

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-207			Issued on Date	24/05/2023
Assessment Reference	As Built	Prop Type Ref	A Semi As		
Property	3, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT				
SAP Rating	87 B	DER	13.73	TER	18.78
Environmental	90 B	% DER<TER	26.88		
CO ₂ Emissions (t/year)	0.81	DFEE	44.07	TFEE	51.98
General Requirements Compliance	Pass	% DFEE<TFEE	15.21		
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) 18.78 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.73 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (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: 4.78 (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: Programmer, room thermostat and TRVs 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 South East: 3.33 m², No overhang
Windows facing North West: 5.33 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					4.7800
Infiltration rate					0.2390 (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)	=	0.2211 (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	0.2819	0.2763	0.2708	0.2432	0.2377	0.2100	0.2100	0.2045	0.2211	0.2377	0.2487	0.2598 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5319	0.5263	0.5208	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5098 (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	34.8627	34.5004	34.1381	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	33.4136 (38)
Heat transfer coeff	84.9520	84.5897	84.2274	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	83.5029 (39)
Average = Sum(39)m / 12 =												83.3480 (39)
HLP	1.0863	1.0817	1.0771	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0678 (40)
HLP (average)												1.0658 (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)												
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
Southeast			3.3300		36.7938		0.7200		0.7000		0.7700		42.7940 (77)
Northwest			1.5300		11.2829		0.7200		0.7000		0.7700		6.0294 (81)
Northwest			3.8000		11.2829		0.7200		0.7000		0.7700		14.9751 (81)
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761	(83)
Total gains	435.2840	484.8153	532.2750	583.7736	620.1059	609.2338	579.0317	539.7352	496.3421	449.3274	419.3693	414.2338	(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	24.8862	24.9927	25.1002	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.3180
alpha	2.6591	2.6662	2.6733	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.6879
util living area	0.9696	0.9580	0.9357	0.8879	0.8035	0.6774	0.5481	0.5942	0.7791	0.9094	0.9575	0.9732 (86)
MIT	18.6328	18.8649	19.2764	19.8385	20.3467	20.7179	20.8867	20.8550	20.5562	19.9132	19.2006	18.6094 (87)
Th 2	20.0120	20.0158	20.0196	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0272 (88)
util rest of house	0.9652	0.9518	0.9257	0.8693	0.7678	0.6125	0.4519	0.5003	0.7264	0.8906	0.9502	0.9692 (89)
MIT 2	17.8395	18.0716	18.4801	19.0383	19.5196	19.8490	19.9790	19.9593	19.7193	19.1189	18.4192	17.8270 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	17.9217	18.1538	18.5626	19.1212	19.6052	19.9390	20.0731	20.0521	19.8060	19.2012	18.5002	17.9080 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7717	18.0038	18.4126	18.9712	19.4552	19.7890	19.9231	19.9021	19.6560	19.0512	18.3502	17.7580 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9512	0.9348	0.9045	0.8440	0.7427	0.5940	0.4398	0.4859	0.7018	0.8660	0.9329	0.9564 (94)
Ext temp.	414.0318	453.2120	481.4287	492.6869	460.5374	361.8588	254.6375	262.2795	348.3367	389.0976	391.2334	396.1815 (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	1144.4474	1108.4429	1003.3667	834.5314	642.6225	429.9779	275.3583	290.1939	460.3877	700.2879	932.2221	1132.1350 (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	543.4292	440.3152	388.3219	246.1281	135.4714	0.0000	0.0000	0.0000	0.0000	231.5256	389.5119	547.5494 (98)
Space heating per m2												2922.2526 (98)
										(98) / (4) =		37.3690 (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													3229.0084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	543.4292	440.3152	388.3219	246.1281	135.4714	0.0000	0.0000	0.0000	0.0000	231.5256	389.5119	547.5494	(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)	600.4743	486.5361	429.0850	271.9647	149.6921	0.0000	0.0000	0.0000	0.0000	255.8293	430.3999	605.0270	(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	89.7376	89.6907	89.5880	89.3595	88.9221	87.3000	87.3000	87.3000	87.3000	89.2864	89.5990	87.3000	(216)
Fuel for water heating, kWh/month	182.7169	160.3186	166.6541	147.1296	142.9627	127.3000	119.5890	134.9162	135.8416	152.8312	164.3570	177.3933	(219)
Water heating fuel used												1812.0103	(219)
Annual totals kWh/year													
Space heating fuel - main system												3229.0084	(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 * 1029 * 1.00) =													-543.4106 (233)
Total delivered energy for all uses													5011.4531 (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	3229.0084	0.2160	697.4658	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.0103	0.2160	391.3942	(264)
Space and water heating			1088.8600	(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	-543.4106	0.5190	-282.0301	(269)
Total CO2, kg/year			1073.5155	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7300	(273)

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

DER		13.7300	ZC1
Total Floor Area	TFA	78.2000	
Assumed number of occupants	N	2.4278	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3404	ZC2
CO2 emissions from cooking, equation (L16)		2.2669	ZC3
Total CO2 emissions		32.3373	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		32.3373	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
Southeast					3.3300	36.7938	0.6300	0.7000			0.7700	37.4448
Northwest					5.3300	11.2829	0.6300	0.7000			0.7700	18.3790
Solar gains	55.8237	101.1932	154.6723	218.8259	269.9112	278.8716	264.3208	224.5406	176.6258	116.2121	67.9757	47.0541
Total gains	439.6892	482.2961	521.4984	563.2168	591.6317	578.8618	550.7454	517.7489	481.8235	444.0548	421.6009	419.8956

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	0.9985	0.9973	0.9938	0.9805	0.9342	0.8073	0.6401	0.6956	0.9083	0.9865	0.9971	0.9989	(86)
MIT	19.7758	19.8944	20.1116	20.4211	20.7134	20.9172	20.9812	20.9712	20.8265	20.4607	20.0713	19.7608	(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	0.9980	0.9964	0.9915	0.9723	0.9042	0.7250	0.5124	0.5703	0.8548	0.9793	0.9960	0.9985	(89)
MIT 2	18.3535	18.5289	18.8477	19.3047	19.7114	19.9649	20.0181	20.0148	19.8679	19.3672	18.7979	18.3398	(90)
Living area fraction									fLA = Living area / (4) =			0.1036	(91)
MIT	18.5008	18.6704	18.9786	19.4203	19.8152	20.0636	20.1179	20.1139	19.9672	19.4804	18.9298	18.4870	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5008	18.6704	18.9786	19.4203	19.8152	20.0636	20.1179	20.1139	19.9672	19.4804	18.9298	18.4870	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9969	0.9945	0.9879	0.9656	0.8966	0.7286	0.5252	0.5823	0.8511	0.9737	0.9940	0.9975	(94)
Ext temp.	438.3177	479.6471	515.2133	543.8220	530.4799	421.7832	289.2748	301.4859	410.1026	432.3554	419.0643	418.8652	(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	1234.0053	1192.6796	1077.3124	894.4625	687.9826	456.9471	294.2207	309.8270	493.2872	752.8568	1008.7616	1225.7073	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	591.9916	479.1579	418.2017	252.4611	117.1820	0.0000	0.0000	0.0000	0.0000	238.4530	424.5820	600.2905	(98)
												3122.3199	(98)
												39.9274	(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													3342.9549 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	591.9916	479.1579	418.2017	252.4611	117.1820	0.0000	0.0000	0.0000	0.0000	238.4530	424.5820	600.2905	(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)	633.8239	513.0170	447.7535	270.3010	125.4626	0.0000	0.0000	0.0000	0.0000	255.3030	454.5846	642.7093	(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	87.6089	87.4468	87.0667	86.1594	84.3245	80.3000	80.3000	80.3000	80.3000	85.9005	87.1167	87.6845	(216)
Fuel for water heating, kWh/month	229.2100	201.1249	210.1709	188.3741	186.3479	172.3505	165.1249	184.0755	186.1085	198.1048	208.5207	223.6200	(219)
Water heating fuel used												2353.1328	(219)
Annual totals kWh/year													
Space heating fuel - main system												3342.9549	(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												6154.6406	(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	3342.9549	0.2160	722.0783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2353.1328	0.2160	508.2767 (264)
Space and water heating			1230.3549 (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			1468.3439 (272)
Emissions per m2 for space and water heating			15.7334 (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) = (15.7334 * 1.00) + 2.5456 + 0.4978, rounded to 2 d.p.			18.7800 (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 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1510 (8)
Pressure test					Yes
Measured/design AP50					4.7800
Infiltration rate					0.3900 (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) =		0.3608 (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	0.4600	0.4510	0.4420	0.3969	0.3878	0.3427	0.3427	0.3337	0.3608	0.3878	0.4059	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5977	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5899 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 7258.9600 (34)
92.8256 (35)
9.8392 (36)
(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	39.7085	39.4392	39.1752	37.9354	37.7035	36.6237	36.6237	36.4237	37.0396	37.7035	38.1727	38.6633 (38)
Heat transfer coeff	89.7978	89.5285	89.2646	88.0248	87.7928	86.7130	86.7130	86.5130	87.1289	87.7928	88.2621	88.7527 (39)
Average = Sum(39)m / 12 =												88.0237 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1483	1.1449	1.1415	1.1256	1.1227	1.1089	1.1089	1.1063	1.1142	1.1227	1.1287	1.1349 (40)
HLP (average)												1.1256 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.4278 (42)
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)

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				
Southeast				3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (77)				
Northwest				1.5300	11.2829	0.7200	0.7000	0.7700	6.0294 (81)				
Northwest				3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)				
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761	(83)
Total gains	403.3714	453.6755	502.7371	556.4115	594.1572	585.2729	556.7578	515.2968	471.1324	421.8664	389.3655	383.0876	(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	22.4546	22.5222	22.5888	22.9069	22.9675	23.2535	23.2535	23.3072	23.1425	22.9675	22.8454	22.7191	
alpha	2.4970	2.5015	2.5059	2.5271	2.5312	2.5502	2.5502	2.5538	2.5428	2.5312	2.5230	2.5146	
util living area	0.9722	0.9613	0.9407	0.8970	0.8194	0.6990	0.5739	0.6210	0.7988	0.9185	0.9616	0.9754	(86)
MIT	18.3541	18.5952	19.0326	19.6366	20.2052	20.6464	20.8497	20.8108	20.4560	19.7325	18.9488	18.3175	(87)
Th 2	19.9616	19.9644	19.9671	19.9800	19.9824	19.9936	19.9936	19.9957	19.9893	19.9824	19.9775	19.9724	(88)
util rest of house	0.9681	0.9555	0.9313	0.8793	0.7849	0.6340	0.4738	0.5246	0.7477	0.9010	0.9549	0.9718	(89)
MIT 2	17.5345	17.7751	18.2093	18.8091	19.3535	19.7594	19.9198	19.8968	19.6001	18.9126	18.1372	17.5055	(90)
Living area fraction	17.6194	17.8601	18.2946	18.8948	19.4417	19.8513	20.0161	19.9915	19.6888	18.9975	18.2213	17.5896	(91)
MIT	17.6194	17.8601	18.2946	18.8948	19.4417	19.8513	20.0161	19.9915	19.6888	18.9975	18.2213	17.5896	(92)
Temperature adjustment													0.0000
adjusted MIT	17.6194	17.8601	18.2946	18.8948	19.4417	19.8513	20.0161	19.9915	19.6888	18.9975	18.2213	17.5896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Utilisation	0.9551	0.9396	0.9114	0.8559	0.7632	0.6236	0.4763	0.5241	0.7295	0.8790	0.9391	0.9599	(94)		
Useful gains	385.2503	426.2773	458.1935	476.2316	453.4433	364.9999	265.1899	270.0895	343.6825	370.8284	365.6637	367.7348	(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	1196.0514	1160.2969	1052.8374	879.7940	679.6655	455.3578	296.2210	310.7113	486.9424	737.2421	981.5880	1188.3601	(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	603.2360	493.2611	442.4151	290.5649	168.3093	0.0000	0.0000	0.0000	0.0000	272.6118	443.4655	610.5452	(98)		
Space heating													3324.4089	(99)	
Space heating per m2													(98) / (4) =	42.5116	(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	815.1021	641.6761	657.4989	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	0.7003	0.7677	0.7377	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.7893	492.5895	485.0318	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.6012	740.4976	693.9014	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	147.4645	184.4437	155.3990	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												487.3072 (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	36.8661	46.1109	38.8497	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												121.8268 (107)
Space cooling per m2												1.5579 (108)
Energy for space heating												42.5116 (99)
Energy for space cooling												1.5579 (108)
Total												44.0695 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)		
	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 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)												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 (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
Southeast					3.3300	36.7938	0.6300		0.7000	0.7700		37.4448 (77)
Northwest					5.3300	11.2829	0.6300		0.7000	0.7700		18.3790 (81)
Solar gains	55.8237	101.1932	154.6723	218.8259	269.9112	278.8716	264.3208	224.5406	176.6258	116.2121	67.9757	47.0541 (83)
Total gains	395.3966	439.2193	480.6411	525.1507	555.5984	545.4341	518.9976	483.2196	445.9002	405.2646	379.6547	376.3656 (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	0.9991	0.9983	0.9957	0.9855	0.9475	0.8340	0.6718	0.7320	0.9293	0.9909	0.9983	0.9993 (86)
MIT	19.7226	19.8429	20.0635	20.3789	20.6815	20.9020	20.9764	20.9634	20.7982	20.4164	20.0210	19.7083 (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	0.9988	0.9977	0.9941	0.9792	0.9220	0.7557	0.5414	0.6061	0.8839	0.9860	0.9975	0.9991 (89)
MIT 2	18.8201	18.9427	19.1649	19.4883	19.7798	19.9751	20.0191	20.0161	19.8949	19.5294	19.1320	18.8151 (90)
Living area fraction												0.1036 (91)
MIT	18.9136	19.0359	19.2580	19.5806	19.8732	20.0711	20.1182	20.1142	19.9885	19.6213	19.2241	18.9076 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9136	19.0359	19.2580	19.5806	19.8732	20.0711	20.1182	20.1142	19.9885	19.6213	19.2241	18.9076 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9968	0.9924	0.9755	0.9175	0.7599	0.5547	0.6184	0.8820	0.9831	0.9967	0.9987	(94)
Ext temp.	394.7398	437.8253	476.9683	512.2975	509.7376	414.4923	287.8785	298.8318	393.2637	398.4339	378.3979	375.8875	(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	1269.8722	1224.3385	1101.4352	908.0843	692.8980	457.5794	294.2479	309.8532	495.0759	764.7990	1033.8563	1261.7915	(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	651.0985	528.5369	464.6033	284.9665	136.2713	0.0000	0.0000	0.0000	0.0000	272.5756	471.9300	659.1126	(98)
Space heating per m2												3469.0948	(98)
												(98) / (4) =	44.3618 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	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)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8086	0.8872	0.8565	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	635.6878	549.0671	543.0420	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	729.0363	696.3624	656.4085	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	67.2110	109.5877	84.3447	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												261.1434	(104)
												fC = cooled area / (4) =	1.0000 (105)

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	16.8027	27.3969	21.0862	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											65.2858 (107)
Space cooling per m2											0.8349 (108)
Energy for space heating											44.3618 (99)
Energy for space cooling											0.8349 (108)
Total											45.1967 (109)
Target Fabric Energy Efficiency (TFEE)											52.0 (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												4.7800
Infiltration rate												0.2390 (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) =	0.2211 (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												
	0.2432	0.2266	0.2266	0.2155	0.2155	0.2045	0.2045	0.1934	0.1934	0.2100	0.2045	0.2155 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			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 32.7736	Feb 32.7736	Mar 32.7736	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	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	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)												1.0596 (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	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	3.3300	45.1778	0.7200	0.7000	0.7700	52.5452 (77)
Northwest	1.5300	14.6176	0.7200	0.7000	0.7700	7.8115 (81)
Northwest	3.8000	14.6176	0.7200	0.7000	0.7700	19.4010 (81)

Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242	63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581	600.1634 (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	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9206	0.9045	0.8646	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2933	19.4530	19.8227	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9097	0.8915	0.8455	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.5028	18.6580	19.0159	19.4342	19.7985	19.9831	20.0248	20.0239	19.9269	19.5634	18.9870	18.4659 (90)
Living area fraction	18.5847	18.7404	19.0995	19.5202	19.8887	20.0784	20.1229	20.1218	20.0194	19.6495	19.0699	0.1036 (91)
MIT	18.5847	18.7404	19.0995	19.5202	19.8887	20.0784	20.1229	20.1218	20.0194	19.6495	19.0699	18.5476 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4347	18.5904	18.9495	19.3702	19.7387	19.9284	19.9729	19.9718	19.8694	19.4995	18.9199	18.3976 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8872	0.8676	0.8200	0.7347	0.5945	0.3973	0.2490	0.2586	0.5063	0.7287	0.8458	0.8954 (94)
Ext temp.	559.9376	581.4193	587.5263	562.7837	462.7644	314.2347	184.8564	184.4203	338.3282	454.1706	512.2531	537.3645 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1080.0950	1051.5618	940.4534	776.4426	550.1045	333.8065	188.3358	188.2448	378.6322	621.4317	871.7091	1068.7303 (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	386.9971	315.9358	262.5778	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362 (98)
RHI space heating demand												1962.9128 (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												4.7800
Infiltration rate												0.2390 (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) =	0.2211 (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												
	0.2819	0.2763	0.2708	0.2432	0.2377	0.2100	0.2100	0.2045	0.2211	0.2377	0.2487	0.2598 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5319	0.5263	0.5208	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5098 (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 34.8627	Feb 34.5004	Mar 34.1381	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 33.4136 (38)
Heat transfer coeff	84.9520	84.5897	84.2274	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	83.5029 (39)
Average = Sum(39)m / 12 =												83.3480 (39)
HLP	Jan 1.0863	Feb 1.0817	Mar 1.0771	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 1.0678 (40)
HLP (average)												1.0658 (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	
				3.3300	36.7938	0.7200	0.7000		0.7700		42.7940 (77)	
				1.5300	11.2829	0.7200	0.7000		0.7700		6.0294 (81)	
				3.8000	11.2829	0.7200	0.7000		0.7700		14.9751 (81)	
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761 (83)
Total gains	615.2049	662.1959	701.4747	741.3441	765.7148	745.7537	711.7709	675.0147	639.8024	604.4170	586.4204	590.3739 (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	24.8862	24.9927	25.1002	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.3180
alpha	2.6591	2.6662	2.6733	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.6879
util living area	0.9356	0.9191	0.8888	0.8286	0.7321	0.5970	0.4675	0.5050	0.6876	0.8433	0.9136	0.9410 (86)
MIT	18.9974	19.2078	19.5753	20.0687	20.4963	20.7959	20.9235	20.9033	20.6838	20.1556	19.5226	18.9740 (87)
Th 2	20.0120	20.0158	20.0196	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0272 (88)
util rest of house	0.9270	0.9084	0.8735	0.8039	0.6911	0.5314	0.3789	0.4167	0.6282	0.8156	0.9005	0.9332 (89)
MIT 2	18.1962	18.4048	18.7661	19.2506	19.6469	19.9044	19.9983	19.9863	19.8186	19.3414	18.7300	18.1843 (90)
Living area fraction	18.2792	18.4880	18.8499	19.3353	19.7349	19.9967	20.0942	20.0813	fLA = Living area / (4) =	19.4257	18.8121	0.1036 (91)
MIT	18.2792	18.4880	18.8499	19.3353	19.7349	19.9967	20.0942	20.0813	19.9082	19.4257	18.8121	18.2661 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1292	18.3380	18.6999	19.1853	19.5849	19.8467	19.9442	19.9313	19.7582	19.2757	18.6621	18.1161 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9059	0.8853	0.8483	0.7785	0.6696	0.5175	0.3701	0.4066	0.6091	0.7896	0.8770	0.9132 (94)
Ext temp.	557.3124	586.2702	595.0741	577.1060	512.7527	385.9158	263.4493	274.4524	389.7041	477.2391	514.2780	539.1033 (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	1174.8147	1136.7148	1027.5681	852.2724	653.3626	434.7604	277.1062	292.6151	468.8578	718.8978	958.0701	1162.0341 (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	459.4217	369.8988	321.7756	198.1198	104.6138	0.0000	0.0000	0.0000	0.0000	179.7941	319.5303	463.4605 (98)
Space heating per m2												2416.6147 (98)
										(98) / (4) =		30.9030 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													2670.2925 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.4217	369.8988	321.7756	198.1198	104.6138	0.0000	0.0000	0.0000	0.0000	179.7941	319.5303	463.4605	(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)	507.6483	408.7280	355.5531	218.9169	115.5954	0.0000	0.0000	0.0000	0.0000	198.6675	353.0722	512.1111	(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	89.6358	89.5809	89.4607	89.1958	88.7161	87.3000	87.3000	87.3000	87.3000	89.0909	89.4654	87.3000	(216)
Fuel for water heating, kWh/month	182.9243	160.5152	166.8913	147.3997	143.2946	127.3000	119.5890	134.9162	135.8416	153.1665	164.6023	177.5895	(219)
Water heating fuel used												1814.0302	(219)
Annual totals kWh/year													
Space heating fuel - main system												2670.2925	(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)
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 * 1029 * 1.00) =										-543.4106			-543.4106 (233)
Total delivered energy for all uses													4454.7571 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2670.2925	3.4800	92.9262 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1814.0302	3.4800	63.1283 (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	-543.4106	13.1900	-71.6759 (252)
Total energy cost			272.1547 (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] =	0.9278 (257)
SAP value			87.0572
SAP rating (Section 12)			87 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2670.2925	0.2160	576.7832 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.0302	0.2160	391.8305 (264)
Space and water heating			968.6137 (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	-543.4106	0.5190	-282.0301 (269)
Total kg/year			953.2692 (272)
CO2 emissions per m2			12.1900 (273)
EI value			89.6317
EI rating			90 (274)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8867 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8867 = 0.2436$, 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												4.7800
Infiltration rate												0.2390 (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) =	0.2211 (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												
	0.2432	0.2266	0.2266	0.2155	0.2155	0.2045	0.2045	0.1934	0.1934	0.2100	0.2045	0.2155 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			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 32.7736	Feb 32.7736	Mar 32.7736	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	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	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)												1.0596 (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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Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	
				3.3300	45.1778	0.7200	0.7000		0.7700		52.5452 (77)	
Southeast				1.5300	14.6176	0.7200	0.7000		0.7700		7.8115 (81)	
Northwest				3.8000	14.6176	0.7200	0.7000		0.7700		19.4010 (81)	
Northwest												
Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242	63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581	600.1634 (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	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9206	0.9045	0.8646	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2933	19.4530	19.8227	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9097	0.8915	0.8455	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.5028	18.6580	19.0159	19.4342	19.7985	19.9831	20.0248	20.0239	19.9269	19.5634	18.9870	18.4659 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.5847	18.7404	19.0995	19.5202	19.8887	20.0784	20.1229	20.1218	20.0194	19.6495	19.0699	18.5476 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4347	18.5904	18.9495	19.3702	19.7387	19.9284	19.9729	19.9718	19.8694	19.4995	18.9199	18.3976 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8872	0.8676	0.8200	0.7347	0.5945	0.3973	0.2490	0.2586	0.5063	0.7287	0.8458	0.8954 (94)
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	1080.0950	1051.5618	940.4534	776.4426	550.1045	333.8065	188.3358	188.2448	378.6322	621.4317	871.7091	1068.7303 (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	386.9971	315.9358	262.5778	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362 (98)
Space heating												1962.9128 (98)
Space heating per m2										(98) / (4) =		25.1012 (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													2168.9645 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	386.9971	315.9358	262.5778	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362	(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)	427.6211	349.1003	290.1412	169.9827	71.8023	0.0000	0.0000	0.0000	0.0000	137.5053	285.9760	436.8355	(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	89.5234	89.4742	89.3133	88.9967	88.3568	87.3000	87.3000	87.3000	87.3000	88.7976	89.3128	87.3000	(216)
Fuel for water heating, kWh/month	183.1539	160.7065	167.1668	147.7294	143.8773	127.3000	119.5890	134.9162	135.8416	153.6724	164.8837	177.7921	(219)
Water heating fuel used												1816.6290	(219)
Annual totals kWh/year													
Space heating fuel - main system												2168.9645	(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 * 1149 * 1.00) =													-606.6838 (233)
Total delivered energy for all uses													3892.7547 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2168.9645	9.7400	211.2571 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1816.6290	9.7400	176.9397 (247)
Mechanical ventilation fans	55.2921	36.8500	20.3752 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	383.5529	36.8500	141.3392 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-606.6838	36.8500	-223.5630 (252)
Total energy cost			457.9857 (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	2168.9645	0.2160	468.4963 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.6290	0.2160	392.3919 (264)
Space and water heating			860.8882 (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	-606.6838	0.5190	-314.8689 (269)
Total kg/year			812.7049 (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	2168.9645	1.2200	2646.1366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.6290	1.2200	2216.2874 (264)
Space and water heating			4862.4240 (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 -606.6838 3.0700 -1862.5192 (269)
 Primary energy kWh/year 4577.4091 (272)
 Primary energy kWh/m2/year 58.5346 (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	-£ 76	-184 kg (22.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76 2.35 kg/m²	B 88	A 92
Total Savings	£76 2.35 kg/m²		

Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£208	-£18
Mains gas	£492	£398	£95
Space heating	£363	£363	£0
Water heating	£177	£101	£76
Lighting	£141	£141	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£457	£382	£77
Total cost of uses	£457	£381	£76
Delivered energy	50 kWh/m²	38 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	45 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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7800
Infiltration rate					0.2390 (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)	=	0.2211 (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	0.2819	0.2763	0.2708	0.2432	0.2377	0.2100	0.2100	0.2045	0.2211	0.2377	0.2487	0.2598 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5319	0.5263	0.5208	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5098 (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	34.8627	34.5004	34.1381	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	32.7736	33.4136 (38)
Heat transfer coeff	84.9520	84.5897	84.2274	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	83.5029 (39)
Average = Sum(39)m / 12 =												83.3480 (39)
HLP	1.0863	1.0817	1.0771	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0596	1.0678 (40)
HLP (average)												1.0658 (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)												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)
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 W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				3.3300	36.7938		0.7200		0.7000		0.7700		42.7940 (77)
Northwest				1.5300	11.2829		0.7200		0.7000		0.7700		6.0294 (81)
Northwest				3.8000	11.2829		0.7200		0.7000		0.7700		14.9751 (81)
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865		53.7761 (83)
Total gains	615.2049	662.1959	701.4747	741.3441	765.7148	745.7537	711.7709	675.0147	639.8024	604.4170	586.4204		590.3739 (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	24.8862	24.9927	25.1002	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.3180	25.3180
alpha	2.6591	2.6662	2.6733	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.6879	2.6879
util living area	0.9356	0.9191	0.8888	0.8286	0.7321	0.5970	0.4675	0.5050	0.6876	0.8433	0.9136	0.9410 (86)	0.9410
MIT	18.9974	19.2078	19.5753	20.0687	20.4963	20.7959	20.9235	20.9033	20.6838	20.1556	19.5226	18.9740 (87)	18.9740
Th 2	20.0120	20.0158	20.0196	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0272 (88)	20.0272
util rest of house	0.9270	0.9084	0.8735	0.8039	0.6911	0.5314	0.3789	0.4167	0.6282	0.8156	0.9005	0.9332 (89)	0.9332
MIT 2	18.1962	18.4048	18.7661	19.2506	19.6469	19.9044	19.9983	19.9863	19.8186	19.3414	18.7300	18.1843 (90)	18.1843
Living area fraction													
MIT	18.2792	18.4880	18.8499	19.3353	19.7349	19.9967	20.0942	20.0813	19.9082	19.4257	18.8121	18.2661 (92)	18.2661
Temperature adjustment													-0.1500
adjusted MIT	18.1292	18.3380	18.6999	19.1853	19.5849	19.8467	19.9442	19.9313	19.7582	19.2757	18.6621	18.1161 (93)	18.1161

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	0.9059	0.8853	0.8483	0.7785	0.6696	0.5175	0.3701	0.4066	0.6091	0.7896	0.8770	0.9132	(94)
Useful gains	557.3124	586.2702	595.0741	577.1060	512.7527	385.9158	263.4493	274.4524	389.7041	477.2391	514.2780	539.1033	(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	1174.8147	1136.7148	1027.5681	852.2724	653.3626	434.7604	277.1062	292.6151	468.8578	718.8978	958.0701	1162.0341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	459.4217	369.8988	321.7756	198.1198	104.6138	0.0000	0.0000	0.0000	0.0000	179.7941	319.5303	463.4605	(98)
Space heating												2416.6147	(98)
Space heating per m2												30.9030	(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													2670.2925 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	459.4217	369.8988	321.7756	198.1198	104.6138	0.0000	0.0000	0.0000	0.0000	179.7941	319.5303	463.4605	(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)	507.6483	408.7280	355.5531	218.9169	115.5954	0.0000	0.0000	0.0000	0.0000	198.6675	353.0722	512.1111	(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	89.7335	89.7825	89.8440	89.9617	90.1486	87.3000	87.3000	87.3000	87.3000	89.4519	89.6122	87.3000	(216)
Fuel for water heating, kWh/month	155.5663	114.8590	89.0884	42.9629	13.8094	0.0000	0.0000	23.5711	48.6361	94.4299	132.0748	154.7017	(219)
Water heating fuel used												869.6996	(219)
Annual totals kWh/year													
Space heating fuel - main system												2670.2925	(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 * 1029 * 1.00) =										-543.4106		-543.4106	(233)
Total delivered energy for all uses												3560.4265	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2670.2925	3.4800	92.9262 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	869.6996	3.4800	30.2655 (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	-543.4106	13.1900	-71.6759 (252)
Total energy cost			245.8870 (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] =	0.8383 (257)
SAP value		88.3064
SAP rating (Section 12)		88 (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	2670.2925	0.2160	576.7832 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	869.6996	0.2160	187.8551 (264)
Space and water heating			764.6383 (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	-543.4106	0.5190	-282.0301 (269)
Total kg/year			775.2438 (272)
CO2 emissions per m2			9.9100 (273)
EI value			91.5680
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												4.7800
Infiltration rate												0.2390 (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) =	0.2211 (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												
	0.2432	0.2266	0.2266	0.2155	0.2155	0.2045	0.2045	0.1934	0.1934	0.2100	0.2045	0.2155 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			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 32.7736	Feb 32.7736	Mar 32.7736	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	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	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)												1.0596 (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)												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)
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)
(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
Southeast				3.3300	45.1778		0.7200		0.7000		0.7700		52.5452 (77)
Northwest				1.5300	14.6176		0.7200		0.7000		0.7700		7.8115 (81)
Northwest				3.8000	14.6176		0.7200		0.7000		0.7700		19.4010 (81)
Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242		63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581		600.1634 (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	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9206	0.9045	0.8646	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2933	19.4530	19.8227	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9097	0.8915	0.8455	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.5028	18.6580	19.0159	19.4342	19.7985	19.9831	20.0248	20.0239	19.9269	19.5634	18.9870	18.4659 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.5847	18.7404	19.0995	19.5202	19.8887	20.0784	20.1229	20.1218	20.0194	19.6495	19.0699	18.5476 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4347	18.5904	18.9495	19.3702	19.7387	19.9284	19.9729	19.9718	19.8694	19.4995	18.9199	18.3976 (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	0.8872	0.8676	0.8200	0.7347	0.5945	0.3973	0.2490	0.2586	0.5063	0.7287	0.8458	0.8954	(94)
Useful gains	559.9376	581.4193	587.5263	562.7837	462.7644	314.2347	184.8564	184.4203	338.3282	454.1706	512.2531	537.3645	(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	1080.0950	1051.5618	940.4534	776.4426	550.1045	333.8065	188.3358	188.2448	378.6322	621.4317	871.7091	1068.7303	(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	386.9971	315.9358	262.5778	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362	(98)
Space heating												1962.9128	(98)
Space heating per m2												25.1012	(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													2168.9645 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	386.9971	315.9358	262.5778	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362	(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)	427.6211	349.1003	290.1412	169.9827	71.8023	0.0000	0.0000	0.0000	0.0000	137.5053	285.9760	436.8355	(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	89.6483	89.6908	89.7358	89.8580	89.8175	87.3000	87.3000	87.3000	87.3000	89.2098	89.5001	87.3000	(216)
Fuel for water heating, kWh/month	151.0224	115.0138	88.5508	41.4471	18.9201	0.0000	0.0000	16.9068	43.6289	90.9045	126.7748	152.3579	(219)
Water heating fuel used												845.5270	(219)
Annual totals kWh/year													
Space heating fuel - main system												2168.9645	(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 * 1149 * 1.00) =										-606.6838		-606.6838	(233)
Total delivered energy for all uses												2971.6527	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2168.9645	9.7400	211.2571 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	845.5270	9.7400	82.3543 (247)
Mechanical ventilation fans	55.2921	36.8500	20.3752 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Pump for solar water heating	50.0000	36.8500	18.4250 (249)
Energy for lighting	383.5529	36.8500	141.3392 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-606.6838	36.8500	-223.5630 (252)
Total energy cost			381.8254 (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	2168.9645	0.2160	468.4963 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.5270	0.2160	182.6338 (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			651.1302 (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	-606.6838	0.5190	-314.8689 (269)
Total kg/year			628.8969 (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	2168.9645	1.2200	2646.1366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.5270	1.2200	1031.5430 (264)
Space and water heating			3677.6796 (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	-606.6838	3.0700	-1862.5192 (269)
Primary energy kWh/year			3546.1647 (272)
Primary energy kWh/m2/year			45.3474 (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 East
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			
South East	0.000	1.000	None
North West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	3.3300	127.3119	0.7200	0.7000	0.9000	173.0727
North West	1.5300	106.0502	0.7200	0.7000	0.9000	66.2397
North West	3.8000	106.0502	0.7200	0.7000	0.9000	164.5170

total: 403.8294

	Jun	Jul	Aug	
Solar gains	437	404	350	(P3)
Internal gains	424	407	415	
Total summer gains	861	811	765	(P5)

Summer gain/loss ratio	2.76	2.60	2.45	(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	19.47	21.21	21.07	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			