

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-168				Issued on Date	27/09/2022
Assessment Reference	As Built	Prop Type Ref	G Det Op			
Property	8, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS					
SAP Rating		88 B	DER	12.43	TER	16.70
Environmental		89 B	% DER<TER	25.58		
CO ₂ Emissions (t/year)		1.19	DFEE	48.57	TFEE	56.83
General Requirements Compliance		Pass	% DFEE<TFEE	14.53		
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) 16.70 kgCO₂/m²

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

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.6 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:	4.79 (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 s15

Efficiency: 89.4% 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
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Boiler interlock	Yes	OK
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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 (Thames Valley):	Medium	OK
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Based on:

Overshading:	Average	
Windows facing North:	1.21 m ² , No overhang	
Windows facing East:	9.52 m ² , No overhang	
Windows facing South:	4.01 m ² , No overhang	
Windows facing West:	7.33 m ² , No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Photovoltaic array	0.96 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	(8)
Measured/design AP50											4.7900	
Infiltration rate											0.2395 (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) =	0.2395 (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)
	0.3054	0.2994	0.2934	0.2635	0.2575	0.2275	0.2275	0.2215	0.2395	0.2575	0.2694	0.2814 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5554	0.5494	0.5434	0.5135	0.5075	0.5000	0.5000	0.5000	0.5000	0.5075	0.5194	0.5314 (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 57.5961	Feb 56.9752	Mar 56.3542	Apr 53.2494	May 52.6285	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 52.6285	Nov 53.8704	Dec 55.1123 (38)
Heat transfer coeff	151.5835	150.9626	150.3416	147.2368	146.6159	145.8419	145.8419	145.8419	145.8419	146.6159	147.8578	149.0997 (39)
Average = Sum(39)m / 12 =												147.8068 (39)
HLP	Jan 1.2244	Feb 1.2194	Mar 1.2144	Apr 1.1893	May 1.1843	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1843	Nov 1.1943	Dec 1.2044 (40)
HLP (average)												1.1939 (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					1.2100	10.6334	0.7200	0.7000			0.7700			4.4939 (74)
East					5.0100	19.6403	0.7200	0.7000			0.7700			34.3676 (76)
South					4.0100	46.7521	0.7200	0.7000			0.7700			65.4800 (78)
West					7.3300	19.6403	0.7200	0.7000			0.7700			50.2823 (80)
East					4.5100	19.6403	0.7200	0.7000			0.7700			30.9377 (76)
Solar gains	185.5614	341.9412	523.5743	720.9224	858.0395	869.9709	831.4992	729.1413	593.3347	394.1937	227.2840	155.3807	(83)	
Total gains	692.6077	846.6714	1011.4131	1181.2844	1290.0234	1274.9997	1219.2690	1123.5152	1002.0470	830.6169	695.5586	648.0046	(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	19.6713	19.7522	19.8338	20.2520	20.3378	20.4457	20.4457	20.4457	20.4457	20.3378	20.1670	19.9990
alpha	2.3114	2.3168	2.3223	2.3501	2.3559	2.3630	2.3630	2.3630	2.3630	2.3559	2.3445	2.3333
util living area	0.9632	0.9416	0.9023	0.8284	0.7212	0.5876	0.4645	0.5107	0.7041	0.8749	0.9464	0.9680 (86)
MIT	18.1555	18.5035	19.0592	19.7589	20.3293	20.7141	20.8830	20.8494	20.5332	19.7641	18.8448	18.1141 (87)
Th 2	19.9005	19.9045	19.9085	19.9286	19.9326	19.9376	19.9376	19.9376	19.9376	19.9326	19.9245	19.9165 (88)
util rest of house	0.9579	0.9334	0.8883	0.8032	0.6783	0.5190	0.3705	0.4166	0.6436	0.8508	0.9375	0.9634 (89)
MIT 2	16.0987	16.6027	17.4022	18.4005	19.1797	19.6724	19.8581	19.8288	19.4683	18.4321	17.1133	16.0466 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	16.4177	16.8975	17.6592	18.6112	19.3580	19.8339	20.0170	19.9871	19.6334	18.6386	17.3819	16.3673 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.2677	16.7475	17.5092	18.4612	19.2080	19.6839	19.8670	19.8371	19.4834	18.4886	17.2319	16.2173 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9304	0.8984	0.8461	0.7603	0.6446	0.5009	0.3638	0.4069	0.6133	0.8074	0.9040	0.9384 (94)
Useful gains	644.3762	760.6291	855.7835	898.0726	831.5812	638.6643	443.5552	457.1199	614.5241	670.6234	628.7543	608.1104 (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	1814.1097	1788.5306	1655.1344	1407.7540	1100.7909	741.4487	476.4672	501.2741	785.1303	1156.6012	1498.0767	1791.7712 (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	870.2817	690.7499	594.7171	366.9707	200.2920	0.0000	0.0000	0.0000	0.0000	361.5675	625.9121	880.6436 (98)
Space heating												4591.1345 (98)
Space heating per m2										(98) / (4) =		37.0851 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5078.6886 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	870.2817	690.7499	594.7171	366.9707	200.2920	0.0000	0.0000	0.0000	0.0000	361.5675	625.9121	880.6436 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	962.7010	764.1038	657.8729	405.9410	221.5619	0.0000	0.0000	0.0000	0.0000	399.9640	692.3807	974.1633 (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	88.0956	87.9024	87.5070	86.6643	85.1576	79.7000	79.7000	79.7000	79.7000	86.5387	87.6476	79.7000 (216)
(217)m	88.0956	87.9024	87.5070	86.6643	85.1576	79.7000	79.7000	79.7000	79.7000	86.5387	87.6476	88.1622 (217)
Fuel for water heating, kWh/month	239.0556	210.9504	222.0319	200.2530	199.1833	189.3511	181.0773	199.7653	199.7469	207.9876	218.0372	232.8893 (219)
Water heating fuel used												2500.3290 (219)
Annual totals kWh/year												
Space heating fuel - main system												5078.6886 (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 * 0.96 * 1068 * 1.00) =										-820.2781		-820.2781 (233)
Total delivered energy for all uses												7388.9001 (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	5078.6886	0.2160	1096.9967 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2500.3290	0.2160	540.0711 (264)
Space and water heating			1637.0678 (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	-820.2781	0.5190	-425.7244 (269)
Total CO2, kg/year			1538.3968 (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	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476 (64)
Heat gains from water heating, kWh/month	94.3118	83.5934	88.8907	81.2093	80.6867	73.6832	72.2741	77.2265	76.4381	84.1347	87.0469	92.5572 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820 (68)
Pumps, fans	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Total internal gains	126.7632	124.3949	119.4768	112.7907	108.4499	102.3378	97.1426	103.7990	106.1640	113.0843	120.8985	124.4048 (72)
	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	FF	Access		Gains
					m2	Table 6a		Specific data	Specific data	factor		W
						W/m2		or Table 6b	or Table 6c	Table 6d		
North					1.2100	10.6334		0.6300	0.7000	0.7700		3.9321 (74)
East					9.5200	19.6403		0.6300	0.7000	0.7700		57.1421 (76)
South					4.0100	46.7521		0.6300	0.7000	0.7700		57.2950 (78)
West					7.3300	19.6403		0.6300	0.7000	0.7700		43.9970 (80)

Solar gains	162.3663	299.1985	458.1275	630.8071	750.7845	761.2245	727.5618	637.9987	519.1679	344.9195	198.8735	135.9581 (83)
Total gains	674.8182	809.3344	951.3720	1096.5748	1188.1742	1171.6591	1120.7373	1037.7782	933.2858	786.7484	672.5538	633.9877 (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												
	0.9987	0.9966	0.9894	0.9617	0.8817	0.7206	0.5512	0.6114	0.8595	0.9807	0.9971	0.9990 (86)
MIT	19.6309	19.8026	20.0874	20.4585	20.7652	20.9404	20.9873	20.9793	20.8503	20.4358	19.9665	19.6083 (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												
	0.9982	0.9954	0.9854	0.9468	0.8364	0.6277	0.4271	0.4848	0.7893	0.9707	0.9959	0.9987 (89)
MIT 2	18.0865	18.3394	18.7555	19.2948	19.7044	19.9083	19.9434	19.9418	19.8212	19.2726	18.5894	18.0617 (90)
Living area fraction												
MIT	18.3260	18.5663	18.9620	19.4753	19.8689	20.0683	20.1053	20.1027	19.9808	19.4530	18.8030	18.3016 (91)
Temperature adjustment												0.1551 (91)
adjusted MIT	18.3260	18.5663	18.9620	19.4753	19.8689	20.0683	20.1053	20.1027	19.9808	19.4530	18.8030	18.3016 (92)
												0.0000
												18.3016 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9972	0.9931	0.9805	0.9385	0.8330	0.6392	0.4464	0.5042	0.7922	0.9642	0.9939	0.9979 (94)
Ext temp.	672.9083	803.7394	932.7944	1029.1692	989.7684	748.9774	500.2423	523.2467	739.3901	758.6032	668.4231	632.6579 (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	2097.8912	2037.7231	1852.4644	1549.3178	1193.4957	788.7200	505.5824	532.7718	852.4434	1293.4359	1719.3295	2083.6910 (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	1060.1873	829.2370	684.2345	374.5070	151.5732	0.0000	0.0000	0.0000	0.0000	397.9155	756.6527	1079.5686 (98)
Space heating per m2												5333.8758 (98)
												(98) / (4) = 43.0846 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5704.6800 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1060.1873	829.2370	684.2345	374.5070	151.5732	0.0000	0.0000	0.0000	0.0000	397.9155	756.6527	1079.5686	(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)	1133.8901	886.8845	731.8016	400.5423	162.1103	0.0000	0.0000	0.0000	0.0000	425.5781	809.2542	1154.6188	(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	88.4946	88.2933	87.8429	86.7468	84.4386	79.8000	79.8000	79.8000	79.8000	86.8058	88.0707	79.8000	(216)
Fuel for water heating, kWh/month	243.6588	215.1593	226.9060	205.6709	206.8332	195.2105	187.1503	205.8148	205.5933	213.1390	222.5139	237.5104	(219)
Water heating fuel used												2565.1605	(219)
Annual totals kWh/year													
Space heating fuel - main system												5704.6800	(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												8812.0345	(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	5704.6800	0.2160	1232.2109 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2565.1605	0.2160	554.0747 (264)
Space and water heating			1786.2855 (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			2067.6842 (272)
Emissions per m2 for space and water heating			14.4288 (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) = (14.4288 * 1.00) + 1.9586 + 0.3144, rounded to 2 d.p.			16.7000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					4.7900
Infiltration rate					0.3668 (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) =	0.3668 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4676	0.4585	0.4493	0.4035	0.3943	0.3484	0.3484	0.3393	0.3668	0.3943	0.4126	0.4310 (22b)
	0.6093	0.6051	0.6009	0.5814	0.5777	0.5607	0.5607	0.5576	0.5673	0.5777	0.5851	0.5929 (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	63.1946	62.7543	62.3227	60.2953	59.9160	58.1502	58.1502	57.8232	58.8304	59.9160	60.6833	61.4856 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	157.1820	156.7417	156.3100	154.2827	153.9034	152.1376	152.1376	151.8106	152.8178	153.9034	154.6707	155.4729 (39)
												154.2809 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2696	1.2661	1.2626	1.2462	1.2432	1.2289	1.2289	1.2263	1.2344	1.2432	1.2494	1.2558 (40)
HLP (average)												1.2462 (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					1.2100	10.6334	0.7200		0.7000	0.7700		4.4939 (74)	
East					5.0100	19.6403	0.7200		0.7000	0.7700		34.3676 (76)	
South					4.0100	46.7521	0.7200		0.7000	0.7700		65.4800 (78)	
West					7.3300	19.6403	0.7200		0.7000	0.7700		50.2823 (80)	
East					4.5100	19.6403	0.7200		0.7000	0.7700		30.9377 (76)	
Solar gains	185.5614	341.9412	523.5743	720.9224	858.0395	869.9709	831.4992	729.1413	593.3347	394.1937	227.2840	155.3807	(83)
Total gains	616.0190	770.9374	937.4541	1109.7384	1220.0441	1207.2263	1153.3705	1055.2144	932.8926	758.9650	621.0865	572.2670	(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	17.9972	18.0478	18.0976	18.3354	18.3806	18.5940	18.5940	18.6340	18.5112	18.3806	18.2894	18.1951	
alpha	2.1998	2.2032	2.2065	2.2224	2.2254	2.2396	2.2396	2.2423	2.2341	2.2254	2.2193	2.2130	
util living area	0.9681	0.9479	0.9112	0.8430	0.7430	0.6144	0.4935	0.5416	0.7319	0.8902	0.9540	0.9727	(86)
MIT	17.8682	18.2286	18.8139	19.5495	20.1818	20.6364	20.8428	20.8009	20.4186	19.5578	18.5773	17.8106	(87)
Th 2	19.8647	19.8675	19.8702	19.8832	19.8856	19.8970	19.8970	19.8991	19.8926	19.8856	19.8807	19.8756	(88)
util rest of house	0.9635	0.9405	0.8982	0.8190	0.7009	0.5446	0.3941	0.4433	0.6725	0.8682	0.9462	0.9687	(89)
MIT 2	17.0040	17.3616	17.9386	18.6597	19.2548	19.6643	19.8231	19.7995	19.4892	18.6848	17.7198	16.9539	(90)
Living area fraction	17.1381	17.4961	18.0744	18.7977	19.3985	19.8150	19.9813	19.9548	19.6334	18.8202	17.8528	17.0868	(92)
MIT	17.1381	17.4961	18.0744	18.7977	19.3985	19.8150	19.9813	19.9548	19.6334	18.8202	17.8528	17.0868	(92)
Temperature adjustment	17.1381	17.4961	18.0744	18.7977	19.3985	19.8150	19.9813	19.9548	19.6334	18.8202	17.8528	17.0868	(93)
adjusted MIT	17.1381	17.4961	18.0744	18.7977	19.3985	19.8150	19.9813	19.9548	19.6334	18.8202	17.8528	17.0868	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	583.8318	708.6893	816.9352	877.5367	829.3814	650.4812	464.0154	473.5137	612.1975	638.3624	575.4446	546.2639	(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	2017.9118	1974.3316	1809.1905	1527.0417	1184.8305	793.3998	514.4208	539.6548	845.5969	1265.1196	1663.1465	2003.5440	(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	1066.9555	850.5117	738.2380	467.6436	264.4541	0.0000	0.0000	0.0000	0.0000	466.3074	783.1454	1084.2163	(98)
Space heating												5721.4721	(98)
Space heating per m2												(98) / (4) =	46.2154 (99)

8c. Space cooling requirement

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

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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1430.0937	1125.8184	1153.7608	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7138	0.7757	0.7438	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1020.7592	873.3170	858.1247	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1527.5133	1461.9612	1349.4780	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	364.8629	437.9513	365.5668	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1168.3810	(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	91.2157	109.4878	91.3917	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												292.0953	(107)
Space cooling per m2												2.3594	(108)
Energy for space heating												46.2154	(99)
Energy for space cooling												2.3594	(108)
Total												48.5749	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	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					5.0000
Infiltration rate					0.3773 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3773 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			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		(31)
Total net area of external elements Aum(A, m ²)			289.6200				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.8969	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8212 (36)
Total fabric heat loss						(33) + (36) =	85.7181 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	63.8532	63.3873	62.9306	60.7855	60.3842	58.5159	58.5159	58.1699	59.2355	60.3842	61.1961	62.0449 (38)
Heat transfer coeff	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2082	1.2044	1.2007	1.1834	1.1801	1.1651	1.1651	1.1623	1.1709	1.1801	1.1867	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	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)

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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	1.2100	10.6334	0.6300	0.7000	0.7700	3.9321 (74)
East	9.5200	19.6403	0.6300	0.7000	0.7700	57.1421 (76)
South	4.0100	46.7521	0.6300	0.7000	0.7700	57.2950 (78)
West	7.3300	19.6403	0.6300	0.7000	0.7700	43.9970 (80)

Solar gains	162.3663	299.1985	458.1275	630.8071	750.7845	761.2245	727.5618	637.9987	519.1679	344.9195	198.8735	135.9581	(83)
Total gains	592.8238	728.1948	872.0073	1019.6231	1112.7891	1098.4799	1049.4331	964.0717	858.7257	709.6908	592.6760	552.8445	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9993	0.9978	0.9926	0.9708	0.9023	0.7529	0.5841	0.6496	0.8886	0.9873	0.9983	0.9995	(86)
MIT	19.5697	19.7426	20.0305	20.4097	20.7324	20.9274	20.9836	20.9731	20.8208	20.3823	19.9070	19.5475	(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	0.9990	0.9971	0.9898	0.9589	0.8619	0.6612	0.4549	0.5191	0.8263	0.9804	0.9976	0.9993	(89)
MIT 2	18.6050	18.7800	19.0688	19.4517	19.7517	19.9140	19.9439	19.9425	19.8395	19.4317	18.9557	18.5921	(90)
Living area fraction									fLA = Living area / (4) =			0.1551	(91)
MIT	18.7546	18.9293	19.2179	19.6003	19.9038	20.0711	20.1051	20.1023	19.9917	19.5792	19.1033	18.7403	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7546	18.9293	19.2179	19.6003	19.9038	20.0711	20.1051	20.1023	19.9917	19.5792	19.1033	18.7403	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9961	0.9873	0.9541	0.8605	0.6731	0.4751	0.5393	0.8298	0.9771	0.9968	0.9990	(94)
Ext temp.	591.9944	725.3276	860.9206	972.8569	957.5243	739.3323	498.5381	519.9474	712.5292	693.4382	590.7939	552.2983	(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	2161.9950	2091.8387	1890.5037	1567.6318	1198.5956	789.1253	505.5573	532.7154	854.0202	1311.8747	1763.4492	2148.5175	(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 per m2	1168.0804	918.2955	766.0098	428.2379	179.3571	0.0000	0.0000	0.0000	0.0000	460.1167	844.3118	1187.5871	(98)
										(98) / (4) =		5951.9963	(98)
												48.0775	(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	0.8458	0.9118	0.8814	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1146.7113	973.1711	963.8156	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1400.4072	1340.4759	1242.9476	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	182.6611	273.2747	207.6742	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												663.6100 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.6653	68.3187	51.9186	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												165.9025 (107)
Energy for space heating												1.3401 (108)
Energy for space cooling												48.0775 (99)
Total												1.3401 (108)
Target Fabric Energy Efficiency (TFEE)												49.4176 (109)
												56.8 (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												4.7900
Infiltration rate												0.2395 (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) =	0.2395 (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	0.2635	0.2455	0.2455	0.2335	0.2335	0.2215	0.2215	0.2096	0.2096	0.2275	0.2215	0.2335 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5135	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 53.2494	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	147.2368	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 =												145.9582 (39)
HLP	Jan 1.1893	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)												1.1790 (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)
								Total per year (kWh/year) = Sum (64)m =				2123.5464 (64)
												2124 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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					1.2100	13.4839	0.7200	0.7000			0.7700	5.6986 (74)
East					5.0100	25.1925	0.7200	0.7000			0.7700	44.0832 (76)
South					4.0100	56.7559	0.7200	0.7000			0.7700	79.4912 (78)
West					7.3300	25.1925	0.7200	0.7000			0.7700	64.4970 (80)
East					4.5100	25.1925	0.7200	0.7000			0.7700	39.6837 (76)
Solar gains	233.4537	366.4987	566.1975	784.8019	883.7447	982.7250	906.0427	828.7192	672.8163	450.2462	285.1057	184.9842 (83)
Total gains	969.5799	1097.3547	1269.8442	1446.0548	1501.1003	1561.1627	1462.0201	1394.2549	1263.0083	1083.0662	965.2962	901.4869 (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	20.2520	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457
alpha	2.3501	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	0.9194	0.8930	0.8348	0.7382	0.6055	0.4293	0.3128	0.3264	0.5473	0.7668	0.8829	0.9283 (86)
MIT	18.8277	19.1028	19.6121	20.1668	20.6224	20.8857	20.9628	20.9592	20.7826	20.2517	19.4706	18.7902 (87)
Th 2	19.9286	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	0.9084	0.8788	0.8129	0.7034	0.5508	0.3528	0.2182	0.2282	0.4707	0.7257	0.8644	0.9182 (89)
MIT 2	17.0798	17.4759	18.1938	18.9553	19.5502	19.8511	19.9208	19.9191	19.7516	19.0926	18.0093	17.0327 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	17.3509	17.7282	18.4138	19.1432	19.7165	20.0116	20.0824	20.0804	19.9115	19.2724	18.2359	17.3053 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2009	17.5782	18.2638	18.9932	19.5665	19.8616	19.9324	19.9304	19.7615	19.1224	18.0859	17.1553 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	842.8373	918.4230	977.8617	965.4822	795.2190	541.7421	318.2613	317.2233	576.9375	744.9730	793.1516	794.1815 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1737.5274	1703.1689	1555.2266	1311.5852	943.0868	577.7606	325.5836	325.2869	650.6698	1038.7449	1412.6089	1699.8302 (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	665.6495	527.3493	429.5595	249.1941	110.0136	0.0000	0.0000	0.0000	0.0000	218.5663	446.0093	673.8026 (98)
RHI space heating demand												3320.1441 (98)
												3320 (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	(8)
Measured/design AP50											4.7900	
Infiltration rate											0.2395	(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) =	0.2395 (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)
	0.3054	0.2994	0.2934	0.2635	0.2575	0.2275	0.2275	0.2215	0.2395	0.2575	0.2694	0.2814 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5554	0.5494	0.5434	0.5135	0.5075	0.5000	0.5000	0.5000	0.5000	0.5075	0.5194	0.5314 (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 57.5961	Feb 56.9752	Mar 56.3542	Apr 53.2494	May 52.6285	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 52.6285	Nov 53.8704	Dec 55.1123 (38)
Heat transfer coeff	151.5835	150.9626	150.3416	147.2368	146.6159	145.8419	145.8419	145.8419	145.8419	146.6159	147.8578	149.0997 (39)
Average = Sum(39)m / 12 =												147.8068 (39)
HLP	Jan 1.2244	Feb 1.2194	Mar 1.2144	Apr 1.1893	May 1.1843	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1843	Nov 1.1943	Dec 1.2044 (40)
HLP (average)												1.1939 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)
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					1.2100	10.6334	0.7200	0.7000	0.7700	4.4939 (74)		
East					5.0100	19.6403	0.7200	0.7000	0.7700	34.3676 (76)		
South					4.0100	46.7521	0.7200	0.7000	0.7700	65.4800 (78)		
West					7.3300	19.6403	0.7200	0.7000	0.7700	50.2823 (80)		
East					4.5100	19.6403	0.7200	0.7000	0.7700	30.9377 (76)		
Solar gains	185.5614	341.9412	523.5743	720.9224	858.0395	869.9709	831.4992	729.1413	593.3347	394.1937	227.2840	155.3807 (83)
Total gains	921.6876	1072.7972	1227.2210	1382.1752	1475.3952	1448.4086	1387.4767	1294.6770	1183.5267	1027.0137	907.4745	871.8834 (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	19.6713	19.7522	19.8338	20.2520	20.3378	20.4457	20.4457	20.4457	20.4457	20.3378	20.1670	19.9990
alpha	2.3114	2.3168	2.3223	2.3501	2.3559	2.3630	2.3630	2.3630	2.3630	2.3559	2.3445	2.3333
util living area	0.9362	0.9100	0.8649	0.7844	0.6739	0.5393	0.4191	0.4589	0.6439	0.8248	0.9121	0.9427 (86)
MIT	18.4542	18.7772	19.2870	19.9222	20.4281	20.7637	20.9065	20.8808	20.6209	19.9506	19.1063	18.4133 (87)
Th 2	19.9005	19.9045	19.9085	19.9286	19.9326	19.9376	19.9376	19.9376	19.9376	19.9326	19.9245	19.9165 (88)
util rest of house	0.9277	0.8983	0.8470	0.7557	0.6289	0.4720	0.3311	0.3700	0.5809	0.7948	0.8987	0.9351 (89)
MIT 2	16.5269	16.9909	17.7186	18.6171	19.2996	19.7222	19.8753	19.8536	19.5652	18.6805	17.4828	16.4765 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	16.8258	17.2680	17.9619	18.8195	19.4746	19.8837	20.0352	20.0129	19.7289	18.8774	17.7346	16.7769 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6758	17.1180	17.8119	18.6695	19.3246	19.7337	19.8852	19.8629	19.5789	18.7274	17.5846	16.6269 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	821.4542	919.5113	985.2074	988.7648	885.3706	663.3787	452.9672	470.2657	659.1219	772.5454	778.7956	785.3638 (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	1875.9621	1844.4546	1700.6419	1438.4353	1117.8892	748.7114	479.1254	505.0350	799.0594	1191.6127	1550.2233	1852.8436 (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	784.5539	621.5619	532.2833	323.7627	172.9938	0.0000	0.0000	0.0000	0.0000	311.7860	555.4279	794.2049 (98)
Space heating												4096.5745 (98)
Space heating per m2										(98) / (4) =		33.0903 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4531.6090 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.5539	621.5619	532.2833	323.7627	172.9938	0.0000	0.0000	0.0000	0.0000	311.7860	555.4279	794.2049 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	867.8694	687.5684	588.8089	358.1446	191.3649	0.0000	0.0000	0.0000	0.0000	344.8961	614.4114	878.5453 (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	87.9026	87.6947	87.2671	86.3542	84.7660	79.7000	79.7000	79.7000	79.7000	86.1661	87.3964	79.7000 (216)
Fuel for water heating, kWh/month	239.5806	211.4501	222.6424	200.9720	200.1036	189.3511	181.0773	199.7653	199.7469	208.8869	218.6640	233.3879 (219)
Water heating fuel used												2505.6281 (219)
Annual totals kWh/year												
Space heating fuel - main system												4531.6090 (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 * 0.96 * 1068 * 1.00) =										-820.2781		-820.2781 (233)
Total delivered energy for all uses												6847.1195 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4531.6090	3.4800	157.7000 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	2505.6281	3.4800	87.1959 (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	-820.2781	13.1900	-108.1947 (252)	
Total energy cost			339.8193 (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] =	0.8455 (257)
SAP value		88.2050
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	4531.6090	0.2160	978.8275 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2505.6281	0.2160	541.2157 (264)	
Space and water heating			1520.0432 (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	-820.2781	0.5190	-425.7244 (269)
Total kg/year			1421.3722 (272)
CO2 emissions per m2			11.4800 (273)
EI value			88.7166
EI rating			89 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8453 = 4.117$, stars = 4
Water heating environmental impact	$0.216 / 0.8453 = 0.2555$, stars = 4

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Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main 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												4.7900
Infiltration rate												0.2395 (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) =	0.2395 (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												
	0.2635	0.2455	0.2455	0.2335	0.2335	0.2215	0.2215	0.2096	0.2096	0.2275	0.2215	0.2335 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5135	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 53.2494	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	147.2368	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 =												145.9582 (39)
HLP	Jan 1.1893	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)												1.1790 (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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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
								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	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					1.2100	13.4839		0.7200	0.7000	0.7700		5.6986 (74)
East					5.0100	25.1925		0.7200	0.7000	0.7700		44.0832 (76)
South					4.0100	56.7559		0.7200	0.7000	0.7700		79.4912 (78)
West					7.3300	25.1925		0.7200	0.7000	0.7700		64.4970 (80)
East					4.5100	25.1925		0.7200	0.7000	0.7700		39.6837 (76)

Solar gains	233.4537	366.4987	566.1975	784.8019	883.7447	982.7250	906.0427	828.7192	672.8163	450.2462	285.1057	184.9842 (83)
Total gains	969.5799	1097.3547	1269.8442	1446.0548	1501.1003	1561.1627	1462.0201	1394.2549	1263.0083	1083.0662	965.2962	901.4869 (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	20.2520	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457
alpha	2.3501	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	0.9194	0.8930	0.8348	0.7382	0.6055	0.4293	0.3128	0.3264	0.5473	0.7668	0.8829	0.9283 (86)
MIT	18.8277	19.1028	19.6121	20.1668	20.6224	20.8857	20.9628	20.9592	20.7826	20.2517	19.4706	18.7902 (87)
Th 2	19.9286	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	0.9084	0.8788	0.8129	0.7034	0.5508	0.3528	0.2182	0.2282	0.4707	0.7257	0.8644	0.9182 (89)
MIT 2	17.0798	17.4759	18.1938	18.9553	19.5502	19.8511	19.9208	19.9191	19.7516	19.0926	18.0093	17.0327 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	17.3509	17.7282	18.4138	19.1432	19.7165	20.0116	20.0824	20.0804	19.9115	19.2724	18.2359	17.3053 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2009	17.5782	18.2638	18.9932	19.5665	19.8616	19.9324	19.9304	19.7615	19.1224	18.0859	17.1553 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8693	0.8369	0.7701	0.6677	0.5298	0.3470	0.2177	0.2275	0.4568	0.6878	0.8217	0.8810 (94)
Useful gains	842.8373	918.4230	977.8617	965.4822	795.2190	541.7421	318.2613	317.2233	576.9375	744.9730	793.1516	794.1815 (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	1737.5274	1703.1689	1555.2266	1311.5852	943.0868	577.7606	325.5836	325.2869	650.6698	1038.7449	1412.6089	1699.8302 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	665.6495	527.3493	429.5595	249.1941	110.0136	0.0000	0.0000	0.0000	0.0000	218.5663	446.0093	673.8026	(98)
Space heating												3320.1441	(98)
Space heating per m2											(98) / (4) =	26.8186	(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 %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3672.7258	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	665.6495	527.3493	429.5595	249.1941	110.0136	0.0000	0.0000	0.0000	0.0000	218.5663	446.0093	673.8026	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	736.3379	583.3510	475.1764	275.6572	121.6965	0.0000	0.0000	0.0000	0.0000	241.7769	493.3731	745.3569	(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	87.5743	87.3492	86.7719	85.6779	83.5926	79.7000	79.7000	79.7000	79.7000	85.2324	86.9005	79.7000	(216)	
Fuel for water heating, kWh/month	240.4787	212.2865	223.9130	202.5586	202.9124	189.3511	181.0773	199.7653	199.7469	211.1752	219.9117	234.2457	(219)	
Water heating fuel used												2517.4224	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3672.7258	(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 * 0.96 * 1179 * 1.00) =										-905.5311		-905.5311	(233)	
Total delivered energy for all uses												5914.7776	(238)	

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3672.7258	3.7400	137.3599 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2517.4224	3.7400	94.1516 (247)
Mechanical ventilation fans	87.9666	20.4300	17.9716 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	467.1940	20.4300	95.4477 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-905.5311	20.4300	-185.0000 (252)
Total energy cost			270.2533 (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	3672.7258	0.2160	793.3088 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2517.4224	0.2160	543.7632 (264)
Space and water heating			1337.0720 (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	-905.5311	0.5190	-469.9706 (269)
Total kg/year			1194.1547 (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

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Space heating - main system 1	3672.7258	1.2200	4480.7254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2517.4224	1.2200	3071.2553 (264)
Space and water heating			7551.9807 (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	-905.5311	3.0700	-2779.9805 (269)
Primary energy kWh/year			6706.5931 (272)
Primary energy kWh/m2/year			54.1728 (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	-£ 40	-265 kg (22.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 2.14 kg/m²	B 90	B 91
Total Savings	£40 2.14 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 505 TEST (31 Aug 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£129	£139	-£10
Mains gas	£327	£276	£50
Space heating	£266	£266	-£1
Water heating	£94	£53	£41
Lighting	£95	£95	£0
Generated (PV)	-£185	-£185	£0
Total cost of fuels	£271	£230	£40
Total cost of uses	£270	£229	£40
Delivered energy	48 kWh/m²	37 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	(8)
Measured/design AP50											4.7900	
Infiltration rate											0.2395	(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) =	0.2395 (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												
	0.3054	0.2994	0.2934	0.2635	0.2575	0.2275	0.2275	0.2215	0.2395	0.2575	0.2694	0.2814 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5554	0.5494	0.5434	0.5135	0.5075	0.5000	0.5000	0.5000	0.5000	0.5075	0.5194	0.5314 (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 57.5961	Feb 56.9752	Mar 56.3542	Apr 53.2494	May 52.6285	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 52.6285	Nov 53.8704	Dec 55.1123 (38)
Heat transfer coeff	151.5835	150.9626	150.3416	147.2368	146.6159	145.8419	145.8419	145.8419	145.8419	146.6159	147.8578	149.0997 (39)
Average = Sum(39)m / 12 =												147.8068 (39)
HLP	Jan 1.2244	Feb 1.2194	Mar 1.2144	Apr 1.1893	May 1.1843	Jun 1.1780	Jul 1.1780	Aug 1.1780	Sep 1.1780	Oct 1.1843	Nov 1.1943	Dec 1.2044 (40)
HLP (average)												1.1939 (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					1.2100	10.6334		0.7200	0.7000	0.7700		4.4939 (74)	
East					5.0100	19.6403		0.7200	0.7000	0.7700		34.3676 (76)	
South					4.0100	46.7521		0.7200	0.7000	0.7700		65.4800 (78)	
West					7.3300	19.6403		0.7200	0.7000	0.7700		50.2823 (80)	
East					4.5100	19.6403		0.7200	0.7000	0.7700		30.9377 (76)	
Solar gains	185.5614	341.9412	523.5743	720.9224	858.0395	869.9709	831.4992	729.1413	593.3347	394.1937	227.2840	155.3807	(83)
Total gains	914.1676	1065.2771	1218.2001	1367.1512	1454.1178	1426.8811	1365.9492	1274.1501	1170.0035	1017.9929	899.9545	864.3633	(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	19.6713	19.7522	19.8338	20.2520	20.3378	20.4457	20.4457	20.4457	20.4457	20.3378	20.1670	19.9990
alpha	2.3114	2.3168	2.3223	2.3501	2.3559	2.3630	2.3630	2.3630	2.3630	2.3559	2.3445	2.3333
util living area												
	0.9372	0.9111	0.8665	0.7877	0.6791	0.5450	0.4244	0.4646	0.6481	0.8271	0.9134	0.9437 (86)
MIT	18.4448	18.7685	19.2781	19.9109	20.4178	20.7582	20.9038	20.8776	20.6151	19.9427	19.0975	18.4036 (87)
Th 2	19.9005	19.9045	19.9085	19.9286	19.9326	19.9376	19.9376	19.9376	19.9376	19.9326	19.9245	19.9165 (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	0.9288	0.8995	0.8488	0.7592	0.6344	0.4775	0.3357	0.3750	0.5853	0.7973	0.9002	0.9361 (89)
Living area fraction	16.5135	16.9787	17.7062	18.6022	19.2871	19.7167	19.8734	19.8510	19.5589	18.6701	17.4705	16.4627 (90)
MIT	16.8130	17.2563	17.9500	18.8052	19.4625	19.8783	20.0332	20.0102	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.7227	18.8675	17.7228	16.7637 (92)
adjusted MIT	16.6630	17.1063	17.8000	18.6552	19.3125	19.7283	19.8832	19.8602	19.5727	18.7175	17.5728	-0.1500
												16.6137 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8926	0.8585	0.8046	0.7186	0.6050	0.4630	0.3308	0.3680	0.5608	0.7547	0.8598	0.9021 (94)
Useful gains	815.9516	914.5280	980.1320	982.4569	879.7001	660.6344	451.9211	468.9049	656.1803	768.2526	773.8076	779.7178 (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	1874.0260	1842.6957	1698.8635	1436.3224	1116.1092	747.9139	478.8319	504.6492	798.1557	1190.1517	1548.4839	1850.8821 (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	787.2073	623.7287	534.7362	326.7832	175.8884	0.0000	0.0000	0.0000	0.0000	313.8929	557.7669	796.9462 (98)
Space heating per m2												4116.9498 (98)
										(98) / (4) =		33.2548 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4554.1481 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	787.2073	623.7287	534.7362	326.7832	175.8884	0.0000	0.0000	0.0000	0.0000	313.8929	557.7669	796.9462 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	870.8046	689.9654	591.5223	361.4859	194.5668	0.0000	0.0000	0.0000	0.0000	347.2267	616.9988	881.5777 (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	88.2319	88.3079	88.3985	88.6518	89.0896	79.7000	79.7000	79.7000	79.7000	87.2882	87.8733	79.7000 (216)
Fuel for water heating, kWh/month	199.8836	151.3495	122.7172	63.4649	24.2911	6.9084	0.0000	39.4770	77.6977	130.0123	173.0022	198.8746 (219)
Water heating fuel used												1187.6785 (219)
Annual totals kWh/year												
Space heating fuel - main system												4554.1481 (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 * 0.96 * 1068 * 1.00) =									-820.2781			-820.2781 (233)
Total delivered energy for all uses												5601.7090 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4554.1481	3.4800	158.4844 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1187.6785	3.4800	41.3312 (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	-820.2781	13.1900	-108.1947 (252)
Total energy cost			301.3341 (255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7498 (257)
SAP value		89.5408
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	4554.1481	0.2160	983.6960 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1187.6785	0.2160	256.5386 (264)
Space and water heating			1240.2345 (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	-820.2781	0.5190	-425.7244 (269)
Total kg/year			1167.5135 (272)
CO2 emissions per m2			9.4300 (273)
EI value			90.7318
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 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												4.7900
Infiltration rate												0.2395 (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) =	0.2395 (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	0.2635	0.2455	0.2455	0.2335	0.2335	0.2215	0.2215	0.2096	0.2096	0.2275	0.2215	0.2335 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5135	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 53.2494	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	147.2368	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 =												145.9582 (39)
HLP	Jan 1.1893	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)												1.1790 (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 =											
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					1.2100	13.4839		0.7200	0.7000	0.7700		5.6986 (74)
East					5.0100	25.1925		0.7200	0.7000	0.7700		44.0832 (76)
South					4.0100	56.7559		0.7200	0.7000	0.7700		79.4912 (78)
West					7.3300	25.1925		0.7200	0.7000	0.7700		64.4970 (80)
East					4.5100	25.1925		0.7200	0.7000	0.7700		39.6837 (76)
Solar gains	233.4537	366.4987	566.1975	784.8019	883.7447	982.7250	906.0427	828.7192	672.8163	450.2462	285.1057	184.9842 (83)
Total gains	962.0598	1089.8347	1260.8233	1431.0307	1479.8230	1539.6352	1440.4926	1373.7279	1249.4850	1074.0453	957.7761	893.9669 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	20.2520	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457	20.4457 (85)
alpha	2.3501	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	0.9205	0.8942	0.8366	0.7417	0.6109	0.4341	0.3170	0.3307	0.5514	0.7694	0.8844	0.9294 (86)
MIT	18.8187	19.0946	19.6039	20.1573	20.6148	20.8829	20.9617	20.9581	20.7790	20.2453	19.4626	18.7809 (87)
Th 2	19.9286	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												

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Calculation Type: New Build (As Built)

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

MIT 2	0.9097	0.8802	0.8149	0.7071	0.5562	0.3571	0.2213	0.2314	0.4746	0.7285	0.8661	0.9195 (89)
Living area fraction	17.0671	17.4643	18.1828	18.9432	19.5417	19.8488	19.9203	19.9185	19.7482	19.0847	17.9982	17.0195 (90)
MIT	17.3388	17.7171	18.4032	19.1315	19.7082	20.0092	20.0818	20.0797	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.9081	19.2647	18.2253	17.2927 (92)
adjusted MIT	17.1888	17.5671	18.2532	18.9815	19.5582	19.8592	19.9318	19.9297	19.7581	19.1147	18.0753	-0.1500
												17.1427 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8707	0.8384	0.7720	0.6710	0.5346	0.3511	0.2207	0.2307	0.4604	0.6904	0.8235	0.8824 (94)	
Useful gains	837.6884	913.7518	973.3179	960.2158	791.1727	540.4994	317.9466	316.8799	575.2308	741.5605	788.6904	788.8596 (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	1735.7393	1701.5555	1553.6798	1309.8751	941.8702	577.4142	325.4937	325.1886	650.1712	1037.6201	1411.0687	1697.9958 (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	668.1498	529.4041	431.7893	251.7547	112.1189	0.0000	0.0000	0.0000	0.0000	220.2683	448.1123	676.3974 (98)	
Space heating per m2												3337.9948 (98)	
												(98) / (4) =	26.9628 (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 %)	90.4000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3692.4721 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	668.1498	529.4041	431.7893	251.7547	112.1189	0.0000	0.0000	0.0000	0.0000	220.2683	448.1123	676.3974 (98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)	
Space heating fuel (main heating system)	739.1038	585.6240	477.6430	278.4897	124.0253	0.0000	0.0000	0.0000	0.0000	243.6597	495.6995	748.2272 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating requirement	171.5492	133.5341	107.5636	54.3268	26.2960	0.0000	0.0000	24.5620	56.7280	109.5006	146.4242	172.9446 (64)	
Efficiency of water heater (217)m	87.9867	88.0197	88.0427	88.2960	88.1517	79.7000	79.7000	79.7000	79.7000	86.5420	87.5067	79.7000 (216)	
Fuel for water heating, kWh/month	194.9717	151.7093	122.1721	61.5280	29.8305	0.0000	0.0000	30.8181	71.1769	126.5288	167.3292	196.5403 (219)	
Water heating fuel used												1152.6048 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3692.4721 (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 + 0.96 + 1179 + 1.00) =									-905.5311				-905.5311 (233)
Total delivered energy for all uses													4619.7064 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3692.4721	3.7400	138.0985 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1152.6048	3.7400	43.1074 (247)	
Mechanical ventilation fans	87.9666	20.4300	17.9716 (249)	
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)	
Pump for solar water heating	50.0000	20.4300	10.2150 (249)	
Energy for lighting	467.1940	20.4300	95.4477 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-905.5311	20.4300	-185.0000 (252)	
Total energy cost			230.1627 (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	3692.4721	0.2160	797.5740 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1152.6048	0.2160	248.9626 (264)
Space and water heating			1046.5366 (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	-905.5311	0.5190	-469.9706 (269)
Total kg/year			929.5693 (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	3692.4721	1.2200	4504.8160 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1152.6048	1.2200	1406.1779 (264)
Space and water heating			5910.9939 (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	-905.5311	3.0700	-2779.9805 (269)
Primary energy kWh/year			5219.1063 (272)
Primary energy kWh/m2/year			42.1576 (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	Thames Valley
Front of dwelling faces	West
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	Ratio	Z_overhangs	Overhang type
Orientation			
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	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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	1.2100	81.1852	0.7200	0.7000	0.9000	40.1031
East	5.0100	117.5071	0.7200	0.7000	0.9000	240.3351
South	4.0100	112.2060	0.7200	0.7000	0.9000	183.6860
West	7.3300	117.5071	0.7200	0.7000	0.9000	351.6281
East	4.5100	117.5071	0.7200	0.7000	0.9000	216.3496
total:						1032.1018

Solar gains	Jun 1092	Jul 1032	Aug 925	(P3)
Internal gains	575	553	563	
Total summer gains	1667	1585	1487	(P5)
Summer gain/loss ratio	3.28	3.12	2.92	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 86.7)	1.39	1.39	1.39	
Threshold temperature	20.67	22.41	22.12	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

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:

Medium