

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-198				Issued on Date	23/08/2023
Assessment Reference	As Built	Prop Type Ref	A Semi Op			
Property	17, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR					
SAP Rating		87 B	DER	12.90	TER	18.76
Environmental		90 B	% DER<TER	31.23		
CO ₂ Emissions (t/year)		0.76	DFEE	44.28	TFEE	51.74
General Requirements Compliance		Pass	% DFEE<TFEE	14.41		
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

Semi-Detached House, total floor area 78 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.76 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 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	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (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: 5.29 (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 COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 5.33 m², No overhang
Windows facing South: 3.33 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.66 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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.2900
Infiltration rate					0.2645 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2447 (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	0.3119	0.3058	0.2997	0.2691	0.2630	0.2324	0.2324	0.2263	0.2447	0.2630	0.2752	0.2875 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5619	0.5558	0.5497	0.5191	0.5130	0.5000	0.5000	0.5000	0.5000	0.5130	0.5252	0.5375 (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)			4.8600	1.3258	6.4432		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)
Total net area of external elements Aum(A, m ²)			168.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)
Timber GF			62.6100			9.0000	563.4900 (32c)
Timber FF			75.8400			9.0000	682.5600 (32c)
Internal Floor			39.1000			18.0000	703.8000 (32d)
Internal Ceiling			39.1000			18.0000	703.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.3256 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)
Total fabric heat loss						(33) + (36) =	50.0893 (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	36.8339	36.4330	36.0321	34.0275	33.6265	32.7736	32.7736	32.7736	32.7736	33.6265	34.4284	35.2302 (38)
Heat transfer coeff	86.9233	86.5223	86.1214	84.1168	83.7159	82.8630	82.8630	82.8630	82.8630	83.7159	84.5177	85.3196 (39)
Average = Sum(39)m / 12 =												84.3670 (39)
HLP	1.1116	1.1064	1.1013	1.0757	1.0705	1.0596	1.0596	1.0596	1.0596	1.0705	1.0808	1.0910 (40)
HLP (average)												1.0789 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
Total per year (kWh/year) = Sum(64)m =												1610.5098 (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	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	371.4855	369.1659	355.5066	333.6869	311.6359	290.5233	276.9508	283.1174	294.4840	316.5135	341.6828	360.4577 (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				1.5300	10.6334	0.7200	0.7000		0.7700	5.6823 (74)		
South				3.3300	46.7521	0.7200	0.7000		0.7700	54.3762 (78)		
North				3.8000	10.6334	0.7200	0.7000		0.7700	14.1130 (74)		
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	445.6570	496.0500	533.2281	565.1516	584.3320	568.0012	541.5962	515.4118	490.2728	457.5984	430.5572	423.9461 (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	24.3218	24.4345	24.5482	25.1332	25.2536	25.5135	25.5135	25.5135	25.5135	25.2536	25.0140	24.7789
alpha	2.6215	2.6290	2.6365	2.6755	2.6836	2.7009	2.7009	2.7009	2.7009	2.6836	2.6676	2.6519
util living area	0.9682	0.9563	0.9363	0.8959	0.8230	0.7043	0.5749	0.6128	0.7832	0.9069	0.9553	0.9718 (86)
MIT	18.5988	18.8337	19.2294	19.7804	20.2890	20.6875	20.8724	20.8433	20.5496	19.9115	19.1830	18.5781 (87)
Th 2	19.9914	19.9956	19.9998	20.0208	20.0250	20.0339	20.0339	20.0339	20.0339	20.0250	20.0166	20.0082 (88)
util rest of house	0.9635	0.9498	0.9263	0.8781	0.7891	0.6406	0.4771	0.5183	0.7309	0.8875	0.9477	0.9677 (89)
MIT 2	16.7695	17.1118	17.6860	18.4870	19.1999	19.7304	19.9421	19.9146	19.5654	18.6853	17.6334	16.7487 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	16.9589	17.2902	17.8459	18.6209	19.3127	19.8295	20.0384	20.0108	19.6674	18.8123	17.7939	16.9382 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8089	17.1402	17.6959	18.4709	19.1627	19.6795	19.8884	19.8608	19.5174	18.6623	17.6439	16.7882 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9407	0.9227	0.8939	0.8411	0.7524	0.6136	0.4607	0.4992	0.6969	0.8509	0.9202	0.9468 (94)
Ext temp.	419.2303	457.6987	476.6722	475.3384	439.6541	348.5140	249.5031	257.2947	341.6605	389.3645	396.2106	401.3782 (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	1087.3185	1059.0492	964.2057	805.0754	624.7470	420.9032	272.4876	286.7736	448.8979	674.9453	891.1495	1074.0227 (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	497.0576	404.1075	362.7250	237.4106	137.7091	0.0000	0.0000	0.0000	0.0000	212.4721	356.3560	500.4475 (98)
Space heating per m2												2708.2855 (98)
										(98) / (4) =		34.6328 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2992.5806 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	497.0576	404.1075	362.7250	237.4106	137.7091	0.0000	0.0000	0.0000	0.0000	212.4721	356.3560	500.4475	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	549.2349	446.5276	400.8011	262.3322	152.1647	0.0000	0.0000	0.0000	0.0000	234.7758	393.7636	552.9807	(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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater (217)m	89.6846	89.6377	89.5429	89.3329	88.9352	87.3000	87.3000	87.3000	87.3000	89.2210	89.5403	87.3000	(216)
Fuel for water heating, kWh/month	182.8249	160.4134	166.7381	147.1734	142.9416	127.3000	119.5890	134.9162	135.8416	152.9431	164.4647	177.4970	(219)
Water heating fuel used												1812.6431	(219)
Annual totals kWh/year													
Space heating fuel - main system												2992.5806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =													-569.9890 (233)
Total delivered energy for all uses													4749.0797 (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	2992.5806	0.2160	646.3974 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1812.6431	0.2160	391.5309 (264)
Space and water heating			1037.9283 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total CO2, kg/year			1008.7896 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9000 (273)

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

DER		12.9000	ZC1
Total Floor Area		78.2000	
Assumed number of occupants		2.4278	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.3404	ZC2
CO2 emissions from cooking, equation (L16)		2.2669	ZC3
Total CO2 emissions		31.5073	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		31.5073	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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1510 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4010 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3710 (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	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359	(22b)				
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950	(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)						8.6600		1.3258		11.4811				(27)	
150mm EPS B&B						39.1000		0.1300		5.0830				(28a)	
140mm Timber Frame	90.0700			10.7800		79.2900		0.1800		14.2722				(29a)	
400mm Mineral Wool	39.1000					39.1000		0.1300		5.0830				(30)	
Total net area of external elements Aum(A, m2)						168.2700								(31)	
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =				38.0393				(33)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														250.0000 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														8.7522 (36)	
Total fabric heat loss												(33) + (36) =		46.7915 (37)	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)															
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Heat transfer coeff	40.1052	39.8205	39.5414	38.2307	37.9855	36.8439	36.8439	36.6325	37.2836	37.9855	38.4816	39.0002	(38)		
	86.8966	86.6119	86.3329	85.0222	84.7769	83.6353	83.6353	83.4239	84.0751	84.7769	85.2730	85.7917	(39)		
Average = Sum(39)m / 12 =														85.0210 (39)	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	1.1112	1.1076	1.1040	1.0872	1.0841	1.0695	1.0695	1.0668	1.0751	1.0841	1.0904	1.0971	(40)		
Days in month													1.0872 (40)		
	31	28	31	30	31	30	31	31	30	31	30	31	(41)		

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum(45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.8180	47.7474	44.3952	44.0025	40.7711	42.1301	44.0025	44.3952	47.7474	48.0193	50.9589 (61)
Solar input	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (64)
	62.5647	54.7817	56.9047	50.3028	48.6178	42.6535	40.6122	45.5175	46.0279	52.6434	56.4391	60.9925 (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	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	84.0923	81.5204	76.4847	69.8650	65.3465	59.2410	54.5863	61.1794	63.9276	70.7572	78.3877	81.9792	(72)
Total internal gains	383.8654	381.1029	366.8261	344.3909	321.7205	299.9902	286.4246	293.2084	305.1977	327.8427	353.6252	372.8414	(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	5.3300				10.6334	0.6300		0.7000	0.7700		17.3209 (74)	
South	3.3300				46.7521	0.6300		0.7000	0.7700		47.5792 (78)	
Solar gains	64.9001	111.0236	155.5063	202.5316	238.6090	242.7931	231.5648	203.2576	171.3152	123.4492	77.7651	55.5524 (83)
Total gains	448.7655	492.1264	522.3324	546.9226	560.3295	542.7833	517.9893	496.4660	476.5129	451.2919	431.3903	428.3938 (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	62.4944	62.6999	62.9025	63.8722	64.0570	64.9314	64.9314	65.0959	64.5918	64.0570	63.6843	63.2993	
alpha	5.1663	5.1800	5.1935	5.2581	5.2705	5.3288	5.3288	5.3397	5.3061	5.2705	5.2456	5.2200	
util living area	0.9984	0.9971	0.9937	0.9828	0.9458	0.8361	0.6728	0.7178	0.9115	0.9855	0.9968	0.9988	(86)
MIT	19.7867	19.9061	20.1125	20.4032	20.6858	20.9007	20.9763	20.9666	20.8225	20.4689	20.0830	19.7710	(87)
Th 2	19.9917	19.9947	19.9976	20.0113	20.0138	20.0258	20.0258	20.0280	20.0212	20.0138	20.0086	20.0032	(88)
util rest of house	0.9978	0.9960	0.9914	0.9754	0.9198	0.7582	0.5423	0.5919	0.8592	0.9778	0.9955	0.9983	(89)
MIT 2	18.3694	18.5460	18.8491	19.2796	19.6766	19.9504	20.0158	20.0123	19.8636	19.3786	18.8149	18.3548	(90)
Living area fraction	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(91)
MIT	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9940	0.9879	0.9691	0.9119	0.7603	0.5552	0.6038	0.8553	0.9720	0.9934	0.9973	(94)
Ext temp.	447.2349	489.1817	515.9966	529.9979	510.9639	412.6932	287.6108	299.7463	407.5692	438.6605	428.5277	427.2443	(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	1235.3410	1194.1090	1077.4303	892.3875	685.0911	455.7133	294.0050	309.6013	492.9240	753.7991	1010.1637	1226.9483	(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	586.3509	473.7112	417.7067	260.9205	129.5507	0.0000	0.0000	0.0000	0.0000	234.4631	418.7779	594.9798	(98)
Space heating per m2												3116.4609	(98)
												39.8524	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3336.6819 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.3509	473.7112	417.7067	260.9205	129.5507	0.0000	0.0000	0.0000	0.0000	234.4631	418.7779	594.9798	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	627.7847	507.1854	447.2234	279.3582	138.7052	0.0000	0.0000	0.0000	0.0000	251.0312	448.3703	637.0234	(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	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801	(64)
Efficiency of water heater (217)m	87.5895	87.4228	87.0641	86.2402	84.5697	80.3000	80.3000	80.3000	80.3000	85.8583	87.0861	87.6668	(216)
Fuel for water heating, kWh/month	229.2607	201.1800	210.1773	188.1975	185.8076	172.3505	165.1249	184.0755	186.1085	198.2021	208.5940	223.6651	(219)
Water heating fuel used												2352.7436	(219)
Annual totals kWh/year													
Space heating fuel - main system												3336.6819	(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)												383.5529	(232)
Total delivered energy for all uses												6147.9783	(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	3336.6819	0.2160	720.7233 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2352.7436	0.2160	508.1926 (264)
Space and water heating			1228.9159 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Total CO2, kg/m2/year			1466.9048 (272)
Emissions per m2 for space and water heating			15.7150 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5456 (272b)
Emissions per m2 for pumps and fans			0.4978 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7150 * 1.00) + 2.5456 + 0.4978, rounded to 2 d.p.			18.7600 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1510 (8)				
Pressure test							Yes					
Measured/design AP50							5.2900					
Infiltration rate							0.4155	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3844 (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	0.4901	0.4805	0.4709	0.4228	0.4132	0.3652	0.3652	0.3555	0.3844	0.4132	0.4324	0.4516 (22b)
Effective ac	0.6201	0.6154	0.6109	0.5894	0.5854	0.5667	0.5667	0.5632	0.5739	0.5854	0.5935	0.6020 (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)			4.8600	1.3258	6.4432		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)
Total net area of external elements Aum, m ²			168.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)
Timber Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)
Timber GF			62.6100			9.0000	563.4900 (32c)
Timber FF			75.8400			9.0000	682.5600 (32c)
Internal Floor			39.1000			18.0000	703.8000 (32d)
Internal Ceiling			39.1000			9.0000	351.9000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7258.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.8256 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)
Total fabric heat loss							(33) + (36) = 50.0893 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.6449	40.3393	40.0397	38.6324	38.3692	37.1435	37.1435	36.9166	37.6156	38.3692	38.9018	39.4586 (38)
Heat transfer coeff	90.7342	90.4286	90.1290	88.7218	88.4585	87.2329	87.2329	87.0059	87.7050	88.4585	88.9911	89.5479 (39)
Average = Sum(39)m / 12 =												88.7205 (39)
HLP	1.1603	1.1564	1.1525	1.1345	1.1312	1.1155	1.1155	1.1126	1.1215	1.1312	1.1380	1.1451 (40)
HLP (average)												1.1345 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (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 = 1445.3269 (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	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (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	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(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			1.5300		10.6334		0.7200		0.7000		0.7700		5.6823 (74)
South			3.3300		46.7521		0.7200		0.7000		0.7700		54.3762 (78)
North			3.8000		10.6334		0.7200		0.7000		0.7700		14.1130 (74)
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884	(83)
Total gains	413.7444	464.9101	503.6902	537.7895	558.3832	544.0403	519.3223	490.9735	465.0632	430.1373	400.5534	392.7999	(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	22.2229	22.2980	22.3721	22.7270	22.7946	23.1149	23.1149	23.1752	22.9905	22.7946	22.6582	22.5173	
alpha	2.4815	2.4865	2.4915	2.5151	2.5196	2.5410	2.5410	2.5450	2.5327	2.5196	2.5105	2.5012	
util living area	0.9707	0.9594	0.9407	0.9038	0.8374	0.7268	0.6030	0.6414	0.8038	0.9158	0.9594	0.9741	(86)
MIT	18.3508	18.5943	19.0128	19.5894	20.1464	20.6062	20.8291	20.7935	20.4418	19.7353	18.9551	18.3168	(87)
Th 2	19.9519	19.9551	19.9582	19.9727	19.9754	19.9882	19.9882	19.9906	19.9833	19.9754	19.9699	19.9642	(88)
util rest of house	0.9663	0.9534	0.9313	0.8870	0.8049	0.6634	0.5014	0.5446	0.7531	0.8978	0.9523	0.9702	(89)
MIT 2	17.5247	17.7678	18.1837	18.7592	19.2960	19.7244	19.9031	19.8816	19.5834	18.9101	18.1381	17.4992	(90)
Living area fraction	17.6103	17.8534	18.2696	18.8452	19.3841	19.8157	19.9990	19.9760	19.6723	18.9956	18.2227	17.5839	(91)
MIT	17.6103	17.8534	18.2696	18.8452	19.3841	19.8157	19.9990	19.9760	19.6723	18.9956	18.2227	17.5839	(92)
Temperature adjustment	17.6103	17.8534	18.2696	18.8452	19.3841	19.8157	19.9990	19.9760	19.6723	18.9956	18.2227	17.5839	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	394.2167	435.5650	459.0149	464.4755	436.7898	354.1535	261.0029	266.6046	341.5804	376.5858	374.8759	376.2494	(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	1207.6962	1171.3597	1060.7802	882.3576	679.7247	454.9819	296.5061	311.1364	488.7202	742.6586	989.8243	1198.5001	(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	605.2287	494.4540	447.7134	300.8751	180.7436	0.0000	0.0000	0.0000	0.0000	272.3581	442.7629	611.7545	(98)
Space heating												3355.8904	(98)
Space heating per m2												42.9142	(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	819.9889	645.5232	661.2448	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6734	0.7444	0.7202	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	552.1983	480.5396	476.2265	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	727.4072	696.7418	665.4715	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	126.1504	160.8544	140.7983	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												427.8032 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	31.5376	40.2136	35.1996	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												106.9508 (107)
Space cooling per m2												1.3677 (108)
Energy for space heating												42.9142 (99)
Energy for space cooling												1.3677 (108)
Total												44.2819 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.6280 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
														Air changes per hour			
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1510 (8)	
Pressure test														Yes			
Measured/design AP50																5.0000	
Infiltration rate																0.4010 (18)	
Number of sides sheltered																1 (19)	
Shelter factor														(20) = 1 - [0.075 x (19)] =		0.9250 (20)	
Infiltration rate adjusted to include shelter factor														(21) = (18) x (20) =		0.3710 (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	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359	(22b)				
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950	(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)			8.6600	1.3258	11.4811		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1800	14.2722		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		38.0393		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7522 (36)					
Total fabric heat loss						(33) + (36) =	46.7915 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1052	Feb 39.8205	Mar 39.5414	Apr 38.2307	May 37.9855	Jun 36.8439	Jul 36.8439	Aug 36.6325	Sep 37.2836	Oct 37.9855	Nov 38.4816	Dec 39.0002 (38)
Heat transfer coeff	86.8966	86.6119	86.3329	85.0222	84.7769	83.6353	83.6353	83.4239	84.0751	84.7769	85.2730	85.7917 (39)
Average = Sum(39)m / 12 =												85.0210 (39)
HLP	Jan 1.1112	Feb 1.1076	Mar 1.1040	Apr 1.0872	May 1.0841	Jun 1.0695	Jul 1.0695	Aug 1.0668	Sep 1.0751	Oct 1.0841	Nov 1.0904	Dec 1.0971 (40)
HLP (average)												1.0872 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss	Total = Sum(45)m = 1445.3269 (45)											
	(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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (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	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(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	5.3300				10.6334		0.6300		0.7000		0.7700		17.3209 (74)
South	3.3300				46.7521		0.6300		0.7000		0.7700		47.5792 (78)
Solar gains	64.9001	111.0236	155.5063	202.5316	238.6090	242.7931	231.5648	203.2576	171.3152	123.4492	77.7651	55.5524 (83)	
Total gains	404.4729	449.0496	481.4751	508.8564	524.2962	509.3556	486.2416	461.9367	440.5896	412.5017	389.4441	384.8639 (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	62.4944	62.6999	62.9025	63.8722	64.0570	64.9314	64.9314	65.0959	64.5918	64.0570	63.6843	63.2993	
alpha	5.1663	5.1800	5.1935	5.2581	5.2705	5.3288	5.3288	5.3397	5.3061	5.2705	5.2456	5.2200	
util living area	0.9990	0.9981	0.9957	0.9874	0.9577	0.8621	0.7065	0.7552	0.9322	0.9902	0.9980	0.9993	(86)
MIT	19.7335	19.8547	20.0645	20.3606	20.6520	20.8828	20.9702	20.9574	20.7937	20.4248	20.0328	19.7186	(87)
Th 2	19.9917	19.9947	19.9976	20.0113	20.0138	20.0258	20.0258	20.0280	20.0212	20.0138	20.0086	20.0032	(88)
util rest of house	0.9987	0.9974	0.9940	0.9818	0.9362	0.7896	0.5743	0.6298	0.8880	0.9848	0.9972	0.9990	(89)
MIT 2	18.8310	18.9544	19.1659	19.4705	19.7537	19.9629	20.0169	20.0137	19.8914	19.5375	19.1437	18.8254	(90)
Living area fraction	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(91)
MIT	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9965	0.9923	0.9784	0.9315	0.7925	0.5876	0.6419	0.8859	0.9819	0.9963	0.9986	(94)
Ext temp.	403.7278	447.4770	477.7687	497.8447	488.3628	403.6676	285.7245	296.5339	390.3278	405.0347	387.9988	384.3215	(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	1270.8195	1225.3550	1101.5196	906.5666	690.6571	456.5006	294.0347	309.6275	494.7734	765.4889	1034.8551	1262.6709	(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	645.1162	522.7340	464.0707	294.2798	150.5069	0.0000	0.0000	0.0000	0.0000	268.1780	465.7365	653.4919	(98)
Space heating per m2												3464.1140	(98)
												44.2981	(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	786.1722	618.9015	634.0219	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7801	0.8666	0.8406	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.3316	536.3687	532.9607	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	686.8666	658.0761	631.5324	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	52.9452	90.5503	73.3374	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												216.8329	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	13.2363	22.6376	18.3343	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											54.2082 (107)
Space cooling per m2											0.6932 (108)
Energy for space heating											44.2981 (99)
Energy for space cooling											0.6932 (108)
Total											44.9913 (109)
Target Fabric Energy Efficiency (TFEE)											51.7 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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												5.2900
Infiltration rate												0.2645 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2447 (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												
	0.2691	0.2508	0.2508	0.2385	0.2385	0.2263	0.2263	0.2141	0.2141	0.2324	0.2263	0.2385 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5191	0.5008	0.5008	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)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	40.2502			(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.0275	Feb 32.8247	Mar 32.8247	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.1168	82.9140	82.9140	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.9759 (39)
HLP	Jan 1.0757	Feb 1.0603	Mar 1.0603	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0611 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
RHI water heating demand												1610.5098 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (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				1.5300	13.4839	0.7200	0.7000	0.7700		7.2056 (74)		
South				3.3300	56.7559	0.7200	0.7000	0.7700		66.0114 (78)		
North				3.8000	13.4839	0.7200	0.7000	0.7700		17.8963 (74)		
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (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)												
tau	25.1332	25.4978	25.4978	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6755	2.6999	2.6999	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9186	0.9020	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)
MIT	19.2784	19.4676	19.8175	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)
Th 2	20.0208	20.0334	20.0334	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9074	0.8887	0.8466	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)
MIT 2	17.7619	18.0389	18.5354	19.1197	19.6581	19.9487	20.0185	20.0176	19.8722	19.3536	18.5271	17.7641 (90)
Living area fraction	17.9190	18.1869	18.6682	19.2354	19.7600	20.0463	20.1168	20.1158	19.9699	19.4621	18.6596	17.9205 (91)
MIT	17.9190	18.1869	18.6682	19.2354	19.7600	20.0463	20.1168	20.1158	19.9699	19.4621	18.6596	17.9205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7690	18.0369	18.5182	19.0854	19.6100	19.8963	19.9668	19.9658	19.8199	19.3121	18.5096	17.7705 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	560.9845	579.7486	577.9357	545.3558	448.8696	309.2756	183.8529	183.5363	334.2378	450.5307	512.2864	537.9511 (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	1040.4379	1006.3153	905.2726	752.8458	539.4386	331.1437	187.8334	187.7495	374.5287	605.9056	837.7102	1016.7680 (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	356.7133	286.6528	243.5387	149.3928	67.3833	0.0000	0.0000	0.0000	0.0000	115.5989	234.3051	356.2397 (98)
Space heating												1809.8247 (98)
RHI space heating demand												1810 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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												5.2900
Infiltration rate												0.2645 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2447 (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												
	0.3119	0.3058	0.2997	0.2691	0.2630	0.2324	0.2324	0.2263	0.2447	0.2630	0.2752	0.2875 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5619	0.5558	0.5497	0.5191	0.5130	0.5000	0.5000	0.5000	0.5000	0.5130	0.5252	0.5375 (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)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.8339	Feb 36.4330	Mar 36.0321	Apr 34.0275	May 33.6265	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 33.6265	Nov 34.4284	Dec 35.2302 (38)
Heat transfer coeff	86.9233	86.5223	86.1214	84.1168	83.7159	82.8630	82.8630	82.8630	82.8630	83.7159	84.5177	85.3196 (39)
Average = Sum(39)m / 12 =												84.3670 (39)
HLP	Jan 1.1116	Feb 1.1064	Mar 1.1013	Apr 1.0757	May 1.0705	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0705	Nov 1.0808	Dec 1.0910 (40)
HLP (average)												1.0789 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum (45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
										Total per year (kWh/year) = Sum (64)m =		1610.5098 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (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				1.5300	10.6334	0.7200	0.7000		0.7700		5.6823 (74)	
South				3.3300	46.7521	0.7200	0.7000		0.7700		54.3762 (78)	
North				3.8000	10.6334	0.7200	0.7000		0.7700		14.1130 (74)	
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	625.5779	673.4306	702.4278	722.7221	729.9408	704.5212	674.3354	650.6913	633.7331	612.6879	597.6083	600.0861 (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	24.3218	24.4345	24.5482	25.1332	25.2536	25.5135	25.5135	25.5135	25.5135	25.2536	25.0140	24.7789
alpha	2.6215	2.6290	2.6365	2.6755	2.6836	2.7009	2.7009	2.7009	2.7009	2.6836	2.6676	2.6519
util living area	0.9342	0.9177	0.8905	0.8380	0.7516	0.6199	0.4881	0.5194	0.6912	0.8410	0.9116	0.9397 (86)
MIT	18.9588	19.1724	19.5276	20.0172	20.4507	20.7755	20.9150	20.8964	20.6794	20.1511	19.5006	18.9384 (87)
Th 2	19.9914	19.9956	19.9998	20.0208	20.0250	20.0339	20.0339	20.0339	20.0339	20.0250	20.0166	20.0082 (88)
util rest of house	0.9254	0.9067	0.8752	0.8139	0.7115	0.5541	0.3972	0.4298	0.6320	0.8130	0.8981	0.9316 (89)
MIT 2	17.2850	17.5933	18.1040	18.8081	19.4035	19.8234	19.9753	19.9587	19.7137	19.0071	18.0821	17.2656 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	17.4583	17.7569	18.2515	18.9333	19.5120	19.9220	20.0727	20.0558	19.8137	19.1256	18.2290	17.4389 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3083	17.6069	18.1015	18.7833	19.3620	19.7720	19.9227	19.9058	19.6637	18.9756	18.0790	17.2889 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8928	0.8715	0.8376	0.7767	0.6799	0.5343	0.3860	0.4170	0.6062	0.7756	0.8626	0.9006 (94)
Ext temp.	558.5002	586.8916	588.3723	561.3361	496.2994	376.4444	260.2846	271.3188	384.1410	475.2102	515.4773	540.4396 (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	1130.7276	1099.4297	999.1370	831.3521	641.4318	428.5704	275.3264	290.5015	461.0235	701.1709	927.9199	1116.7372 (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	425.7372	344.4256	305.6090	194.4115	107.9785	0.0000	0.0000	0.0000	0.0000	168.1148	296.9587	428.7654 (98)
Space heating per m2												2272.0007 (98)
										(98) / (4) =		29.0537 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2510.4980 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	425.7372	344.4256	305.6090	194.4115	107.9785	0.0000	0.0000	0.0000	0.0000	168.1148	296.9587	428.7654	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	470.4279	380.5807	337.6895	214.8194	119.3133	0.0000	0.0000	0.0000	0.0000	185.7622	328.1312	473.7739	(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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater (217)m	89.5869	89.5334	89.4242	89.1812	88.7411	87.3000	87.3000	87.3000	87.3000	89.0378	89.4135	87.3000	(216)
Fuel for water heating, kWh/month	183.0241	160.6002	166.9595	147.4239	143.2542	127.3000	119.5890	134.9162	135.8416	153.2579	164.6979	177.6868	(219)
Water heating fuel used												1814.5513	(219)
Annual totals kWh/year													
Space heating fuel - main system												2510.4980	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890			-569.9890 (233)
Total delivered energy for all uses													4268.9053 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2510.4980	3.4800	87.3653 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1814.5513	3.4800	63.1464 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			263.1063 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.8970 (257)
SAP rating (Section 12)		87.4875
SAP band		B (258)

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	2510.4980	0.2160	542.2676 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.5513	0.2160	391.9431 (264)
Space and water heating			934.2106 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			905.0719 (272)
CO2 emissions per m2			11.5700 (273)
EI value			90.1559
EI rating			90 (274)

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EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8864 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8864 = 0.2437$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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												5.2900
Infiltration rate												0.2645 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2447 (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												
	0.2691	0.2508	0.2508	0.2385	0.2385	0.2263	0.2263	0.2141	0.2141	0.2324	0.2263	0.2385 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5191	0.5008	0.5008	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)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.0275	Feb 32.8247	Mar 32.8247	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.1168	82.9140	82.9140	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.9759 (39)
HLP	Jan 1.0757	Feb 1.0603	Mar 1.0603	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0611 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum (45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
										Total per year (kWh/year) = Sum (64)m =		1610.5098 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (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				1.5300	13.4839	0.7200	0.7000		0.7700		7.2056 (74)	
South				3.3300	56.7559	0.7200	0.7000		0.7700		66.0114 (78)	
North				3.8000	13.4839	0.7200	0.7000		0.7700		17.8963 (74)	
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (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	25.1332	25.4978	25.4978	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6755	2.6999	2.6999	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9186	0.9020	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)
MIT	19.2784	19.4676	19.8175	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)
Th 2	20.0208	20.0334	20.0334	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9074	0.8887	0.8466	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)
MIT 2	17.7619	18.0389	18.5354	19.1197	19.6581	19.9487	20.0185	20.0176	19.8722	19.3536	18.5271	17.7641 (90)
Living area fraction												
MIT	17.9190	18.1869	18.6682	19.2354	19.7600	20.0463	20.1168	20.1158	19.9699	19.4621	18.6596	17.9205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7690	18.0369	18.5182	19.0854	19.6100	19.8963	19.9668	19.9658	19.8199	19.3121	18.5096	17.7705 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8731	0.8531	0.8096	0.7352	0.6078	0.4170	0.2631	0.2692	0.5085	0.7157	0.8295	0.8813 (94)
Useful gains	560.9845	579.7486	577.9357	545.3558	448.8696	309.2756	183.8529	183.5363	334.2378	450.5307	512.2864	537.9511 (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	1040.4379	1006.3153	905.2726	752.8458	539.4386	331.1437	187.8334	187.7495	374.5287	605.9056	837.7102	1016.7680 (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	356.7133	286.6528	243.5387	149.3928	67.3833	0.0000	0.0000	0.0000	0.0000	115.5989	234.3051	356.2397 (98)
Space heating												1809.8247 (98)
Space heating per m2										(98) / (4) =		23.1435 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	1999.8063 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	356.7133	286.6528	243.5387	149.3928	67.3833	0.0000	0.0000	0.0000	0.0000	115.5989	234.3051	356.2397 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	394.1584	316.7434	269.1035	165.0749	74.4567	0.0000	0.0000	0.0000	0.0000	127.7336	258.9007	393.6350 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Efficiency of water heater (217)m	89.4673	89.4053	89.2566	88.9734	88.3826	87.3000	87.3000	87.3000	87.3000	88.7390	89.2376	87.3000 (216)
Fuel for water heating, kWh/month	183.2689	160.8305	167.2730	147.7682	143.8353	127.3000	119.5890	134.9162	135.8416	153.7739	165.0226	177.9325 (219)
Water heating fuel used												1817.3516 (219)
Annual totals kWh/year												1999.8063 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												55.2921 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												130.2921 (231)
Electricity for lighting (calculated in Appendix L)												383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1201 * 1.00) =											-633.9128	-633.9128 (233)
Total delivered energy for all uses												3697.0901 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1999.8063	10.2300	204.5802 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1817.3516	10.2300	185.9151 (247)
Mechanical ventilation fans	55.2921	36.7200	20.3033 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	383.5529	36.7200	140.8406 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-633.9128	36.7200	-232.7728 (252)
Total energy cost			449.4064 (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	1999.8063	0.2160	431.9582 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1817.3516	0.2160	392.5479 (264)
Space and water heating			824.5061 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	0.5190	-329.0007 (269)
Total kg/year			762.1909 (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	1999.8063	1.2200	2439.7636 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1817.3516	1.2200	2217.1690 (264)
Space and water heating			4656.9326 (265)
Pumps and fans	130.2921	3.0700	399.9969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
 PV Unit -633.9128 3.0700 -1946.1123 (269)
 Primary energy kWh/year 4288.3246 (272)
 Primary energy kWh/m2/year 54.8379 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
 Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 81	-184 kg (24.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 2.35 kg/m²	B 89	A 92
Total Savings	£81 2.35 kg/m²		

Potential energy efficiency rating: B 89
 Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£189	£207	-£18
Mains gas	£493	£394	£99
Space heating	£355	£355	£0
Water heating	£186	£105	£81
Lighting	£141	£141	£0
Generated (PV)	-£233	-£233	£0
Total cost of fuels	£449	£368	£81
Total cost of uses	£449	£368	£81
Delivered energy	47 kWh/m²	35 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	42 kWh/m²	13 kWh/m²

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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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												5.2900
Infiltration rate												0.2645 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2447 (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												
	0.3119	0.3058	0.2997	0.2691	0.2630	0.2324	0.2324	0.2263	0.2447	0.2630	0.2752	0.2875 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5619	0.5558	0.5497	0.5191	0.5130	0.5000	0.5000	0.5000	0.5000	0.5130	0.5252	0.5375 (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)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.8339	Feb 36.4330	Mar 36.0321	Apr 34.0275	May 33.6265	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 33.6265	Nov 34.4284	Dec 35.2302 (38)
Heat transfer coeff	86.9233	86.5223	86.1214	84.1168	83.7159	82.8630	82.8630	82.8630	82.8630	83.7159	84.5177	85.3196 (39)
Average = Sum(39)m / 12 =												84.3670 (39)
HLP	Jan 1.1116	Feb 1.1064	Mar 1.1013	Apr 1.0757	May 1.0705	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0705	Nov 1.0808	Dec 1.0910 (40)
HLP (average)												1.0789 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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												1.2548 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-840.4246 (H17)
Solar input	-24.3706	-40.6676	-69.2616	-92.8241	-114.6764	-112.7452	-111.2552	-97.2042	-76.1304	-51.9881	-28.9071	-20.3941 (63)
Solar input (sum of months) = Sum (63)m =												-840.4246 (63)
Output from w/h	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320 (64)
Total per year (kWh/year) = Sum (64)m =												778.5514 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a	g	FF	Access	Gains			
					W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W			
North				1.5300	10.6334	0.7200	0.7000	0.7700	5.6823 (74)			
South				3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)			
North				3.8000	10.6334	0.7200	0.7000	0.7700	14.1130 (74)			
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	625.5779	673.4306	702.4278	722.7221	729.9408	704.5212	674.3354	650.6913	633.7331	612.6879	597.6083	600.0861 (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	24.3218	24.4345	24.5482	25.1332	25.2536	25.5135	25.5135	25.5135	25.5135	25.2536	25.0140	24.7789
alpha	2.6215	2.6290	2.6365	2.6755	2.6836	2.7009	2.7009	2.7009	2.7009	2.6836	2.6676	2.6519
util living area	0.9342	0.9177	0.8905	0.8380	0.7516	0.6199	0.4881	0.5194	0.6912	0.8410	0.9116	0.9397 (86)
MIT	18.9588	19.1724	19.5276	20.0172	20.4507	20.7755	20.9150	20.8964	20.6794	20.1511	19.5006	18.9384 (87)
Th 2	19.9914	19.9956	19.9998	20.0208	20.0250	20.0339	20.0339	20.0339	20.0339	20.0250	20.0166	20.0082 (88)
util rest of house	0.9254	0.9067	0.8752	0.8139	0.7115	0.5541	0.3972	0.4298	0.6320	0.8130	0.8981	0.9316 (89)
MIT 2	17.2850	17.5933	18.1040	18.8081	19.4035	19.8234	19.9753	19.9587	19.7137	19.0071	18.0821	17.2656 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	17.4583	17.7569	18.2515	18.9333	19.5120	19.9220	20.0727	20.0558	19.8137	19.1256	18.2290	17.4389 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3083	17.6069	18.1015	18.7833	19.3620	19.7720	19.9227	19.9058	19.6637	18.9756	18.0790	17.2889 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8715	0.8376	0.7767	0.6799	0.5343	0.3860	0.4170	0.6062	0.7756	0.8626	0.9006	(94)
Useful gains	558.5002	586.8916	588.3723	561.3361	496.2994	376.4444	260.2846	271.3188	384.1410	475.2102	515.4773	540.4396	(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	1130.7276	1099.4297	999.1370	831.3521	641.4318	428.5704	275.3264	290.5015	461.0235	701.1709	927.9199	1116.7372	(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	425.7372	344.4256	305.6090	194.4115	107.9785	0.0000	0.0000	0.0000	0.0000	168.1148	296.9587	428.7654	(98)
Space heating												2272.0007	(98)
Space heating per m2												29.0537	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2510.4980	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	425.7372	344.4256	305.6090	194.4115	107.9785	0.0000	0.0000	0.0000	0.0000	168.1148	296.9587	428.7654	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	470.4279	380.5807	337.6895	214.8194	119.3133	0.0000	0.0000	0.0000	0.0000	185.7622	328.1312	473.7739	(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	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320	(64)	
Efficiency of water heater (217)m	89.6882	89.7420	89.8167	89.9532	90.1584	87.3000	87.3000	87.3000	87.3000	89.4041	89.5644	87.3000	(216)	
Fuel for water heating, kWh/month	155.6448	114.9108	89.1155	42.9670	13.8079	0.0000	0.0000	23.5711	48.6361	94.4804	132.1452	154.7809	(219)	
Water heating fuel used												870.0598	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2510.4980	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)														
mechanical ventilation fans (SFP = 0.2282)													55.2921	(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													180.2921	(231)
Electricity for lighting (calculated in Appendix L)													383.5529	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890			-569.9890	(233)
Total delivered energy for all uses													3374.4138	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2510.4980	3.4800	87.3653 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	870.0598	3.4800	30.2781 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (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	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			236.8330 (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] =	0.8074 (257)
SAP value		88.7370
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2510.4980	0.2160	542.2676 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	870.0598	0.2160	187.9329 (264)
Space and water heating			730.2005 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			727.0118 (272)
CO2 emissions per m2			9.3000 (273)
EI value			92.0926
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.6280 (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												5.2900
Infiltration rate												0.2645 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2447 (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												
	0.2691	0.2508	0.2508	0.2385	0.2385	0.2263	0.2263	0.2141	0.2141	0.2324	0.2263	0.2385 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5191	0.5008	0.5008	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)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.0275	Feb 32.8247	Mar 32.8247	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.1168	82.9140	82.9140	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.9759 (39)
HLP	Jan 1.0757	Feb 1.0603	Mar 1.0603	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0611 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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												1.3955 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-870.5009 (H17)
Solar input	-28.5766	-40.6341	-69.8403	-94.2308	-110.1318	-118.7419	-113.0330	-103.0222	-80.5017	-55.3617	-33.7986	-22.6280 (63)
Solar input (sum of months) = Sum (63)m =												-870.5009 (63)
Output from w/h	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981 (64)
Total per year (kWh/year) = Sum (64)m =												756.2498 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (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				1.5300	13.4839	0.7200	0.7000		0.7700	7.2056 (74)		
South				3.3300	56.7559	0.7200	0.7000		0.7700	66.0114 (78)		
North				3.8000	13.4839	0.7200	0.7000		0.7700	17.8963 (74)		
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (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	25.1332	25.4978	25.4978	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6755	2.6999	2.6999	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9186	0.9020	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)
MIT	19.2784	19.4676	19.8175	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)
Th 2	20.0208	20.0334	20.0334	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9074	0.8887	0.8466	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)
MIT 2	17.7619	18.0389	18.5354	19.1197	19.6581	19.9487	20.0185	20.0176	19.8722	19.3536	18.5271	17.7641 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	17.9190	18.1869	18.6682	19.2354	19.7600	20.0463	20.1168	20.1158	19.9699	19.4621	18.6596	17.9205 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7690	18.0369	18.5182	19.0854	19.6100	19.8963	19.9668	19.9658	19.8199	19.3121	18.5096	17.7705 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8731	0.8531	0.8096	0.7352	0.6078	0.4170	0.2631	0.2692	0.5085	0.7157	0.8295	0.8813	(94)
Useful gains	560.9845	579.7486	577.9357	545.3558	448.8696	309.2756	183.8529	183.5363	334.2378	450.5307	512.2864	537.9511	(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	1040.4379	1006.3153	905.2726	752.8458	539.4386	331.1437	187.8334	187.7495	374.5287	605.9056	837.7102	1016.7680	(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	356.7133	286.6528	243.5387	149.3928	67.3833	0.0000	0.0000	0.0000	0.0000	115.5989	234.3051	356.2397	(98)
Space heating												1809.8247	(98)
Space heating per m2												23.1435	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1999.8063 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	356.7133	286.6528	243.5387	149.3928	67.3833	0.0000	0.0000	0.0000	0.0000	115.5989	234.3051	356.2397	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	394.1584	316.7434	269.1035	165.0749	74.4567	0.0000	0.0000	0.0000	0.0000	127.7336	258.9007	393.6350	(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	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981	(64)
Efficiency of water heater (217)m	89.5964	89.6306	89.6912	89.8428	89.8368	87.3000	87.3000	87.3000	87.3000	89.1527	89.4305	87.3000	(216)
Fuel for water heating, kWh/month	151.1099	115.0910	88.5949	41.4541	18.9161	0.0000	0.0000	16.9068	43.6289	90.9628	126.8735	152.4706	(219)
Water heating fuel used												846.0084	(219)
Annual totals kWh/year													
Space heating fuel - main system													1999.8063 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (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													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1201 * 1.00) =									-633.9128				-633.9128 (233)
Total delivered energy for all uses													2775.7469 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1999.8063	10.2300	204.5802 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	846.0084	10.2300	86.5467 (247)
Mechanical ventilation fans	55.2921	36.7200	20.3033 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	383.5529	36.7200	140.8406 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-633.9128	36.7200	-232.7728 (252)
Total energy cost			368.3980 (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	1999.8063	0.2160	431.9582 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	846.0084	0.2160	182.7378 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space and water heating			614.6960 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	0.5190	-329.0007 (269)
Total kg/year			578.3308 (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	1999.8063	1.2200	2439.7636 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	846.0084	1.2200	1032.1303 (264)
Space and water heating			3471.8939 (265)
Pumps and fans	180.2921	3.0700	553.4969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	3.0700	-1946.1123 (269)
Primary energy kWh/year			3256.7859 (272)
Primary energy kWh/m2/year			41.6469 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	97.3 (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	262.19 (P1)
Transmission heat loss coefficient	50.09 (37)
Summer heat loss coefficient	312.28 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.5300	87.1704	0.7200	0.7000	0.9000	54.4473
South	3.3300	118.5567	0.7200	0.7000	0.9000	161.1706
North	3.8000	87.1704	0.7200	0.7000	0.9000	135.2286
total:						350.8464

	Jun	Jul	Aug	
Solar gains	377	351	313	(P3)
Internal gains	424	407	415	
Total summer gains	801	758	728	(P5)

Summer gain/loss ratio	2.57	2.43	2.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 97.3)	1.32	1.32	1.32	
Threshold temperature	19.28	21.04	20.95	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			