast				1.9600	11.2829	0.6300		0.7000	0.7700	6.7585 (75)		
Southeast				6.1700	36.7938	0.6300		0.7000	0.7700	69.3796 (77)		
Southwest				1.9600	36.7938	0.6300		0.7000	0.7700	22.0396 (79)		
Northwest				8.7700	11.2829	0.6300		0.7000	0.7700	30.2408 (81)		

Solar gains	128.4185	231.0339	348.7543	486.8392	595.2423	612.9056	581.7645	497.5323	396.0440	264.1433	156.0539	108.4513 (83)
Total gains	641.6654	741.8759	842.5730	953.0416	1032.9570	1023.6145	975.2364	897.6972	810.6792	706.6288	630.5006	607.2979 (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	59.0755	59.2652	59.4524	60.3476	60.5181	61.3246	61.3246	61.4763	61.0114	60.5181	60.1742	59.8188
alpha	4.9384	4.9510	4.9635	5.0232	5.0345	5.0883	5.0883	5.0984	5.0674	5.0345	5.0116	4.9879
util living area												
	0.9990	0.9977	0.9935	0.9766	0.9183	0.7762	0.6084	0.6739	0.9010	0.9871	0.9978	0.9992 (86)
MIT	19.6489	19.7945	20.0475	20.3984	20.7172	20.9218	20.9821	20.9708	20.8161	20.4081	19.9715	19.6314 (87)
Th 2	19.9396	19.9427	19.9456	19.9596	19.9622	19.9745	19.9745	19.9767	19.9697	19.9622	19.9569	19.9514 (88)
util rest of house												
	0.9986	0.9968	0.9910	0.9668	0.8827	0.6877	0.4787	0.5443	0.8435	0.9801	0.9969	0.9990 (89)
MIT 2	18.1311	18.3461	18.7171	19.2328	19.6711	19.9193	19.9675	19.9638	19.8101	19.2537	18.6153	18.1138 (90)
Living area fraction												
MIT	18.3665	18.5707	18.9234	19.4136	19.8333	20.0748	20.1249	20.1200	19.9661	19.4327	18.8257	18.3492 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3665	18.5707	18.9234	19.4136	19.8333	20.0748	20.1249	20.1200	19.9661	19.4327	18.8257	18.3492 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9978	0.9952	0.9875	0.9598	0.8773	0.6974	0.4987	0.5639	0.8432	0.9750	0.9953	0.9983 (94)
Ext temp.	640.2321	738.2956	832.0202	914.7485	906.2094	713.8542	486.3680	506.1729	683.5669	688.9348	627.5567	606.2705 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2047.0903	1983.1244	1796.5124	1497.7850	1155.4206	767.5212	494.1604	520.2276	826.6081	1254.7806	1675.2704	2033.5338 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1046.7025	836.5250	717.5822	419.7863	185.4132	0.0000	0.0000	0.0000	0.0000	420.9892	754.3539	1061.8839 (98)
Space heating per m2												5443.2361 (98)
												(98) / (4) = 43.9680 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													5821.6429 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1046.7025	836.5250	717.5822	419.7863	185.4132	0.0000	0.0000	0.0000	0.0000	420.9892	754.3539	1061.8839	(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)	1119.4679	894.6791	767.4675	448.9693	198.3028	0.0000	0.0000	0.0000	0.0000	450.2559	806.7956	1135.7047	(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	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476	(64)
Efficiency of water heater (217)m	88.4736	88.3086	87.9368	87.0200	84.9735	79.8000	79.8000	79.8000	79.8000	86.9409	88.0650	79.8000	(216)
Fuel for water heating, kWh/month	243.7165	215.1221	226.6637	205.0253	205.5312	195.2105	187.1503	205.8148	205.5933	212.8077	222.5284	237.5811	(219)
Water heating fuel used												2562.7449	(219)
Annual totals kWh/year													
Space heating fuel - main system												5821.6429	(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)												481.2328	(232)
Total delivered energy for all uses												8940.6206	(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	5821.6429	0.2160	1257.4749	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2562.7449	0.2160	553.5529	(264)
Space and water heating			1811.0277	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	481.2328	0.5190	249.7598	(268)
Total CO2, kg/m2/year			2099.7126	(272)
Emissions per m2 for space and water heating			14.6287	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0174	(272b)
Emissions per m2 for pumps and fans			0.3144	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6287 * 1.00) + 2.0174 + 0.3144, rounded to 2 d.p.			16.9600	(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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3473 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3473 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4428	0.4341	0.4254	0.3820	0.3733	0.3299	0.3299	0.3212	0.3473	0.3733	0.3907	0.4081 (22b)
	0.5980	0.5942	0.5905	0.5730	0.5697	0.5544	0.5544	0.5516	0.5603	0.5697	0.5763	0.5833 (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)			14.3500	1.3258	19.0246		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)
Total net area of external elements Aum(A, m ²)			289.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			9.0000	550.8000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10212.7200 (34)
82.4937 (35)
16.1541 (36)
(33) + (36) = 89.4475 (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	62.0209	61.6261	61.2392	59.4217	59.0816	57.4986	57.4986	57.2055	58.1084	59.0816	59.7695	60.4887 (38)
Heat transfer coeff	151.4684	151.0736	150.6867	148.8692	148.5291	146.9461	146.9461	146.6530	147.5559	148.5291	149.2170	149.9362 (39)
Average = Sum(39)m / 12 =												148.8675 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2235	1.2203	1.2172	1.2025	1.1998	1.1870	1.1870	1.1846	1.1919	1.1998	1.2053	1.2111 (40)
HLP (average)												1.2025 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8769 (42)
102.5258 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.1304 (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	35.5400	31.0835	32.0754	27.9641	26.8322	23.1542	21.4558	24.6208	24.9148	29.0358	31.6949	34.4186 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	47.7688	46.2552	43.1121	38.8391	36.0648	32.1586	28.8384	33.0925	34.6039	39.0267	44.0207	46.2616	(72)
Total internal gains	431.2525	429.7023	414.4540	389.2507	362.3296	337.5297	322.1677	326.4584	340.0750	365.4279	394.5689	417.7034	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					1.9600	11.2829	0.7200	0.7000	0.7700		7.7240 (75)	
Southeast					6.1700	36.7938	0.7200	0.7000	0.7700		79.2910 (77)	
Southwest					1.9600	36.7938	0.7200	0.7000	0.7700		25.1881 (79)	
Northwest					4.2600	11.2829	0.7200	0.7000	0.7700		16.7879 (81)	
Northwest					4.5100	11.2829	0.7200	0.7000	0.7700		17.7731 (81)	
Solar gains	146.7640	264.0388	398.5764	556.3876	680.2770	700.4636	664.8737	568.6084	452.6218	301.8780	178.3473	123.9443 (83)
Total gains	578.0165	693.7411	813.0304	945.6384	1042.6065	1037.9933	987.0414	895.0667	792.6968	667.3060	572.9162	541.6478 (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	18.7291	18.7780	18.8263	19.0561	19.0997	19.3055	19.3055	19.3441	19.2257	19.0997	19.0117	18.9205	
alpha	2.2486	2.2519	2.2551	2.2704	2.2733	2.2870	2.2870	2.2896	2.2817	2.2733	2.2674	2.2614	
util living area	0.9719	0.9569	0.9296	0.8748	0.7851	0.6608	0.5407	0.5932	0.7767	0.9100	0.9603	0.9755	(86)
MIT	17.9139	18.2231	18.7533	19.4602	20.1093	20.5952	20.8205	20.7714	20.3612	19.5165	18.5934	17.8636	(87)
Th 2	19.9013	19.9038	19.9063	19.9180	19.9202	19.9304	19.9304	19.9323	19.9265	19.9202	19.9158	19.9111	(88)
util rest of house	0.9678	0.9507	0.9191	0.8547	0.7472	0.5935	0.4400	0.4952	0.7230	0.8914	0.9536	0.9720	(89)
MIT 2	17.0725	17.3802	17.9052	18.6028	19.2210	19.6645	19.8428	19.8134	19.4715	18.6709	17.7586	17.0290	(90)
Living area fraction	fLA = Living area / (4) =												0.1551 (91)
MIT	17.2030	17.5110	18.0367	18.7358	19.3588	19.8088	19.9945	19.9619	19.6095	18.8020	17.8881	17.1584	(92)
Temperature adjustment													0.0000
adjusted MIT	17.2030	17.5110	18.0367	18.7358	19.3588	19.8088	19.9945	19.9619	19.6095	18.8020	17.8881	17.1584	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	551.2019	646.6272	727.8737	782.4736	755.0145	607.1125	440.8556	445.9941	558.0657	578.0499	536.2034	519.5624	(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	1954.3925	1905.1843	1738.4292	1464.2423	1137.5474	765.4183	498.8051	522.3689	812.9632	1218.2414	1609.7649	1942.9324	(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	1043.9738	845.7504	751.8534	490.8735	284.6045	0.0000	0.0000	0.0000	0.0000	476.3025	772.9643	1058.9873	(98)
Space heating													5725.3095 (98)
Space heating per m2	(98) / (4) =												46.2464 (99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1381.2935	1087.4012	1114.5626	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6825	0.7472	0.7106	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	942.7688	812.5330	792.0295	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1330.0737	1267.9451	1162.8054	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	278.8596	338.8266	275.8573	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												893.5434	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	69.7149	84.7066	68.9643	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												223.3859	(107)
Space cooling per m2												1.8044	(108)
Energy for space heating												46.2464	(99)
Energy for space cooling												1.8044	(108)
Total												48.0509	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.1	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3773 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (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)			18.8600	1.3258	25.0038		(27)
150mm EPS B&B			62.6000	0.1300	8.1380		(28a)
140mm Timber Frame	164.4200	20.9800	143.4400	0.1800	25.8192		(29a)
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560		(30)
Bay Plane	1.4000		1.4000	0.1300	0.1820		(31)
Total net area of external elements Aum(A, m ²)			289.6200				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.2190	(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)							12.4572 (36)
Total fabric heat loss						(33) + (36) =	81.6762 (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	63.8532	63.3873	62.9306	60.7855	60.3842	58.5159	58.5159	58.1699	59.2355	60.3842	61.1961	62.0449 (38)
Heat transfer coeff	145.5294	145.0635	144.6068	142.4617	142.0603	140.1920	140.1920	139.8461	140.9117	142.0603	142.8723	143.7211 (39)
Average = Sum(39)m / 12 =												142.4598 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1755	1.1718	1.1681	1.1507	1.1475	1.1324	1.1324	1.1296	1.1382	1.1475	1.1541	1.1609 (40)
HLP (average)												1.1507 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5400	31.0835	32.0754	27.9641	26.8322	23.1542	21.4558	24.6208	24.9148	29.0358	31.6949	34.4186 (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	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	47.7688	46.2552	43.1121	38.8391	36.0648	32.1586	28.8384	33.0925	34.6039	39.0267	44.0207	46.2616	(72)
Total internal gains	431.2525	429.7023	414.4540	389.2507	362.3296	337.5297	322.1677	326.4584	340.0750	365.4279	394.5689	417.7034	(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
Northeast	1.9600	11.2829	0.6300	0.7000	0.7700	6.7585 (75)
Southeast	6.1700	36.7938	0.6300	0.7000	0.7700	69.3796 (77)
Southwest	1.9600	36.7938	0.6300	0.7000	0.7700	22.0396 (79)
Northwest	8.7700	11.2829	0.6300	0.7000	0.7700	30.2408 (81)

Solar gains	128.4185	231.0339	348.7543	486.8392	595.2423	612.9056	581.7645	497.5323	396.0440	264.1433	156.0539	108.4513	(83)
Total gains	559.6710	660.7362	763.2083	876.0899	957.5719	950.4353	903.9321	823.9907	736.1191	629.5712	550.6228	526.1547	(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	59.0755	59.2652	59.4524	60.3476	60.5181	61.3246	61.3246	61.4763	61.0114	60.5181	60.1742	59.8188	
alpha	4.9384	4.9510	4.9635	5.0232	5.0345	5.0883	5.0883	5.0984	5.0674	5.0345	5.0116	4.9879	
util living area	0.9995	0.9986	0.9958	0.9833	0.9365	0.8108	0.6480	0.7185	0.9273	0.9921	0.9988	0.9996	(86)
MIT	19.5872	19.7338	19.9892	20.3459	20.6779	20.9036	20.9764	20.9610	20.7797	20.3528	19.9115	19.5702	(87)
Th 2	19.9396	19.9427	19.9456	19.9596	19.9622	19.9745	19.9745	19.9767	19.9697	19.9622	19.9569	19.9514	(88)
util rest of house	0.9993	0.9981	0.9941	0.9760	0.9065	0.7262	0.5139	0.5874	0.8798	0.9877	0.9983	0.9995	(89)
MIT 2	18.6433	18.7921	19.0492	19.4131	19.7303	19.9263	19.9680	19.9644	19.8333	19.4247	18.9812	18.6356	(90)
Living area fraction									fLA = Living area / (4) =			0.1551	(91)
MIT	18.7897	18.9382	19.1950	19.5578	19.8772	20.0779	20.1244	20.1189	19.9801	19.5687	19.1255	18.7805	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7897	18.9382	19.1950	19.5578	19.8772	20.0779	20.1244	20.1189	19.9801	19.5687	19.1255	18.7805	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9989	0.9974	0.9925	0.9723	0.9035	0.7359	0.5348	0.6075	0.8804	0.9852	0.9977	0.9992	(94)
Ext temp.	559.0832	659.0381	757.4592	851.8024	865.1741	699.3988	483.4556	500.5355	648.0697	620.2828	549.3731	525.7548	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2108.6765	2036.4255	1835.7765	1518.3254	1161.6581	767.9526	494.0868	520.0804	828.5705	1274.0918	1718.1033	2095.5304	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1152.8972	925.6043	802.2681	479.8966	220.5841	0.0000	0.0000	0.0000	0.0000	486.4339	841.4857	1167.9131	(98)
Space heating per m2										(98) / (4) =		6077.0830	(98)
												49.0879	(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	1317.8052	1037.4211	1062.8301	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8048	0.8819	0.8425	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1060.5797	914.8716	895.4829	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1227.7333	1170.8044	1079.7295	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	120.3506	190.4140	137.0795	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												447.8441 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			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	30.0876	47.6035	34.2699	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												111.9610 (107)
Energy for space heating												0.9044 (108)
Energy for space cooling												49.0879 (99)
Total												0.9044 (108)
Target Fabric Energy Efficiency (TFEE)												49.9923 (109)
												57.5 (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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4000
Infiltration rate												0.2200 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2200 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(33)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
RHI water heating demand												2123.5464 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (73)

6. Solar gains

[Jan]	Area m2					Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast	1.9600					14.6176	0.7200	0.7000	0.7700	10.0069 (75)		
Southeast	6.1700					45.1778	0.7200	0.7000	0.7700	97.3586 (77)		
Southwest	1.9600					45.1778	0.7200	0.7000	0.7700	30.9275 (79)		
Northwest	4.2600					14.6176	0.7200	0.7000	0.7700	21.7496 (81)		
Northwest	4.5100					14.6176	0.7200	0.7000	0.7700	23.0260 (81)		
Solar gains	183.0685	281.4670	431.2323	609.5731	706.9048	798.5419	731.1139	651.3008	514.8470	343.6437	221.9843	146.2032 (83)
Total gains	921.1821	1014.0881	1136.3145	1271.9127	1325.0728	1377.6654	1287.8325	1217.7998	1106.3319	978.1053	904.0909	864.7484 (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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594
Feb	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106
tau	0.9251	0.9052	0.8584	0.7738	0.6441	0.4643	0.3415	0.3586	0.5887	0.7927	0.8933	0.9328 (86)
alpha	18.8756	19.0898	19.5576	20.1042	20.5872	20.8728	20.9583	20.9535	20.7579	20.2201	19.4716	18.8261 (87)
util living area	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)
MIT	0.9150	0.8925	0.8390	0.7419	0.5910	0.3860	0.2422	0.2552	0.5126	0.7547	0.8764	0.9234 (89)
MIT 2	17.1700	17.4756	18.1396	18.8976	19.5362	19.8685	19.9477	19.9452	19.7547	19.0751	18.0292	17.1004 (90)
Living area fraction	17.4345	17.7260	18.3595	19.0847	19.6992	20.0243	20.1044	20.1016	19.9102	19.2527	18.2529	17.3681 (92)
MIT												0.1551 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.2845	17.5760	18.2095	18.9347	19.5492	19.8743	19.9544	19.9516	19.7602	19.1027	18.1029	17.2181 (93)

8. Space heating requirement

Utilisation	0.8781	0.8528	0.7970	0.7042	0.5669	0.3785	0.2409	0.2536	0.4957	0.7158	0.8354	0.8880 (94)
Useful gains	808.9075	864.8099	905.6634	895.6408	751.2258	521.4545	310.2148	308.8160	548.3728	700.1715	755.2772	767.8805 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1679.3025	1649.8368	1499.1431	1262.4974	911.2823	561.5714	318.5518	318.1568	630.2418	1003.6249	1371.0387	1655.7851	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	647.5739	527.5381	441.5489	264.1368	119.0820	0.0000	0.0000	0.0000	0.0000	225.7693	443.3483	660.6010	(98)
RHI space heating demand												3329.5983	(98)
												3330	(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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4000
Infiltration rate												0.2200 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2200 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(32)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.0177	Feb 54.4473	Mar 53.8769	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 52.7361 (38)
Heat transfer coeff	144.4652	143.8948	143.3244	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	142.1836 (39)
Average = Sum(39)m / 12 =												142.0237 (39)
HLP	Jan 1.1669	Feb 1.1623	Mar 1.1577	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1485 (40)
HLP (average)												1.1472 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					1.9600	11.2829		0.7200	0.7000	0.7700	7.7240 (75)	
Southeast					6.1700	36.7938		0.7200	0.7000	0.7700	79.2910 (77)	
Southwest					1.9600	36.7938		0.7200	0.7000	0.7700	25.1881 (79)	
Northwest					4.2600	11.2829		0.7200	0.7000	0.7700	16.7879 (81)	
Northwest					4.5100	11.2829		0.7200	0.7000	0.7700	17.7731 (81)	
Solar gains	146.7640	264.0388	398.5764	556.3876	680.2770	700.4636	664.8737	568.6084	452.6218	301.8780	178.3473	123.9443 (83)
Total gains	884.8776	996.6599	1103.6585	1218.7272	1298.4450	1279.5871	1221.5922	1135.1074	1044.1067	936.3397	860.4538	842.4896 (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	20.6961	20.7781	20.8608	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.0282
alpha	2.3797	2.3852	2.3907	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4019
util living area	0.9398	0.9191	0.8830	0.8146	0.7110	0.5774	0.4544	0.4976	0.6822	0.8441	0.9183	0.9455 (86)
MIT	18.5396	18.8166	19.2766	19.8734	20.3858	20.7399	20.8954	20.8662	20.5873	19.9328	19.1554	18.5051 (87)
Th 2	19.9466	19.9503	19.9540	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9614 (88)
util rest of house	0.9318	0.9086	0.8674	0.7888	0.6686	0.5105	0.3640	0.4068	0.6218	0.8167	0.9059	0.9383 (89)
MIT 2	16.6738	17.0732	17.7331	18.5806	19.2767	19.7251	19.8955	19.8700	19.5534	18.6810	17.5769	16.6323 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	16.9632	17.3436	17.9725	18.7811	19.4487	19.8825	20.0505	20.0245	19.7137	18.8751	17.8217	16.9227 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8132	17.1936	17.8225	18.6311	19.2987	19.7325	19.9005	19.8745	19.5637	18.7251	17.6717	16.7727 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8976	0.8703	0.8255	0.7481	0.6372	0.4938	0.3577	0.3980	0.5947	0.7748	0.8677	0.9059 (94)
Ext temp.	794.2518	867.3906	911.0821	911.7457	827.3086	631.8223	436.9720	451.7606	620.8854	725.5195	746.5933	763.2345 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1807.7218	1768.9816	1622.7835	1375.0242	1073.7154	725.2278	466.3728	490.9507	772.0354	1148.0958	1493.8032	1787.6341 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fraction	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	754.0217	605.8692	529.5059	333.5605	183.3267	0.0000	0.0000	0.0000	0.0000	314.3968	537.9911	762.1532 (98)
Space heating												4020.8251 (98)
Space heating per m2										(98) / (4) =		32.4784 (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												4437.9968 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	754.0217	605.8692	529.5059	333.5605	183.3267	0.0000	0.0000	0.0000	0.0000	314.3968	537.9911	762.1532 (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)	832.2535	668.7298	584.4436	368.1683	202.3473	0.0000	0.0000	0.0000	0.0000	347.0163	593.8092	841.2287 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Efficiency of water heater (217)m	88.0264	87.8433	87.4561	86.6297	85.1217	79.9000	79.9000	79.9000	79.9000	86.3882	87.5277	79.9000 (216)
Fuel for water heating, kWh/month	239.2437	211.0924	222.1611	200.3330	199.2673	188.8772	180.6241	199.2653	199.2469	208.3499	218.3360	233.0635 (219)
Water heating fuel used												2499.8605 (219)
Annual totals kWh/year												
Space heating fuel - main system												4437.9968 (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)												87.9666 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.9666 (231)
Electricity for lighting (calculated in Appendix L)												481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100		-530.1100 (233)
Total delivered energy for all uses												7051.9466 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4437.9968	3.4800	154.4423 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	2499.8605	3.4800	86.9951 (247)	
Mechanical ventilation fans	87.9666	13.1900	11.6028 (249)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Energy for lighting	481.2328	13.1900	63.4746 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-530.1100	13.1900	-69.9215 (252)	
Total energy cost			376.4858 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9368 (257)
SAP value		86.9323
SAP rating (Section 12)		87 (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	4437.9968	0.2160	958.6073 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2499.8605	0.2160	539.9699 (264)	
Space and water heating			1498.5772 (265)	
Pumps and fans	162.9666	0.5190	84.5796 (267)	
Energy for lighting	481.2328	0.5190	249.7598 (268)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1557.7896 (272)
CO2 emissions per m2			12.5800 (273)
EI value			87.6337
EI rating			88 (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	$3.48 / 0.8472 = 4.107$, stars = 4
Water heating environmental impact	$0.216 / 0.8472 = 0.2549$, 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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.4000		
Infiltration rate															0.2200 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2200 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(32)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)
Total per year (kWh/year) = Sum (64)m =												2123.5464 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					1.9600	14.6176	0.7200	0.7000	0.7700	10.0069 (75)		
Southeast					6.1700	45.1778	0.7200	0.7000	0.7700	97.3586 (77)		
Southwest					1.9600	45.1778	0.7200	0.7000	0.7700	30.9275 (79)		
Northwest					4.2600	14.6176	0.7200	0.7000	0.7700	21.7496 (81)		
Northwest					4.5100	14.6176	0.7200	0.7000	0.7700	23.0260 (81)		
Solar gains	183.0685	281.4670	431.2323	609.5731	706.9048	798.5419	731.1139	651.3008	514.8470	343.6437	221.9843	146.2032 (83)
Total gains	921.1821	1014.0881	1136.3145	1271.9127	1325.0728	1377.6654	1287.8325	1217.7998	1106.3319	978.1053	904.0909	864.7484 (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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594
alpha	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106
util living area	0.9251	0.9052	0.8584	0.7738	0.6441	0.4643	0.3415	0.3586	0.5887	0.7927	0.8933	0.9328 (86)
MIT	18.8756	19.0898	19.5576	20.1042	20.5872	20.8728	20.9583	20.9535	20.7579	20.2201	19.4716	18.8261 (87)
Th 2	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)
util rest of house	0.9150	0.8925	0.8390	0.7419	0.5910	0.3860	0.2422	0.2552	0.5126	0.7547	0.8764	0.9234 (89)
MIT 2	17.1700	17.4756	18.1396	18.8976	19.5362	19.8685	19.9477	19.9452	19.7547	19.0751	18.0292	17.1004 (90)
Living area fraction	17.4345	17.7260	18.3595	19.0847	19.6992	20.0243	20.1044	20.1016	19.9102	19.2527	18.2529	17.3681 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2845	17.5760	18.2095	18.9347	19.5492	19.8743	19.9544	19.9516	19.7602	19.1027	18.1029	17.2181 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	808.9075	864.8099	905.6634	895.6408	751.2258	521.4545	310.2148	308.8160	548.3728	700.1715	755.2772	767.8805 (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	1679.3025	1649.8368	1499.1431	1262.4974	911.2823	561.5714	318.5518	318.1568	630.2418	1003.6249	1371.0387	1655.7851 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fraction	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	647.5739	527.5381	441.5489	264.1368	119.0820	0.0000	0.0000	0.0000	0.0000	225.7693	443.3483	660.6010	(98)
Space heating												3329.5983	(98)
Space heating per m2												26.8950	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3675.0534	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	647.5739	527.5381	441.5489	264.1368	119.0820	0.0000	0.0000	0.0000	0.0000	225.7693	443.3483	660.6010	(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)	714.7615	582.2716	487.3609	291.5417	131.4371	0.0000	0.0000	0.0000	0.0000	249.1935	489.3469	729.1402	(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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203	(64)
Efficiency of water heater	87.7173	87.5506	87.0383	86.0317	83.9915	79.9000	79.9000	79.9000	79.9000	85.5198	87.0871	79.9000	(216)
Fuel for water heating, kWh/month	240.0867	211.7981	223.2276	201.7254	201.9486	188.8772	180.6241	199.2653	199.2469	210.4656	219.4405	233.8189	(219)
Water heating fuel used												2510.5247	(219)
Annual totals kWh/year													
Space heating fuel - main system												3675.0534	(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)			87.9666 (230a)
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			
Electricity for lighting (calculated in Appendix L)			162.9666 (231)
			481.2328 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =										-588.6659		-588.6659	(233)
Total delivered energy for all uses												6241.1116	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3675.0534	10.2300	375.9580	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2510.5247	10.2300	256.8267	(247)
Mechanical ventilation fans	87.9666	36.7200	32.3013	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	481.2328	36.7200	176.7087	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.6659	36.7200	-216.1581	(252)
Total energy cost			756.1765	(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	3675.0534	0.2160	793.8115	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2510.5247	0.2160	542.2733	(264)
Space and water heating			1336.0849	(265)
Pumps and fans	162.9666	0.5190	84.5796	(267)
Energy for lighting	481.2328	0.5190	249.7598	(268)
Energy saving/generation technologies				
PV Unit	-588.6659	0.5190	-305.5176	(269)
Total kg/year			1364.9067	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
--	--------------------	-------------------------------------	----------------------------	--

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating - main system 1	3675.0534	1.2200	4483.5651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2510.5247	1.2200	3062.8402 (264)
Space and water heating			7546.4053 (265)
Pumps and fans	162.9666	3.0700	500.3073 (267)
Energy for lighting	481.2328	3.0700	1477.3848 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			7716.8931 (272)
Primary energy kWh/m2/year			62.3335 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(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	+ 1.3	-£ 119	-263 kg (19.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£119	2.13 kg/m²	B 88 B 90
Total Savings	£119	2.13 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 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	£237	£255	-£18
Mains gas	£736	£599	£137
Space heating	£539	£541	-£2
Water heating	£257	£136	£121
Lighting	£177	£177	£0
Generated (PV)	-£216	-£216	£0
Total cost of fuels	£757	£638	£119
Total cost of uses	£757	£638	£119
Delivered energy	50 kWh/m²	40 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	50 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

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4000
Infiltration rate												0.2200 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2200 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5305	0.5250	0.5195	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5085 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(32)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.0177	Feb 54.4473	Mar 53.8769	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 52.7361 (38)
Heat transfer coeff	144.4652	143.8948	143.3244	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	142.1836 (39)
Average = Sum(39)m / 12 =												142.0237 (39)
HLP	Jan 1.1669	Feb 1.1623	Mar 1.1577	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1485 (40)
HLP (average)												1.1472 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	203.6039	179.1137	185.9041	160.0262	149.8318	131.5381	124.2981	140.1228	147.0274	171.6003	184.3364	198.3266 (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												1.1243 (H8)
Utilisation factor												0.5891 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5258 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-939.4680 (H17)
Solar input	-27.2427	-45.4602	-77.4240	-103.7634	-128.1909	-126.0321	-124.3665	-108.6597	-85.1023	-58.1149	-32.3138	-22.7975 (63)
Solar input (sum of months) = Sum (63)m =												-939.4680 (63)
Output from w/h	176.3612	133.6535	108.4801	56.2628	21.6409	5.5060	0.0000	31.4632	61.9251	113.4854	152.0226	175.5292 (64)
Total per year (kWh/year) = Sum (64)m =												1036.3299 (64)
Heat gains from water heating, kWh/month	84.6951	74.9073	78.1574	66.4999	60.8345	54.2913	52.2358	57.9325	62.8093	73.4014	77.7404	82.9404 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	113.8375	111.4691	105.0503	92.3610	81.7668	75.4045	70.2094	77.8663	87.2351	98.6577	107.9727	111.4790	(72)
Total internal gains	730.5935	725.1011	696.0613	647.3156	596.8907	557.5960	535.1910	545.9720	577.9617	625.4408	674.5865	711.0252	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast						1.9600	11.2829	0.7200	0.7000	0.7700		7.7240 (75)
Southeast						6.1700	36.7938	0.7200	0.7000	0.7700		79.2910 (77)
Southwest						1.9600	36.7938	0.7200	0.7000	0.7700		25.1881 (79)
Northwest						4.2600	11.2829	0.7200	0.7000	0.7700		16.7879 (81)
Northwest						4.5100	11.2829	0.7200	0.7000	0.7700		17.7731 (81)
Solar gains	146.7640	264.0388	398.5764	556.3876	680.2770	700.4636	664.8737	568.6084	452.6218	301.8780	178.3473	123.9443 (83)
Total gains	877.3575	989.1399	1094.6377	1203.7032	1277.1677	1258.0596	1200.0647	1114.5804	1030.5834	927.3188	852.9338	834.9696 (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	20.6961	20.7781	20.8608	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.0282
alpha	2.3797	2.3852	2.3907	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4019
util living area												
	0.9407	0.9203	0.8847	0.8180	0.7168	0.5839	0.4608	0.5044	0.6870	0.8464	0.9196	0.9464 (86)
MIT	18.5300	18.8075	19.2669	19.8607	20.3737	20.7332	20.8921	20.8621	20.5805	19.9243	19.1463	18.4952 (87)
Th 2	19.9466	19.9503	19.9540	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9614 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9329	0.9098	0.8691	0.7925	0.6747	0.5168	0.3696	0.4130	0.6267	0.8193	0.9074	0.9393 (89)
Living area fraction	16.6600	17.0604	17.7197	18.5636	19.2618	19.7183	19.8930	19.8667	19.5457	18.6697	17.5641	16.6181 (90)
MIT	16.9500	17.3314	17.9596	18.7648	19.4343	19.8757	20.0479	20.0210	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.7062	18.8643	17.8095	16.9092 (92)
adjusted MIT	16.8000	17.1814	17.8096	18.6148	19.2843	19.7257	19.8979	19.8710	19.5562	18.7143	17.6595	-0.1500
												16.7592 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8989	0.8717	0.8274	0.7516	0.6427	0.4996	0.3630	0.4038	0.5991	0.7774	0.8693	0.9073	(94)
Useful gains	788.6744	862.2425	905.6851	904.7569	820.7731	628.5143	435.6522	450.0430	617.4350	720.9340	741.4944	757.5287	(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													
Month fracti	1805.8217	1767.2225	1620.9452	1372.7160	1071.6708	724.2666	466.0046	490.4652	770.9744	1146.5628	1492.0788	1785.7140	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	756.7576	608.1465	532.1535	336.9306	186.6679	0.0000	0.0000	0.0000	0.0000	316.6678	540.4208	764.9699	(98)
Space heating per m2												4042.7145	(98)
										(98) / (4) =		32.6552	(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	4462.1573	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	756.7576	608.1465	532.1535	336.9306	186.6679	0.0000	0.0000	0.0000	0.0000	316.6678	540.4208	764.9699	(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)	835.2733	671.2434	587.3659	371.8880	206.0352	0.0000	0.0000	0.0000	0.0000	349.5230	596.4909	844.3376	(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	176.3612	133.6535	108.4801	56.2628	21.6409	5.5060	0.0000	31.4632	61.9251	113.4854	152.0226	175.5292	(64)
Efficiency of water heater (217)m	88.3635	88.4655	88.5911	88.8965	89.3568	79.9000	79.9000	79.9000	79.9000	87.5083	88.0124	79.9000	(216)
Fuel for water heating, kWh/month	199.5861	151.0799	122.4504	63.2902	24.2185	6.8911	0.0000	39.3782	77.5032	129.6854	172.7287	198.5831	(219)
Water heating fuel used												1185.3948	(219)
Annual totals kWh/year													
Space heating fuel - main system												4462.1573	(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)		87.9666 (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		212.9666 (231)
Electricity for lighting (calculated in Appendix L)		481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 + 0.66 + 1004 + 1.00) =	-530.1100	-530.1100 (233)
Total delivered energy for all uses		5811.6415 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4462.1573	3.4800	155.2831	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1185.3948	3.4800	41.2517	(247)
Mechanical ventilation fans	87.9666	13.1900	11.6028	(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	481.2328	13.1900	63.4746	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-530.1100	13.1900	-69.9215	(252)
Total energy cost			338.1782	(255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8414 (257)
SAP value		88.2619
SAP rating (Section 12)		88 (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	4462.1573	0.2160	963.8260 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1185.3948	0.2160	256.0453 (264)
Space and water heating			1219.8713 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1305.0337 (272)
CO2 emissions per m2			10.5400 (273)
EI value			89.6401
EI rating			90 (274)
EI band			B

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4000
Infiltration rate												0.2200 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2200 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2420	0.2255	0.2255	0.2145	0.2145	0.2035	0.2035	0.1925	0.1925	0.2090	0.2035	0.2145 (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)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.2934		(33)					
Timber GF			92.1100			9.0000	828.9900 (32c)					
Timber FF			131.3300			9.0000	1181.9700 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use												
	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)												Total = Sum(45)m = 1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	203.6039	179.1137	185.9041	160.0262	149.8318	131.5381	124.2981	140.1228	147.0274	171.6003	184.3364	198.3266 (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												1.2504 (H8)
Utilisation factor												0.5506 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5258 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-976.4479 (H17)
Solar input	-32.0546	-45.5797	-78.3405	-105.6994	-123.5357	-133.1938	-126.7901	-115.5609	-90.2994	-62.0997	-37.9122	-25.3820 (63)
Solar input (sum of months) = Sum(63)m =												-976.4479 (63)
Output from w/h	171.5492	133.5341	107.5636	54.3268	26.2960	0.0000	0.0000	24.5620	56.7280	109.5006	146.4242	172.9446 (64)
Total per year (kWh/year) = Sum(64)m =												1003.4292 (64)
Heat gains from water heating, kWh/month	84.6951	74.9073	78.1574	66.4999	60.8345	54.2913	52.2358	57.9325	62.8093	73.4014	77.7404	82.9404 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	113.8375	111.4691	105.0503	92.3610	81.7668	75.4045	70.2094	77.8663	87.2351	98.6577	107.9727	111.4790 (72)
Total internal gains	730.5935	725.1011	696.0613	647.3156	596.8907	557.5960	535.1910	545.9720	577.9617	625.4408	674.5865	711.0252 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast						1.9600	14.6176		0.7200	0.7000	0.7700		10.0069 (75)				
Southeast						6.1700	45.1778		0.7200	0.7000	0.7700		97.3586 (77)				
Southwest						1.9600	45.1778		0.7200	0.7000	0.7700		30.9275 (79)				
Northwest						4.2600	14.6176		0.7200	0.7000	0.7700		21.7496 (81)				
Northwest						4.5100	14.6176		0.7200	0.7000	0.7700		23.0260 (81)				
Solar gains						183.0685	281.4670	431.2323	609.5731	706.9048	798.5419	731.1139	651.3008	514.8470	343.6437	221.9843	146.2032 (83)
Total gains						913.6620	1006.5681	1127.2937	1256.8886	1303.7955	1356.1379	1266.3049	1197.2728	1092.8087	969.0845	896.5709	857.2284 (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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594
alpha	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106
util living area	0.9263	0.9064	0.8602	0.7775	0.6502	0.4701	0.3466	0.3640	0.5934	0.7954	0.8949	0.9339 (86)
MIT	18.8663	19.0811	19.5487	20.0932	20.5780	20.8693	20.9569	20.9520	20.7534	20.2130	19.4632	18.8166 (87)
Th 2	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	0.9163	0.8939	0.8410	0.7458	0.5971	0.3912	0.2460	0.2593	0.5173	0.7577	0.8781	0.9247 (89)
Living area fraction	17.1568	17.4634	18.1274	18.8834	19.5258	19.8656	19.9470	19.9444	19.7503	19.0662	18.0176	17.0869 (90)
MIT	17.4219	17.7143	18.3478	19.0710	19.6890	20.0212	20.1036	20.1007	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.9059	19.2440	18.2418	17.3551 (92)
adjusted MIT	17.2719	17.5643	18.1978	18.9210	19.5390	19.8712	19.9536	19.9507	19.7559	19.0940	18.0918	-0.1500
												17.2051 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8796	0.8543	0.7990	0.7078	0.5725	0.3834	0.2447	0.2576	0.4999	0.7186	0.8372	0.8895 (94)	
Useful gains	803.6499	859.9343	900.7407	889.6626	746.4482	519.9066	309.8080	308.3619	546.2788	696.4296	750.6501	762.4679 (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													
Month fracti	1677.5276	1648.1879	1497.4908	1260.5617	909.8441	561.1418	318.4371	318.0284	629.6292	1002.4019	1369.4734	1653.9610 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating	650.1650	529.7064	443.9821	267.0474	121.5665	0.0000	0.0000	0.0000	0.0000	227.6434	445.5528	663.2709 (98)	
Space heating per m2												3348.9346 (98)	
												(98) / (4) =	27.0512 (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													3696.3958 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	650.1650	529.7064	443.9821	267.0474	121.5665	0.0000	0.0000	0.0000	0.0000	227.6434	445.5528	663.2709 (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)	717.6214	584.6649	490.0465	294.7543	134.1794	0.0000	0.0000	0.0000	0.0000	251.2621	491.7801	732.0871 (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	171.5492	133.5341	107.5636	54.3268	26.2960	0.0000	0.0000	24.5620	56.7280	109.5006	146.4242	172.9446 (64)	
Efficiency of water heater (217)m	88.1359	88.2213	88.2940	88.5944	88.4925	79.9000	79.9000	79.9000	79.9000	86.8236	87.6952	79.9000 (216)	
Fuel for water heating, kWh/month	194.6417	151.3626	121.8244	61.3208	29.7156	0.0000	0.0000	30.7409	70.9987	126.1185	166.9695	196.1751 (219)	
Water heating fuel used												1149.8677 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3696.3958 (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)													87.9666 (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													212.9666 (231)
Electricity for lighting (calculated in Appendix L)													481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =									-588.6659				-588.6659 (233)
Total delivered energy for all uses													4951.7970 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3696.3958	10.2300	378.1413 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1149.8677	10.2300	117.6315 (247)	
Mechanical ventilation fans	87.9666	36.7200	32.3013 (249)	
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)	
Pump for solar water heating	50.0000	36.7200	18.3600 (249)	
Energy for lighting	481.2328	36.7200	176.7087 (250)	
Additional standing charges			103.0000 (251)	
Energy saving/generation technologies				
PV Unit	-588.6659	36.7200	-216.1581 (252)	
Total energy cost			637.5246 (255)	

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

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 kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3696.3958	0.2160	798.4215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.8677	0.2160	248.3714 (264)
Space and water heating			1046.7929 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	0.5190	-305.5176 (269)
Total kg/year			1101.5648 (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	3696.3958	1.2200	4509.6029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.8677	1.2200	1402.8386 (264)
Space and water heating			5912.4415 (265)
Pumps and fans	212.9666	3.0700	653.8073 (267)
Energy for lighting	481.2328	3.0700	1477.3848 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			6236.4293 (272)
Primary energy kWh/m2/year			50.3750 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	86.9 (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	414.84 (P1)
Transmission heat loss coefficient	89.45 (37)
Summer heat loss coefficient	504.28 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.9600	106.0502	0.7200	0.7000	0.9000	84.8561
South East	6.1700	127.3119	0.7200	0.7000	0.9000	320.6783
South West	1.9600	127.3119	0.7200	0.7000	0.9000	101.8686
North West	4.2600	106.0502	0.7200	0.7000	0.9000	184.4322
North West	4.5100	106.0502	0.7200	0.7000	0.9000	195.2557
total:						887.0909

	Jun	Jul	Aug	
Solar gains	958	887	773	(P3)
Internal gains	576	554	563	
Total summer gains	1534	1441	1337	(P5)
Summer gain/loss ratio	3.04	2.86	2.65	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 86.9)	1.39	1.39	1.39	
Threshold temperature	19.83	21.55	21.34	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Assessment of likelihood of high internal temperature:

Slight