

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-209				Issued on Date	24/08/2023
Assessment Reference	As Built	Prop Type Ref	G Det Op			
Property	1, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	88 B	DER	12.43	TER	17.02	
Environmental	89 B	% DER<TER	26.98			
CO ₂ Emissions (t/year)	1.20	DFEE	49.39	TFEE	58.45	
General Requirements Compliance	Pass	% DFEE<TFEE	15.50			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

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

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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) 17.02 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.43 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.4 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: 4.60 (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: 4.01 m², No overhang
Windows facing East: 7.33 m², No overhang
Windows facing South: 1.21 m², No overhang
Windows facing West: 9.52 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												4.6000
Infiltration rate												0.2300 (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) =	0.2300 (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												
	0.2933	0.2875	0.2818	0.2530	0.2473	0.2185	0.2185	0.2128	0.2300	0.2473	0.2588	0.2703 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5433	0.5375	0.5318	0.5030	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5088	0.5203 (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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392		(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.3400	Feb 55.7436	Mar 55.1473	Apr 52.1657	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.7620	Dec 53.9547 (38)
Heat transfer coeff	150.3274	149.7310	149.1347	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	146.7494	147.9420 (39)
Average = Sum(39)m / 12 =												147.0908 (39)
HLP	Jan 1.2143	Feb 1.2095	Mar 1.2046	Apr 1.1806	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1854	Dec 1.1950 (40)
HLP (average)												1.1881 (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	

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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)
								Total per year (kWh/year) = Sum(64)m =				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												
	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	26.4545	23.4966	19.1087	14.4665	10.8139	9.1296	9.8648	12.8227	17.2105	21.8527	25.5054	27.1897 (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	507.0462	504.7302	487.8388	460.3620	431.9840	405.0288	387.7698	394.3739	408.7122	436.4232	468.2746	492.6239 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.0100	10.6334		0.7200		0.7000		0.7700		14.8929 (74)
East				7.3300	19.6403		0.7200		0.7000		0.7700		50.2823 (76)
South				1.2100	46.7521		0.7200		0.7000		0.7700		19.7583 (78)
West				5.0100	19.6403		0.7200		0.7000		0.7700		34.3676 (80)
West				4.5100	19.6403		0.7200		0.7000		0.7700		30.9377 (80)
Solar gains	150.2388	286.9339	461.9592	667.3595	818.7691	840.0821	798.8986	684.4991	534.2961	337.0845	185.9167	124.5420	(83)
Total gains	657.2850	791.6641	949.7980	1127.7215	1250.7530	1245.1109	1186.6684	1078.8730	943.0084	773.5077	654.1913	617.1659	(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	19.8357	19.9147	19.9943	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.3193	20.1555	
alpha	2.3224	2.3276	2.3330	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3546	2.3437	
util living area	0.9668	0.9484	0.9121	0.8393	0.7306	0.5966	0.4743	0.5259	0.7251	0.8886	0.9523	0.9710 (86)	
MIT	18.1285	18.4536	19.0079	19.7253	20.3131	20.7042	20.8775	20.8394	20.4994	19.7127	18.8069	18.0909 (87)	
Th 2	19.9086	19.9124	19.9163	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9317	19.9240 (88)	
util rest of house	0.9620	0.9411	0.8992	0.8152	0.6884	0.5279	0.3792	0.4306	0.6660	0.8666	0.9443	0.9668 (89)	
MIT 2	16.0638	16.5357	17.3350	18.3604	19.1638	19.6623	19.8540	19.8208	19.4299	18.3656	17.0631	16.0169 (90)	
Living area fraction									fLA = Living area / (4) =				0.1551 (91)
MIT	16.3841	16.8331	17.5944	18.5720	19.3420	19.8238	20.0127	19.9787	19.5957	18.5745	17.3335	16.3386 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	16.2341	16.6831	17.4444	18.4220	19.1920	19.6738	19.8627	19.8287	19.4457	18.4245	17.1835	16.1886 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9362	0.9083	0.8585	0.7721	0.6539	0.5090	0.3719	0.4198	0.6334	0.8238	0.9127	0.9434 (94)
Useful gains	615.3483	719.0363	815.3969	870.7643	817.8590	633.7371	441.3526	452.9065	597.3255	637.2326	597.0915	582.2434 (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	1794.0146	1764.2958	1632.1917	1391.6766	1092.6508	739.9793	475.8393	500.0526	779.6339	1141.1446	1479.7516	1773.6117 (97)

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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	876.9277	702.4144	607.6953	375.0569	204.4451	0.0000	0.0000	0.0000	0.0000	374.9106	635.5153	886.3780 (98)
Space heating												4663.3433 (98)
Space heating per m2										(98) / (4) =		37.6684 (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												5147.1780 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	876.9277	702.4144	607.6953	375.0569	204.4451	0.0000	0.0000	0.0000	0.0000	374.9106	635.5153	886.3780 (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)	967.9114	775.2918	670.7454	413.9700	225.6568	0.0000	0.0000	0.0000	0.0000	413.8086	701.4517	978.3422 (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	88.3099	88.1349	87.7530	86.9178	85.4133	79.9000	79.9000	79.9000	79.9000	86.8284	87.8793	79.9000 (216)
Fuel for water heating, kWh/month	238.4756	210.3940	221.4095	199.6689	198.5871	188.8772	180.6241	199.2653	199.2469	207.2937	217.4625	232.3307 (219)
Water heating fuel used												2493.6354 (219)
Annual totals kWh/year												
Space heating fuel - main system												5147.1780 (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)												467.1940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												7425.0622 (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	5147.1780	0.2160	1111.7905 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2493.6354	0.2160	538.6253 (264)
Space and water heating			1650.4157 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	467.1940	0.5190	242.4737 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total CO2, kg/year			1538.4408 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4300 (273)

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

DER			12.4300 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			27.8339 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			27.8339 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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																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)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4810	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)			22.0700	1.3258	29.2595			(27)					
150mm EPS B&B			62.6000	0.1300	8.1380			(28a)					
140mm Timber Frame	164.4200	24.1900	140.2300	0.1800	25.2414			(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) =	72.8969			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.8212 (36)					
Total fabric heat loss						(33) + (36) =		85.7181 (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	149.5713	149.1054	148.6487	146.5036	146.1022	144.2339	144.2339	143.8879	144.9536	146.1022	146.9141	147.7629	(39)
Average = Sum(39)m / 12 =												146.5016	(39)
HLP	Jan 1.2082	Feb 1.2044	Mar 1.2007	Apr 1.1834	May 1.1801	Jun 1.1651	Jul 1.1651	Aug 1.1623	Sep 1.1709	Oct 1.1801	Nov 1.1867	Dec 1.1936	(40)
HLP (average)												1.1834	(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):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
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	(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												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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												
26.4545	23.4966	19.1087	14.4665	10.8139	9.1296	9.8648	12.8227	17.2105	21.8527	25.5054	27.1897	(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	(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)												
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)
Total internal gains												
512.4519	510.1359	493.2445	465.7677	437.3897	410.4345	393.1755	399.7796	414.1179	441.8289	473.6803	498.0296	(73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W					
						Table 6d						
North	4.0100	10.6334	0.6300		0.7000	0.7700	13.0313	(74)				
East	7.3300	19.6403	0.6300		0.7000	0.7700	43.9970	(76)				
South	1.2100	46.7521	0.6300		0.7000	0.7700	17.2885	(78)				
West	9.5200	19.6403	0.6300		0.7000	0.7700	57.1421	(80)				
Solar gains	131.4589	251.0672	404.2143	583.9395	716.4229	735.0718	699.0362	598.9368	467.5091	294.9490	162.6772	108.9743 (83)
Total gains	643.9109	761.2031	897.4588	1049.7072	1153.8126	1145.5063	1092.2117	998.7163	881.6270	736.7779	636.3574	607.0039 (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	57.4791	57.6587	57.8359	58.6827	58.8439	59.6061	59.6061	59.7494	59.3102	58.8439	58.5187	58.1825
alpha	4.8319	4.8439	4.8557	4.9122	4.9229	4.9737	4.9737	4.9833	4.9540	4.9229	4.9012	4.8788
util living area	0.9989	0.9974	0.9917	0.9674	0.8913	0.7320	0.5640	0.6313	0.8799	0.9852	0.9977	0.9992 (86)
MIT	19.6078	19.7670	20.0488	20.4291	20.7507	20.9360	20.9859	20.9762	20.8304	20.4013	19.9396	19.5881 (87)
Th 2	19.9135	19.9165	19.9194	19.9333	19.9359	19.9481	19.9481	19.9503	19.9434	19.9359	19.9307	19.9252 (88)
util rest of house	0.9986	0.9964	0.9885	0.9544	0.8481	0.6394	0.4378	0.5025	0.8150	0.9772	0.9968	0.9989 (89)
MIT 2	18.0528	18.2876	18.7000	19.2546	19.6876	19.9049	19.9429	19.9403	19.8011	19.2243	18.5502	18.0322 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	18.2940	18.5170	18.9092	19.4367	19.8525	20.0649	20.1046	20.1010	19.9607	19.4068	18.7657	18.2735 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2940	18.5170	18.9092	19.4367	19.8525	20.0649	20.1046	20.1010	19.9607	19.4068	18.7657	18.2735 (93)

8. Space heating requirement

Utilisation	0.9977	0.9946	0.9842	0.9464	0.8441	0.6506	0.4574	0.5221	0.8163	0.9715	0.9951	0.9983 (94)
Useful gains	642.4118	757.0823	883.3119	993.4282	973.9341	745.3213	499.5439	521.4427	719.6298	715.7688	633.2348	605.9458 (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	2093.0994	2030.3739	1844.6101	1543.6676	1191.0957	788.2170	505.4871	532.5275	849.5346	1286.6959	1713.8556	2079.5382 (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	1079.3116	855.6520	715.2058	396.1724	161.5682	0.0000	0.0000	0.0000	0.0000	424.7698	778.0470	1096.3527 (98)
Space heating												5507.0796 (98)
Space heating per m2										(98) / (4) =		44.4837 (99)

8c. Space cooling requirement

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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													5889.9247 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1079.3116	855.6520	715.2058	396.1724	161.5682	0.0000	0.0000	0.0000	0.0000	424.7698	778.0470	1096.3527	(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)	1154.3440	915.1358	764.9260	423.7138	172.8003	0.0000	0.0000	0.0000	0.0000	454.2992	832.1358	1172.5698	(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	88.5235	88.3478	87.9303	86.8827	84.6071	79.8000	79.8000	79.8000	79.8000	86.9621	88.1227	79.8000	(216)
Fuel for water heating, kWh/month	243.5791	215.0268	226.6804	205.3493	206.4214	195.2105	187.1503	205.8148	205.5933	212.7558	222.3827	237.4451	(219)
Water heating fuel used												2563.4095	(219)
Annual totals kWh/year													
Space heating fuel - main system												5889.9247	(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)												467.1940	(232)
Total delivered energy for all uses												8995.5282	(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	5889.9247	0.2160	1272.2237	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2563.4095	0.2160	553.6965	(264)
Space and water heating			1825.9202	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.1940	0.5190	242.4737	(268)
Total CO2, kg/m2/year			2107.3189	(272)
Emissions per m2 for space and water heating			14.7490	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9586	(272b)
Emissions per m2 for pumps and fans			0.3144	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7490 * 1.00) + 1.9586 + 0.3144, rounded to 2 d.p.			17.0200	(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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3573 (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) =	0.3573 (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	0.4555	0.4466	0.4377	0.3930	0.3841	0.3394	0.3394	0.3305	0.3573	0.3841	0.4019	0.4198 (22b)
Effective ac	0.6038	0.5997	0.5958	0.5772	0.5738	0.5576	0.5576	0.5546	0.5638	0.5738	0.5808	0.5881 (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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392		(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)							(28)...(30) + (32) + (32a)...(32e) = 10183.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.2603 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)
Total fabric heat loss							(33) + (36) = 93.9874 (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	62.6148	62.1970	61.7874	59.8637	59.5038	57.8283	57.8283	57.5181	58.4737	59.5038	60.2319	60.9931 (38)
Heat transfer coeff	156.6022	156.1844	155.7748	153.8511	153.4912	151.8157	151.8157	151.5054	152.4611	153.4912	154.2193	154.9805 (39)
Average = Sum(39)m / 12 =												153.8494 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2650	1.2616	1.2583	1.2427	1.2398	1.2263	1.2263	1.2238	1.2315	1.2398	1.2457	1.2519 (40)
HLP (average)												1.2427 (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)

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	26.4545	23.4966	19.1087	14.4665	10.8139	9.1296	9.8648	12.8227	17.2105	21.8527	25.5054	27.1897	(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	430.4576	428.9962	413.8798	388.8160	362.0046	337.2554	321.8713	326.0730	339.5579	364.7713	393.8025	416.8864	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.0100	10.6334	0.7200	0.7000	0.7700	14.8929 (74)			
East				7.3300	19.6403	0.7200	0.7000	0.7700	50.2823 (76)			
South				1.2100	46.7521	0.7200	0.7000	0.7700	19.7583 (78)			
West				5.0100	19.6403	0.7200	0.7000	0.7700	34.3676 (80)			
West				4.5100	19.6403	0.7200	0.7000	0.7700	30.9377 (80)			
Solar gains	150.2388	286.9339	461.9592	667.3595	818.7691	840.0821	798.8986	684.4991	534.2961	337.0845	185.9167	124.5420 (83)
Total gains	580.6963	715.9302	875.8390	1056.1755	1180.7737	1177.3374	1120.7698	1010.5722	873.8540	701.8558	579.7193	541.4284 (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	18.0639	18.1122	18.1598	18.3869	18.4300	18.6334	18.6334	18.6716	18.5545	18.4300	18.3430	18.2529	
alpha	2.2043	2.2075	2.2107	2.2258	2.2287	2.2422	2.2422	2.2448	2.2370	2.2287	2.2229	2.2169	
util living area	0.9716	0.9545	0.9208	0.8540	0.7528	0.6230	0.5032	0.5570	0.7523	0.9034	0.9595	0.9755	(86)
MIT	17.8279	18.1644	18.7485	19.5036	20.1592	20.6264	20.8368	20.7894	20.3821	19.4979	18.5274	17.7744	(87)
Th 2	19.8684	19.8710	19.8737	19.8860	19.8883	19.8990	19.8990	19.9010	19.8949	19.8883	19.8836	19.8787	(88)
util rest of house	0.9674	0.9479	0.9090	0.8313	0.7115	0.5534	0.4030	0.4579	0.6949	0.8835	0.9526	0.9719	(89)
MIT 2	16.9667	17.3012	17.8781	18.6193	19.2378	19.6590	19.8219	19.7948	19.4622	18.6307	17.6729	16.9202	(90)
Living area fraction	17.1002	17.4351	18.0131	18.7565	19.3807	19.8090	19.9793	19.9490	19.6049	18.7652	17.8054	17.0527	(91)
MIT	17.1002	17.4351	18.0131	18.7565	19.3807	19.8090	19.9793	19.9490	19.6049	18.7652	17.8054	17.0527	(92)
Temperature adjustment	17.1002	17.4351	18.0131	18.7565	19.3807	19.8090	19.9793	19.9490	19.6049	18.7652	17.8054	17.0527	(93)
adjusted MIT	17.1002	17.4351	18.0131	18.7565	19.3807	19.8090	19.9793	19.9490	19.6049	18.7652	17.8054	17.0527	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	553.3036	664.6051	773.7162	848.0699	814.4173	644.0485	460.6379	467.6157	591.6058	601.6156	541.6849	519.1305	(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	2004.5455	1957.7849	1793.4497	1516.4268	1178.9193	790.8103	513.0370	537.6968	839.2785	1253.2870	1650.9825	1991.9183	(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	1079.7239	869.0168	758.6817	481.2170	271.1895	0.0000	0.0000	0.0000	0.0000	484.8435	798.6943	1095.7541	(98)
Space heating												5839.1209	(98)
Space heating per m2												47.1658	(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	

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Calculation Type: New Build (As Built)



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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1427.0678	1123.4363	1151.4414	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7069	0.7687	0.7319	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1008.8511	863.5951	842.7881	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1492.5783	1423.8565	1297.2988	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	348.2836	416.8345	338.1560	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1103.2740	(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	87.0709	104.2086	84.5390	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												275.8185	(107)
Space cooling per m2												2.2279	(108)
Energy for space heating												47.1658	(99)
Energy for space cooling												2.2279	(108)
Total												49.3937	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.4	(109)

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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	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																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)			22.0700	1.3258	29.2595			(27)					
150mm EPS B&B			62.6000	0.1300	8.1380			(28a)					
140mm Timber Frame	164.4200	24.1900	140.2300	0.1800	25.2414			(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) =	72.8969		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8212	(36)					
Total fabric heat loss						(33) + (36) =	85.7181	(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	149.5713	149.1054	148.6487	146.5036	146.1022	144.2339	144.2339	143.8879	144.9536	146.1022	146.9141	147.7629	(39)
Average = Sum(39)m / 12 =												146.5016	(39)
HLP	Jan 1.2082	Feb 1.2044	Mar 1.2007	Apr 1.1834	May 1.1801	Jun 1.1651	Jul 1.1651	Aug 1.1623	Sep 1.1709	Oct 1.1801	Nov 1.1867	Dec 1.1936	(40)
HLP (average)												1.1834	(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												
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)

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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	26.4545	23.4966	19.1087	14.4665	10.8139	9.1296	9.8648	12.8227	17.2105	21.8527	25.5054	27.1897	(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	430.4576	428.9962	413.8798	388.8160	362.0046	337.2554	321.8713	326.0730	339.5579	364.7713	393.8025	416.8864	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0100	10.6334	0.6300	0.7000	0.7700	13.0313	(74)
East	7.3300	19.6403	0.6300	0.7000	0.7700	43.9970	(76)
South	1.2100	46.7521	0.6300	0.7000	0.7700	17.2885	(78)
West	9.5200	19.6403	0.6300	0.7000	0.7700	57.1421	(80)

Solar gains	131.4589	251.0672	404.2143	583.9395	716.4229	735.0718	699.0362	598.9368	467.5091	294.9490	162.6772	108.9743	(83)
Total gains	561.9165	680.0634	818.0941	972.7556	1078.4275	1072.3272	1020.9075	925.0098	807.0670	659.7202	556.4797	525.8607	(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	57.4791	57.6587	57.8359	58.6827	58.8439	59.6061	59.6061	59.7494	59.3102	58.8439	58.5187	58.1825	
alpha	4.8319	4.8439	4.8557	4.9122	4.9229	4.9737	4.9737	4.9833	4.9540	4.9229	4.9012	4.8788	
util living area	0.9994	0.9984	0.9944	0.9756	0.9113	0.7647	0.5982	0.6712	0.9075	0.9906	0.9988	0.9996	(86)
MIT	19.5465	19.7068	19.9913	20.3790	20.7163	20.9220	20.9819	20.9689	20.7976	20.3467	19.8800	19.5273	(87)
Th 2	19.9135	19.9165	19.9194	19.9333	19.9359	19.9481	19.9481	19.9503	19.9434	19.9359	19.9307	19.9252	(88)
util rest of house	0.9992	0.9978	0.9922	0.9654	0.8732	0.6737	0.4669	0.5391	0.8515	0.9853	0.9982	0.9994	(89)
MIT 2	18.5819	18.7443	19.0301	19.4226	19.7386	19.9111	19.9434	19.9411	19.8226	19.3973	18.9288	18.5719	(90)
Living area fraction									fLA = Living area / (4) =			0.1551	(91)
MIT	18.7315	18.8936	19.1792	19.5709	19.8902	20.0679	20.1044	20.1005	19.9738	19.5445	19.0763	18.7201	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7315	18.8936	19.1792	19.5709	19.8902	20.0679	20.1044	20.1005	19.9738	19.5445	19.0763	18.7201	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9989	0.9970	0.9901	0.9609	0.8713	0.6852	0.4874	0.5594	0.8535	0.9826	0.9976	0.9992	(94)
Ext temp.	561.2932	678.0520	809.9863	934.7194	939.6098	734.8046	497.6042	517.4922	688.8306	648.2289	555.1291	525.4442	(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	2158.5410	2086.5186	1884.7471	1563.3288	1196.6085	788.6501	505.4556	532.4533	851.4311	1306.8130	1759.4850	2145.5265	(97a)
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	(97b)
Space heating per m2	1188.3524	946.4896	799.6221	452.5987	191.2071	0.0000	0.0000	0.0000	0.0000	489.9866	867.1362	1205.3412	(98)
												6140.7339	(98)
												49.6021	(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	1355.7989	1067.3311	1093.5484	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8369	0.9046	0.8682	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1134.6140	965.5447	949.4489	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1369.8391	1307.1343	1197.2908	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	169.3620	254.1427	184.3944	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			607.8991 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	42.3405	63.5357	46.0986	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												151.9748 (107)
Energy for space heating												1.2276 (108)
Energy for space cooling												49.6021 (99)
Total												1.2276 (108)
Target Fabric Energy Efficiency (TFEE)												50.8296 (109)
												58.5 (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															4.6000		
Infiltration rate															0.2300	(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) =					0.2300	(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	0.2530	0.2358	0.2358	0.2243	0.2243	0.2128	0.2128	0.2013	0.2013	0.2185	0.2128	0.2243	(22b)				
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000	(23a)	
Effective ac	0.5030	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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392			(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.1657	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	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419 (39)
Average = Sum(39)m / 12 =												145.8679 (39)
HLP	Jan 1.1806	Feb 1.1780	Mar 1.1780	Apr 1.1780	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1780	Dec 1.1780 (40)
HLP (average)												1.1783 (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	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	66.1361	58.7415	47.7718	36.1663	27.0348	22.8239	24.6620	32.0566	43.0263	54.6318	63.7634	67.9743 (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	736.1262	730.8560	703.6467	661.2529	617.3557	578.4377	555.9775	565.5357	590.1920	632.8200	680.1905	716.5027 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					4.0100	13.4839	0.7200	0.7000			0.7700			18.8853 (74)
East					7.3300	25.1925	0.7200	0.7000			0.7700			64.4970 (76)
South					1.2100	56.7559	0.7200	0.7000			0.7700			23.9861 (78)
West					5.0100	25.1925	0.7200	0.7000			0.7700			44.0832 (80)
West					4.5100	25.1925	0.7200	0.7000			0.7700			39.6837 (80)
Solar gains	191.1354	311.1018	505.0805	733.1595	849.3280	954.7704	876.2444	784.4655	612.1845	389.4543	235.8688	149.9041	(83)	
Total gains	927.2616	1041.9578	1208.7272	1394.4124	1466.6837	1533.2081	1432.2219	1350.0012	1202.3766	1022.2743	916.0593	866.4068	(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	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457
alpha	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630
util living area	0.9254	0.9022	0.8470	0.7502	0.6142	0.4356	0.3186	0.3358	0.5659	0.7845	0.8929	0.9334 (86)
MIT	18.7951	19.0410	19.5558	20.1335	20.6100	20.8821	20.9613	20.9566	20.7658	20.2075	19.4174	18.7466 (87)
Th 2	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376 (88)
util rest of house	0.9151	0.8890	0.8262	0.7161	0.5596	0.3584	0.2225	0.2353	0.4887	0.7450	0.8756	0.9240 (89)
MIT 2	17.0379	17.3893	18.1174	18.9128	19.5364	19.8481	19.9201	19.9178	19.7357	19.0372	17.9359	16.9708 (90)
Living area fraction	17.3104	17.6455	18.3405	19.1021	19.7029	20.0085	20.0816	20.0789	19.8955	19.2187	18.1656	17.2462 (92)
MIT	17.3104	17.6455	18.3405	19.1021	19.7029	20.0085	20.0816	20.0789	19.8955	19.2187	18.1656	17.2462 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1604	17.4955	18.1905	18.9521	19.5529	19.8585	19.9316	19.9289	19.7455	19.0687	18.0156	17.0962 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8773	0.8479	0.7831	0.6792	0.5377	0.3523	0.2219	0.2344	0.4732	0.7056	0.8335	0.8878 (94)
Ext temp.	813.4418	883.5150	946.5138	947.0904	788.6227	540.1201	317.8221	316.4645	568.9829	721.3193	763.4917	769.1611 (95)
Heat loss rate W	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1718.8169	1691.1079	1544.5346	1305.5989	941.1015	577.3083	325.4581	325.0697	648.3374	1030.9165	1402.3619	1691.2108 (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	673.5991	542.7024	444.9275	258.1261	113.4443	0.0000	0.0000	0.0000	0.0000	230.3403	459.9866	686.0050 (98)
RHI space heating demand												3409.1312 (98)
												3409 (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												4.6000
Infiltration rate												0.2300 (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) =	0.2300 (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												
	0.2933	0.2875	0.2818	0.2530	0.2473	0.2185	0.2185	0.2128	0.2300	0.2473	0.2588	0.2703 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5433	0.5375	0.5318	0.5030	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5088	0.5203 (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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392		(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.3400	Feb 55.7436	Mar 55.1473	Apr 52.1657	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.7620	Dec 53.9547 (38)
Heat transfer coeff	150.3274	149.7310	149.1347	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	146.7494	147.9420 (39)
Average = Sum(39)m / 12 =												147.0908 (39)
HLP	Jan 1.2143	Feb 1.2095	Mar 1.2046	Apr 1.1806	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1854	Dec 1.1950 (40)
HLP (average)												1.1881 (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	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	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	66.1361	58.7415	47.7718	36.1663	27.0348	22.8239	24.6620	32.0566	43.0263	54.6318	63.7634	67.9743 (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	736.1262	730.8560	703.6467	661.2529	617.3557	578.4377	555.9775	565.5357	590.1920	632.8200	680.1905	716.5027 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.0100	10.6334	0.7200	0.7000	0.7700	14.8929 (74)			
East				7.3300	19.6403	0.7200	0.7000	0.7700	50.2823 (76)			
South				1.2100	46.7521	0.7200	0.7000	0.7700	19.7583 (78)			
West				5.0100	19.6403	0.7200	0.7000	0.7700	34.3676 (80)			
West				4.5100	19.6403	0.7200	0.7000	0.7700	30.9377 (80)			
Solar gains	150.2388	286.9339	461.9592	667.3595	818.7691	840.0821	798.8986	684.4991	534.2961	337.0845	185.9167	124.5420 (83)
Total gains	886.3650	1017.7899	1165.6059	1328.6123	1436.1248	1418.5198	1354.8760	1250.0349	1124.4881	969.9045	866.1073	841.0447 (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	19.8357	19.9147	19.9943	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.3193	20.1555
alpha	2.3224	2.3276	2.3330	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3546	2.3437
util living area	0.9405	0.9177	0.8750	0.7949	0.6823	0.5472	0.4272	0.4715	0.6628	0.8388	0.9189	0.9464 (86)
MIT	18.4320	18.7346	19.2441	19.8954	20.4157	20.7560	20.9024	20.8736	20.5948	19.9086	19.0744	18.3942 (87)
Th 2	19.9086	19.9124	19.9163	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9317	19.9240 (88)
util rest of house	0.9325	0.9068	0.8582	0.7670	0.6378	0.4796	0.3381	0.3812	0.6003	0.8104	0.9063	0.9391 (89)
MIT 2	16.4995	16.9354	17.6643	18.5870	19.2888	19.7146	19.8724	19.8479	19.5368	18.6286	17.4423	16.4533 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	16.7992	17.2144	17.9093	18.7899	19.4636	19.8761	20.0322	20.0070	19.7009	18.8271	17.6954	16.7543 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6492	17.0644	17.7593	18.6399	19.3136	19.7261	19.8822	19.8570	19.5509	18.6771	17.5454	16.6043 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8973	0.8670	0.8146	0.7262	0.6083	0.4650	0.3331	0.3738	0.5744	0.7675	0.8670	0.9061 (94)
Useful gains	795.3646	882.3891	949.4650	964.8688	873.5291	659.5458	451.3667	467.2385	645.8572	744.3537	750.9024	762.0431 (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	1856.4207	1821.3903	1679.1490	1423.5138	1110.3797	747.5970	478.6762	504.1756	794.9672	1177.9798	1532.8579	1835.1158 (97)

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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	789.4258	631.0088	542.8849	330.2244	176.2169	0.0000	0.0000	0.0000	0.0000	322.6178	563.0080	798.3661 (98)
Space heating												4153.7526 (98)
Space heating per m2										(98) / (4) =		33.5521 (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												4584.7159 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	789.4258	631.0088	542.8849	330.2244	176.2169	0.0000	0.0000	0.0000	0.0000	322.6178	563.0080	798.3661 (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)	871.3309	696.4777	599.2107	364.4860	194.4999	0.0000	0.0000	0.0000	0.0000	356.0903	621.4216	881.1987 (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	88.1150	87.9257	87.5112	86.6046	85.0160	79.9000	79.9000	79.9000	79.9000	86.4539	87.6262	79.9000 (216)
Fuel for water heating, kWh/month	239.0031	210.8946	222.0212	200.3911	199.5150	188.8772	180.6241	199.2653	199.2469	208.1915	218.0904	232.8312 (219)
Water heating fuel used												2498.9516 (219)
Annual totals kWh/year												
Space heating fuel - main system												4584.7159 (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)												467.1940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												6867.9162 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4584.7159	3.4800	159.5481 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2498.9516	3.4800	86.9635 (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	467.1940	13.1900	61.6229 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-845.9118	13.1900	-111.5758 (252)
Total energy cost			338.0540 (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] =	0.8411 (257)
SAP value		88.2662
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	4584.7159	0.2160	990.2986 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2498.9516	0.2160	539.7735 (264)
Space and water heating			1530.0722 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	467.1940	0.5190	242.4737 (268)

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Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1418.0973 (272)
CO2 emissions per m2			11.4500 (273)
EI value			88.7426
EI rating			89 (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	$3.48 / 0.8475 = 4.106$, stars = 4
Water heating environmental impact	$0.216 / 0.8475 = 0.2549$, stars = 4

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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 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											4.6000	
Infiltration rate											0.2300	(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) =	0.2300 (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	0.2530	0.2358	0.2358	0.2243	0.2243	0.2128	0.2128	0.2013	0.2013	0.2185	0.2128	0.2243 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5030	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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =		76.9392		(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.1657	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	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419 (39)
Average = Sum(39)m / 12 =												145.8679 (39)
HLP	Jan 1.1806	Feb 1.1780	Mar 1.1780	Apr 1.1780	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1780	Dec 1.1780 (40)
HLP (average)												1.1783 (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	

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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	66.1361	58.7415	47.7718	36.1663	27.0348	22.8239	24.6620	32.0566	43.0263	54.6318	63.7634	67.9743 (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	736.1262	730.8560	703.6467	661.2529	617.3557	578.4377	555.9775	565.5357	590.1920	632.8200	680.1905	716.5027 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					4.0100	13.4839		0.7200	0.7000	0.7700		18.8853 (74)
East					7.3300	25.1925		0.7200	0.7000	0.7700		64.4970 (76)
South					1.2100	56.7559		0.7200	0.7000	0.7700		23.9861 (78)
West					5.0100	25.1925		0.7200	0.7000	0.7700		44.0832 (80)
West					4.5100	25.1925		0.7200	0.7000	0.7700		39.6837 (80)

Solar gains	191.1354	311.1018	505.0805	733.1595	849.3280	954.7704	876.2444	784.4655	612.1845	389.4543	235.8688	149.9041 (83)
Total gains	927.2616	1041.9578	1208.7272	1394.4124	1466.6837	1533.2081	1432.2219	1350.0012	1202.3766	1022.2743	916.0593	866.4068 (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	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457
alpha	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630
util living area	0.9254	0.9022	0.8470	0.7502	0.6142	0.4356	0.3186	0.3358	0.5659	0.7845	0.8929	0.9334 (86)
MIT	18.7951	19.0410	19.5558	20.1335	20.6100	20.8821	20.9613	20.9566	20.7658	20.2075	19.4174	18.7466 (87)
Th 2	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376 (88)
util rest of house	0.9151	0.8890	0.8262	0.7161	0.5596	0.3584	0.2225	0.2353	0.4887	0.7450	0.8756	0.9240 (89)
MIT 2	17.0379	17.3893	18.1174	18.9128	19.5364	19.8481	19.9201	19.9178	19.7357	19.0372	17.9359	16.9708 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	17.3104	17.6455	18.3405	19.1021	19.7029	20.0085	20.0816	20.0789	19.8955	19.2187	18.1656	17.2462 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1604	17.4955	18.1905	18.9521	19.5529	19.8585	19.9316	19.9289	19.7455	19.0687	18.0156	17.0962 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8773	0.8479	0.7831	0.6792	0.5377	0.3523	0.2219	0.2344	0.4732	0.7056	0.8335	0.8878 (94)
Ext temp.	813.4418	883.5150	946.5138	947.0904	788.6227	540.1201	317.8221	316.4645	568.9829	721.3193	763.4917	769.1611 (95)
Heat loss rate W	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	1718.8169	1691.1079	1544.5346	1305.5989	941.1015	577.3083	325.4581	325.0697	648.3374	1030.9165	1402.3619	1691.2108 (97)

FULL SAP CALCULATION PRINTOUT

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

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	673.5991	542.7024	444.9275	258.1261	113.4443	0.0000	0.0000	0.0000	0.0000	230.3403	459.9866	686.0050 (98)
Space heating												3409.1312 (98)
Space heating per m2										(98) / (4) =		27.5374 (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												3762.8380 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.5991	542.7024	444.9275	258.1261	113.4443	0.0000	0.0000	0.0000	0.0000	230.3403	459.9866	686.0050 (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)	743.4869	599.0092	491.0899	284.9074	125.2144	0.0000	0.0000	0.0000	0.0000	254.2388	507.7115	757.1799 (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	87.7995	87.6121	87.0564	85.9714	83.8697	79.9000	79.9000	79.9000	79.9000	85.5732	87.1735	79.9000 (216)
Fuel for water heating, kWh/month	239.8618	211.6496	223.1812	201.8671	202.2420	188.8772	180.6241	199.2653	199.2469	210.3341	219.2231	233.6138 (219)
Water heating fuel used												2509.9861 (219)
Annual totals kWh/year												
Space heating fuel - main system												3762.8380 (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)												467.1940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290		-933.8290 (233)
Total delivered energy for all uses												5969.1557 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3762.8380	10.2300	384.9383 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2509.9861	10.2300	256.7716 (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	467.1940	36.7200	171.5536 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-933.8290	36.7200	-342.9020 (252)
Total energy cost			633.2029 (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	3762.8380	0.2160	812.7730 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2509.9861	0.2160	542.1570 (264)
Space and water heating			1354.9300 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	467.1940	0.5190	242.4737 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			1197.3261 (272)

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

Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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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	3762.8380	1.2200	4590.6624 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2509.9861	1.2200	3062.1830 (264)
Space and water heating			7652.8454 (265)
Pumps and fans	162.9666	3.0700	500.3073 (267)
Energy for lighting	467.1940	3.0700	1434.2856 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			6720.5834 (272)
Primary energy kWh/m2/year			54.2858 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(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	-264 kg (22.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£119 2.13 kg/m²	B 90	B 91
Total Savings	£119 2.13 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 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	£231	£250	-£18
Mains gas	£745	£608	£137
Space heating	£548	£550	-£2
Water heating	£257	£136	£121
Lighting	£172	£172	£0
Generated (PV)	-£343	-£343	£0
Total cost of fuels	£633	£515	£119
Total cost of uses	£634	£515	£119
Delivered energy	48 kWh/m²	38 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	42 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												4.6000
Infiltration rate												0.2300 (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) =	0.2300 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.2933	0.2875	0.2818	0.2530	0.2473	0.2185	0.2185	0.2128	0.2300	0.2473	0.2588	0.2703 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5433	0.5375	0.5318	0.5030	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5088	0.5203 (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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392		(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.3400	Feb 55.7436	Mar 55.1473	Apr 52.1657	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.7620	Dec 53.9547 (38)
Heat transfer coeff	150.3274	149.7310	149.1347	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	146.7494	147.9420 (39)
Average = Sum(39)m / 12 =												147.0908 (39)
HLP	Jan 1.2143	Feb 1.2095	Mar 1.2046	Apr 1.1806	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1854	Dec 1.1950 (40)
HLP (average)												1.1881 (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	66.1361	58.7415	47.7718	36.1663	27.0348	22.8239	24.6620	32.0566	43.0263	54.6318	63.7634	67.9743	(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	728.6062	723.3360	694.6258	646.2288	596.0783	556.9102	534.4500	545.0087	576.6688	623.7992	672.6705	708.9826	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				4.0100	10.6334		0.7200		0.7000	0.7700		14.8929 (74)	
East				7.3300	19.6403		0.7200		0.7000	0.7700		50.2823 (76)	
South				1.2100	46.7521		0.7200		0.7000	0.7700		19.7583 (78)	
West				5.0100	19.6403		0.7200		0.7000	0.7700		34.3676 (80)	
West				4.5100	19.6403		0.7200		0.7000	0.7700		30.9377 (80)	
Solar gains	150.2388	286.9339	461.9592	667.3595	818.7691	840.0821	798.8986	684.4991	534.2961	337.0845	185.9167	124.5420	(83)
Total gains	878.8449	1010.2699	1156.5850	1313.5883	1414.8474	1396.9922	1333.3485	1229.5079	1110.9649	960.8837	858.5872	833.5247	(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	19.8357	19.9147	19.9943	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.3193	20.1555
alpha	2.3224	2.3276	2.3330	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3546	2.3437
util living area												
	0.9414	0.9188	0.8766	0.7982	0.6877	0.5530	0.4328	0.4775	0.6672	0.8412	0.9201	0.9473 (86)
MIT	18.4224	18.7257	19.2348	19.8836	20.4050	20.7503	20.8997	20.8700	20.5885	19.9003	19.0654	18.3844 (87)
Th 2	19.9086	19.9124	19.9163	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9317	19.9240 (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	0.9335	0.9080	0.8600	0.7706	0.6434	0.4852	0.3429	0.3866	0.6049	0.8130	0.9078	0.9402 (89)
Living area fraction	16.4858	16.9228	17.6514	18.5714	19.2758	19.7088	19.8704	19.8452	19.5299	18.6176	17.4296	16.4393 (90)
MIT	16.7862	17.2024	17.8970	18.7749	19.4509	19.8703	20.0300	20.0041	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.6941	18.8165	17.6833	16.7409 (92)
adjusted MIT	16.6362	17.0524	17.7470	18.6249	19.3009	19.7203	19.8800	19.8541	19.5441	18.6665	17.5333	-0.1500
												16.5909 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8986	0.8683	0.8164	0.7295	0.6133	0.4701	0.3377	0.3788	0.5785	0.7700	0.8686	0.9074 (94)	
Useful gains	789.7697	877.2653	944.2090	958.3275	867.6652	656.6824	450.2560	465.7592	642.6596	739.8431	745.7886	756.3145 (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	1854.4653	1819.5922	1677.3124	1421.3218	1108.5360	746.7616	478.3638	503.7543	793.9742	1176.4411	1531.0841	1833.1386 (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	792.1335	633.2437	545.4289	333.3559	179.2079	0.0000	0.0000	0.0000	0.0000	324.8289	565.4128	801.1571 (98)	
Space heating per m2												4174.7687 (98)	
												(98) / (4) =	33.7219 (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	4607.9125 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	792.1335	633.2437	545.4289	333.3559	179.2079	0.0000	0.0000	0.0000	0.0000	324.8289	565.4128	801.1571 (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)	874.3196	698.9445	602.0186	367.9425	197.8012	0.0000	0.0000	0.0000	0.0000	358.5308	624.0759	884.2793 (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													
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	88.4432	88.5337	88.6310	88.8812	89.3113	79.9000	79.9000	79.9000	79.9000	87.5639	88.1000	79.9000 (216)	
Fuel for water heating, kWh/month	199.4061	150.9634	122.3953	63.3012	24.2308	6.8911	0.0000	39.3782	77.5032	129.6030	172.5569	198.4037 (219)	
Water heating fuel used												1184.6328 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4607.9125 (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)	467.1940 (232)

Energy saving/generation technologies (Appendices M, N and Q)

PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =	-845.9118	-845.9118 (233)
Total delivered energy for all uses		5626.7940 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4607.9125	3.4800	160.3554 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1184.6328	3.4800	41.2252 (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	467.1940	13.1900	61.6229 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-845.9118	13.1900	-111.5758 (252)	
Total energy cost			299.7180 (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) x (256)] / [(4) + 45.0] = 0.7457 (257)
SAP value 89.5969
SAP rating (Section 12) 90 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4607.9125	0.2160	995.3091 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1184.6328	0.2160	255.8807 (264)
Space and water heating			1251.1898 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	467.1940	0.5190	242.4737 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1165.1649 (272)
CO2 emissions per m2			9.4100 (273)
EI value			90.7505
EI rating			91 (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	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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.6000		
Number of sides sheltered															0.2300 (18)		
															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2300 (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																	
	0.2530	0.2358	0.2358	0.2243	0.2243	0.2128	0.2128	0.2013	0.2013	0.2185	0.2128	0.2243 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5030	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)			17.5600	1.3258	23.2803		(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	24.1900	140.2300	0.1900	26.6437	9.0000	1262.0700 (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) =	76.9392			(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) =		10734.6300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.7095 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0482 (36)					
Total fabric heat loss						(33) + (36) =	93.9874 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.1657	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	146.1531	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419	145.8419 (39)
Average = Sum(39)m / 12 =												145.8679 (39)
HLP	Jan 1.1806	Feb 1.1780	Mar 1.1780	Apr 1.1780	May 1.1780	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1780	Nov 1.1780	Dec 1.1780 (40)
HLP (average)												1.1783 (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	66.1361	58.7415	47.7718	36.1663	27.0348	22.8239	24.6620	32.0566	43.0263	54.6318	63.7634	67.9743	(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	728.6062	723.3360	694.6258	646.2288	596.0783	556.9102	534.4500	545.0087	576.6688	623.7992	672.6705	708.9826	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					4.0100	13.4839		0.7200	0.7000		0.7700		18.8853 (74)	
East					7.3300	25.1925		0.7200	0.7000		0.7700		64.4970 (76)	
South					1.2100	56.7559		0.7200	0.7000		0.7700		23.9861 (78)	
West					5.0100	25.1925		0.7200	0.7000		0.7700		44.0832 (80)	
West					4.5100	25.1925		0.7200	0.7000		0.7700		39.6837 (80)	
Solar gains	191.1354	311.1018	505.0805	733.1595	849.3280	954.7704	876.2444	784.4655	612.1845	389.4543	235.8688	149.9041	(83)	
Total gains	919.7415	1034.4377	1199.7063	1379.3883	1445.4063	1511.6806	1410.6943	1329.4742	1188.8533	1013.2535	908.5393	858.8867	(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	20.4022	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457
alpha	2.3601	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630	2.3630
util living area	0.9265	0.9035	0.8488	0.7537	0.6197	0.4405	0.3230	0.3404	0.5702	0.7872	0.8944	0.9345 (86)
MIT	18.7859	19.0325	19.5473	20.1236	20.6021	20.8791	20.9602	20.9553	20.7619	20.2007	19.4091	18.7371 (87)
Th 2	19.9356	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376	19.9376 (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	0.9164	0.8904	0.8282	0.7198	0.5651	0.3628	0.2257	0.2387	0.4928	0.7479	0.8773	0.9252 (89)
Living area fraction	17.0248	17.3774	18.1058	18.9001	19.5275	19.8457	19.9195	19.9172	19.7319	19.0286	17.9244	16.9574 (90)
MIT	17.2979	17.6340	18.3294	19.0898	19.6942	20.0060	20.0809	20.0782	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.8917	19.2104	18.1547	17.2334 (92)
adjusted MIT	17.1479	17.4840	18.1794	18.9398	19.5442	19.8560	19.9309	19.9282	19.7417	19.0604	18.0047	-0.1500
												17.0834 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8787	0.8494	0.7850	0.6826	0.5427	0.3564	0.2251	0.2378	0.4770	0.7083	0.8353	0.8892 (94)	
Useful gains	808.1761	878.6868	941.7734	941.5840	784.4079	538.8210	317.4882	316.0882	567.0980	717.6750	758.8670	763.7330 (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	1716.9985	1689.4392	1542.9138	1303.7989	939.8279	576.9454	325.3627	324.9619	647.7816	1029.7040	1400.7629	1689.3425 (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	676.1639	544.8256	447.2485	260.7948	115.6325	0.0000	0.0000	0.0000	0.0000	232.1496	462.1651	688.6535 (98)	
Space heating per m2												3427.6334 (98)	
												(98) / (4) =	27.6869 (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													3783.2598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	676.1639	544.8256	447.2485	260.7948	115.6325	0.0000	0.0000	0.0000	0.0000	232.1496	462.1651	688.6535 (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)	746.3178	601.3528	493.6517	287.8530	127.6297	0.0000	0.0000	0.0000	0.0000	256.2357	510.1160	760.1032 (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													
Efficiency of water heater (217)m	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)	
Fuel for water heating, kWh/month	88.2095	88.2730	88.3073	88.5555	88.4065	79.9000	79.9000	79.9000	79.9000	86.8714	87.7720	79.9000 (216)	
Annual totals kWh/year	194.4794	151.2740	121.8061	61.3477	29.7445	0.0000	0.0000	30.7409	70.9987	126.0491	166.8234	196.0193 (219)	
Space heating fuel - main system												3783.2598 (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)													467.1940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290			-933.8290 (233)
Total delivered energy for all uses													4678.8745 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3783.2598	10.2300	387.0275 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1149.2831	10.2300	117.5717 (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	467.1940	36.7200	171.5536 (250)	
Additional standing charges			103.0000 (251)	
Energy saving/generation technologies				
PV Unit	-933.8290	36.7200	-342.9020 (252)	
Total energy cost			514.4521 (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	3783.2598	0.2160	817.1841 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.2831	0.2160	248.2452 (264)
Space and water heating			1065.4293 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	467.1940	0.5190	242.4737 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			933.7754 (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	3783.2598	1.2200	4615.5770 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.2831	1.2200	1402.1254 (264)
Space and water heating			6017.7023 (265)
Pumps and fans	212.9666	3.0700	653.8073 (267)
Energy for lighting	467.1940	3.0700	1434.2856 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			5238.9403 (272)
Primary energy kWh/m2/year			42.3178 (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	East
Overshading	Average or unknown
Thermal mass parameter	86.7 (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	93.99 (37)
Summer heat loss coefficient	508.82 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0100	87.1704	0.7200	0.7000	0.9000	142.7017
East	7.3300	125.2818	0.7200	0.7000	0.9000	374.8931
South	1.2100	118.5567	0.7200	0.7000	0.9000	58.5635
West	5.0100	125.2818	0.7200	0.7000	0.9000	256.2366
West	4.5100	125.2818	0.7200	0.7000	0.9000	230.6641
total:						1063.0590

Solar gains	Jun 1145	Jul 1063	Aug 932	(P3)
Internal gains	575	553	563	
Total summer gains	1720	1616	1494	(P5)
Summer gain/loss ratio	3.38	3.18	2.94	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 86.7)	1.39	1.39	1.39	
Threshold temperature	20.17	21.87	21.63	(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