

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-206				Issued on Date	24/05/2023
Assessment Reference	As Built	Prop Type Ref	A Semi Op			
Property	4, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	87 B	DER	14.10	TER	18.78	
Environmental	89 B	% DER<TER	24.91			
CO ₂ Emissions (t/year)	0.82	DFEE	44.80	TFEE	51.98	
General Requirements Compliance	Pass	% DFEE<TFEE	13.80			
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) 14.10 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.54 (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	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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												
	0.3267	0.3203	0.3139	0.2818	0.2754	0.2434	0.2434	0.2370	0.2562	0.2754	0.2883	0.3011 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5767	0.5703	0.5639	0.5318	0.5254	0.5000	0.5000	0.5000	0.5062	0.5254	0.5383	0.5511 (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 37.8002	Feb 37.3804	Mar 36.9605	Apr 34.8611	May 34.4413	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 33.1817	Oct 34.4413	Nov 35.2810	Dec 36.1207 (38)
Heat transfer coeff	87.8896	87.4697	87.0498	84.9505	84.5306	82.8630	82.8630	82.8630	83.2710	84.5306	85.3703	86.2101 (39)
Average = Sum(39)m / 12 =												84.9884 (39)
HLP	Jan 1.1239	Feb 1.1185	Mar 1.1132	Apr 1.0863	May 1.0810	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0648	Oct 1.0810	Nov 1.0917	Dec 1.1024 (40)
HLP (average)												1.0868 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
Total per year (kWh/year) = Sum(64)m =												1610.5098 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	371.4855	369.1659	355.5066	333.6869	311.6359	290.5233	276.9508	283.1174	294.4840	316.5135	341.6828	360.4577 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
				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	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	24.0544	24.1698	24.2864	24.8866	25.0102	25.5135	25.5135	25.5135	25.3885	25.0102	24.7642	24.5230	
alpha	2.6036	2.6113	2.6191	2.6591	2.6673	2.7009	2.7009	2.7009	2.6926	2.6673	2.6509	2.6349	
util living area	0.9699	0.9586	0.9370	0.8902	0.8070	0.6774	0.5481	0.5942	0.7801	0.9108	0.9580	0.9733 (86)	
MIT	18.5497	18.7847	19.2039	19.7928	20.3200	20.7179	20.8867	20.8550	20.5515	19.8818	19.1393	18.5319 (87)	
Th 2	19.9814	19.9857	19.9901	20.0120	20.0164	20.0339	20.0339	20.0339	20.0296	20.0164	20.0076	19.9988 (88)	
util rest of house	0.9654	0.9524	0.9270	0.8716	0.7712	0.6125	0.4519	0.5003	0.7273	0.8920	0.9507	0.9694 (89)	
MIT 2	17.7363	17.9716	18.3883	18.9784	19.4815	19.8490	19.9790	19.9593	19.7118	19.0759	18.3405	17.7306 (90)	
Living area fraction									fLA = Living area / (4) =				0.1036 (91)
MIT	17.8205	18.0558	18.4728	19.0627	19.5684	19.9390	20.0731	20.0521	19.7988	19.1594	18.4233	17.8136 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.6705	17.9058	18.3228	18.9127	19.4184	19.7890	19.9231	19.9021	19.6488	19.0094	18.2733	17.6636 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9512	0.9351	0.9054	0.8458	0.7455	0.5940	0.4398	0.4859	0.7026	0.8670	0.9332	0.9564 (94)
Ext temp.	414.0447	453.3737	481.9442	493.7653	462.3110	361.8588	254.6375	262.2795	348.7243	389.5871	391.3710	396.1668 (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	1175.1310	1137.6168	1029.1724	850.5852	652.4384	429.9779	275.3583	290.1939	462.0513	710.8525	953.8645	1160.7013 (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	566.2482	459.8114	407.1378	256.9104	141.4548	0.0000	0.0000	0.0000	0.0000	239.0214	404.9953	568.8137 (98)
Space heating per m2												3044.3929 (98)
												(98) / (4) = 38.9309 (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													3363.9701 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	566.2482	459.8114	407.1378	256.9104	141.4548	0.0000	0.0000	0.0000	0.0000	239.0214	404.9953	568.8137	(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)	625.6887	508.0789	449.8760	283.8789	156.3036	0.0000	0.0000	0.0000	0.0000	264.1121	447.5087	628.5234	(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	89.7612	89.7166	89.6186	89.3908	88.9566	87.3000	87.3000	87.3000	87.3000	89.3103	89.6240	87.3000	(216)
Fuel for water heating, kWh/month	182.6688	160.2723	166.5973	147.0781	142.9072	127.3000	119.5890	134.9162	135.8416	152.7903	164.3111	177.3509	(219)
Water heating fuel used												1811.6228	(219)
Annual totals kWh/year													
Space heating fuel - main system												3363.9701	(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													5146.0274 (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	3363.9701	0.2160	726.6175 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1811.6228	0.2160	391.3105 (264)
Space and water heating			1117.9281 (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			1102.5836 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1000 (273)

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

DER			14.1000 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			32.7073 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			32.7073 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 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)
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												
Water storage loss:	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)
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 (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	439.6892	482.2961	521.4984	563.2168	591.6317	578.8618	550.7454	517.7489	481.8235	444.0548	421.6009	419.8956 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4944	62.6999	62.9025	63.8722	64.0570	64.9314	64.9314	65.0959	64.5918	64.0570	63.6843	63.2993	
alpha	5.1663	5.1800	5.1935	5.2581	5.2705	5.3288	5.3288	5.3397	5.3061	5.2705	5.2456	5.2200	
util living area	0.9985	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 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	(217)
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					5.5400
Infiltration rate					0.4280 (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) =	0.3959 (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	0.5048	0.4949	0.4850	0.4355	0.4256	0.3761	0.3761	0.3662	0.3959	0.4256	0.4454	0.4652 (22b)
Effective ac	0.6274	0.6225	0.6176	0.5948	0.5906	0.5707	0.5707	0.5671	0.5784	0.5906	0.5992	0.6082 (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	41.1256	40.8013	40.4834	38.9902	38.7109	37.4104	37.4104	37.1696	37.9113	38.7109	39.2760	39.8669 (38)
Heat transfer coeff	91.2149	90.8906	90.5727	89.0796	88.8002	87.4997	87.4997	87.2589	88.0007	88.8002	89.3654	89.9562 (39)
Average = Sum(39)m / 12 =												89.0782 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1664	1.1623	1.1582	1.1391	1.1356	1.1189	1.1189	1.1158	1.1253	1.1356	1.1428	1.1503 (40)
HLP (average)												1.1391 (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	22.1058	22.1847	22.2625	22.6357	22.7069	23.0444	23.0444	23.1080	22.9132	22.7069	22.5633	22.4151	
alpha	2.4737	2.4790	2.4842	2.5090	2.5138	2.5363	2.5363	2.5405	2.5275	2.5138	2.5042	2.4943	
util living area	0.9723	0.9615	0.9411	0.8979	0.8211	0.7012	0.5766	0.6235	0.8005	0.9191	0.9618	0.9755	(86)
MIT	18.3153	18.5584	18.9999	19.6138	20.1888	20.6387	20.8456	20.8063	20.4457	19.7140	18.9228	18.2842	(87)
Th 2	19.9469	19.9503	19.9536	19.9690	19.9719	19.9854	19.9854	19.9879	19.9802	19.9719	19.9660	19.9599	(88)
util rest of house	0.9681	0.9557	0.9317	0.8802	0.7866	0.6360	0.4758	0.5264	0.7493	0.9016	0.9551	0.9718	(89)
MIT 2	17.4862	17.7293	18.1679	18.7794	19.3306	19.7464	19.9097	19.8868	19.5840	18.8873	18.1038	17.4641	(90)
Living area fraction	17.5721	17.8152	18.2541	18.8659	19.4195	19.8388	20.0067	19.9821	19.6732	18.9729	18.1886	17.5491	(91)
MIT	17.5721	17.8152	18.2541	18.8659	19.4195	19.8388	20.0067	19.9821	19.6732	18.9729	18.1886	17.5491	(92)
Temperature adjustment	17.5721	17.8152	18.2541	18.8659	19.4195	19.8388	20.0067	19.9821	19.6732	18.9729	18.1886	17.5491	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	385.2310	426.3058	458.3395	476.6080	454.2361	365.9738	266.1852	270.9469	344.2848	371.0116	365.6827	367.7106	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1210.6141	1173.8661	1064.5978	887.7554	685.4904	458.3942	298.0824	312.5686	490.4486	743.5174	990.9380	1200.8316	(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	614.0850	502.3605	451.0562	296.0261	172.0532	0.0000	0.0000	0.0000	0.0000	277.1443	450.1838	619.8420	(98)
Space heating												3382.7512	(98)
Space heating per m2												43.2577	(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	822.4974	647.4980	663.1676	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	0.6959	0.7635	0.7336	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	572.3466	494.3774	486.5091	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	146.3433	183.1135	154.2999	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												483.7566 (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	36.5858	45.7784	38.5750	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.9391 (107)
Space cooling per m2												1.5465 (108)
Energy for space heating												43.2577 (99)
Energy for space cooling												1.5465 (108)
Total												44.8042 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.8 (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]												Gains
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		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												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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	0.2818	0.2626	0.2626	0.2498	0.2498	0.2370	0.2370	0.2242	0.2242	0.2434	0.2370	0.2498 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5318	0.5126	0.5126	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.8611	Feb 33.6015	Mar 33.6015	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.9505	83.6909	83.6909	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												83.1749 (39)
HLP	Jan 1.0863	Feb 1.0702	Mar 1.0702	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)												1.0636 (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	24.8866	25.2612	25.2612	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6591	2.6841	2.6841	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9220	0.9053	0.8657	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2345	19.4302	19.8027	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0120	20.0252	20.0252	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9111	0.8923	0.8467	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.4296	18.6296	18.9903	19.4342	19.7985	19.9831	20.0248	20.0239	19.9269	19.5634	18.9870	18.4659 (90)
Living area fraction	18.5130	18.7125	19.0744	19.5202	19.8887	20.0784	20.1229	20.1218	20.0194	19.6495	19.0699	0.1036 (91)
MIT	18.5130	18.7125	19.0744	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	18.3630	18.5625	18.9244	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	560.6388	581.8223	588.2141	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	1101.2102	1059.7359	947.7512	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	402.1851	321.1579	267.4956	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362 (98)
Space heating												1988.2408 (98)
RHI space heating demand												1988 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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												
	0.3267	0.3203	0.3139	0.2818	0.2754	0.2434	0.2434	0.2370	0.2562	0.2754	0.2883	0.3011 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5767	0.5703	0.5639	0.5318	0.5254	0.5000	0.5000	0.5000	0.5062	0.5254	0.5383	0.5511 (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 37.8002	Feb 37.3804	Mar 36.9605	Apr 34.8611	May 34.4413	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 33.1817	Oct 34.4413	Nov 35.2810	Dec 36.1207 (38)
Heat transfer coeff	87.8896	87.4697	87.0498	84.9505	84.5306	82.8630	82.8630	82.8630	83.2710	84.5306	85.3703	86.2101 (39)
Average = Sum(39)m / 12 =												84.9884 (39)
HLP	Jan 1.1239	Feb 1.1185	Mar 1.1132	Apr 1.0863	May 1.0810	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0648	Oct 1.0810	Nov 1.0917	Dec 1.1024 (40)
HLP (average)												1.0868 (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	
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	24.0544	24.1698	24.2864	24.8866	25.0102	25.5135	25.5135	25.5135	25.3885	25.0102	24.7642	24.5230
alpha	2.6036	2.6113	2.6191	2.6591	2.6673	2.7009	2.7009	2.7009	2.6926	2.6673	2.6509	2.6349
util living area	0.9369	0.9210	0.8917	0.8324	0.7368	0.5970	0.4675	0.5050	0.6889	0.8460	0.9155	0.9421 (86)
MIT	18.9110	19.1254	19.5021	20.0242	20.4718	20.7959	20.9235	20.9033	20.6797	20.1247	19.4596	18.8932 (87)
Th 2	19.9814	19.9857	19.9901	20.0120	20.0164	20.0339	20.0339	20.0339	20.0296	20.0164	20.0076	19.9988 (88)
util rest of house	0.9283	0.9102	0.8764	0.8076	0.6956	0.5314	0.3789	0.4167	0.6294	0.8183	0.9024	0.9342 (89)
MIT 2	18.0898	18.3027	18.6738	19.1920	19.6109	19.9044	19.9983	19.9863	19.8116	19.2992	18.6498	18.0849 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.1749	18.3879	18.7596	19.2782	19.7001	19.9967	20.0942	20.0813	19.9015	19.3847	18.7337	18.1686 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0249	18.2379	18.6096	19.1282	19.5501	19.8467	19.9442	19.9313	19.7515	19.2347	18.5837	18.0186 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9069	0.8868	0.8507	0.7816	0.6734	0.5175	0.3701	0.4066	0.6101	0.7918	0.8785	0.9140 (94)
Ext temp.	557.9232	587.2496	596.7282	579.4078	515.6602	385.9158	263.4493	274.4524	390.3601	478.6001	515.1634	539.5802 (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	1206.2738	1166.6654	1054.1396	868.8920	663.5722	434.7604	277.1062	292.6151	470.6068	729.8994	980.3653	1191.3046 (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	482.3729	389.3674	340.3141	208.4287	110.0465	0.0000	0.0000	0.0000	0.0000	186.9667	334.9453	484.8829 (98)
Space heating per m2												2537.3244 (98)
										(98) / (4) =		32.4466 (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													2803.6734 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	482.3729	389.3674	340.3141	208.4287	110.0465	0.0000	0.0000	0.0000	0.0000	186.9667	334.9453	484.8829	(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)	533.0087	430.2402	376.0376	230.3079	121.5983	0.0000	0.0000	0.0000	0.0000	206.5930	370.1053	535.7822	(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	89.6662	89.6141	89.4996	89.2348	88.7562	87.3000	87.3000	87.3000	87.3000	89.1217	89.4981	87.3000	(216)
Fuel for water heating, kWh/month	182.8623	160.4556	166.8188	147.3353	143.2299	127.3000	119.5890	134.9162	135.8416	153.1136	164.5422	177.5347	(219)
Water heating fuel used													1813.5391 (219)
Annual totals kWh/year													
Space heating fuel - main system													2803.6734 (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													4587.6469 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2803.6734	3.4800	97.5678 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1813.5391	3.4800	63.1112 (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			276.7793 (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] =	0.9436 (257)
SAP value		86.8373
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	2803.6734	0.2160	605.5935 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1813.5391	0.2160	391.7244 (264)
Space and water heating			997.3179 (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			981.9734 (272)
CO2 emissions per m2			12.5600 (273)
EI value			89.3194
EI rating			89 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	$3.48 / 0.8869 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8869 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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												
	0.2818	0.2626	0.2626	0.2498	0.2498	0.2370	0.2370	0.2242	0.2242	0.2434	0.2370	0.2498 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5318	0.5126	0.5126	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.8611	Feb 33.6015	Mar 33.6015	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.9505	83.6909	83.6909	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												83.1749 (39)
HLP	Jan 1.0863	Feb 1.0702	Mar 1.0702	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)												1.0636 (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 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	24.8866	25.2612	25.2612	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6591	2.6841	2.6841	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9220	0.9053	0.8657	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2345	19.4302	19.8027	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0120	20.0252	20.0252	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9111	0.8923	0.8467	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.4296	18.6296	18.9903	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	18.5130	18.7125	19.0744	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	18.3630	18.5625	18.9244	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	0.8883	0.8682	0.8209	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	1101.2102	1059.7359	947.7512	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	402.1851	321.1579	267.4956	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362 (98)
Space heating												1988.2408 (98)
Space heating per m2										(98) / (4) =		25.4251 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2196.9512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.1851	321.1579	267.4956	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)	444.4035	354.8707	295.5752	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	89.5494	89.4856	89.3271	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	183.1009	160.6861	167.1409	147.7294	143.8773	127.3000	119.5890	134.9162	135.8416	153.6724	164.8837	177.7921	(219)
Water heating fuel used												1816.5297	(219)
Annual totals kWh/year													
Space heating fuel - main system												2196.9512	(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			-606.6838 (233)
Total delivered energy for all uses													3920.6421 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2196.9512	9.7400	213.9830 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1816.5297	9.7400	176.9300 (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			460.7020 (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	2196.9512	0.2160	474.5415 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.5297	0.2160	392.3704 (264)
Space and water heating			866.9119 (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			818.7286 (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	2196.9512	1.2200	2680.2805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.5297	1.2200	2216.1662 (264)
Space and water heating			4896.4467 (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 4611.4318 (272)
 Primary energy kWh/m2/year 58.9697 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
 Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 76	-184 kg (22.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76 2.35 kg/m²	B 88	B 91
Total Savings	£76 2.35 kg/m²		

Potential energy efficiency rating: B 88
 Potential environmental impact rating: B 91

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	£495	£400	£95
Space heating	£366	£366	£0
Water heating	£177	£101	£76
Lighting	£141	£141	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£460	£384	£77
Total cost of uses	£460	£384	£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	46 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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												
	0.3267	0.3203	0.3139	0.2818	0.2754	0.2434	0.2434	0.2370	0.2562	0.2754	0.2883	0.3011 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5767	0.5703	0.5639	0.5318	0.5254	0.5000	0.5000	0.5000	0.5062	0.5254	0.5383	0.5511 (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 37.8002	Feb 37.3804	Mar 36.9605	Apr 34.8611	May 34.4413	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 33.1817	Oct 34.4413	Nov 35.2810	Dec 36.1207 (38)
Heat transfer coeff	87.8896	87.4697	87.0498	84.9505	84.5306	82.8630	82.8630	82.8630	83.2710	84.5306	85.3703	86.2101 (39)
Average = Sum(39)m / 12 =												84.9884 (39)
HLP	Jan 1.1239	Feb 1.1185	Mar 1.1132	Apr 1.0863	May 1.0810	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0648	Oct 1.0810	Nov 1.0917	Dec 1.1024 (40)
HLP (average)												1.0868 (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	24.0544	24.1698	24.2864	24.8866	25.0102	25.5135	25.5135	25.5135	25.3885	25.0102	24.7642	24.5230
alpha	2.6036	2.6113	2.6191	2.6591	2.6673	2.7009	2.7009	2.7009	2.6926	2.6673	2.6509	2.6349
util living area	0.9369	0.9210	0.8917	0.8324	0.7368	0.5970	0.4675	0.5050	0.6889	0.8460	0.9155	0.9421 (86)
MIT	18.9110	19.1254	19.5021	20.0242	20.4718	20.7959	20.9235	20.9033	20.6797	20.1247	19.4596	18.8932 (87)
Th 2	19.9814	19.9857	19.9901	20.0120	20.0164	20.0339	20.0339	20.0339	20.0296	20.0164	20.0076	19.9988 (88)
util rest of house	0.9283	0.9102	0.8764	0.8076	0.6956	0.5314	0.3789	0.4167	0.6294	0.8183	0.9024	0.9342 (89)
MIT 2	18.0898	18.3027	18.6738	19.1920	19.6109	19.9044	19.9983	19.9863	19.8116	19.2992	18.6498	18.0849 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.1749	18.3879	18.7596	19.2782	19.7001	19.9967	20.0942	20.0813	19.9015	19.3847	18.7337	18.1686 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0249	18.2379	18.6096	19.1282	19.5501	19.8467	19.9442	19.9313	19.7515	19.2347	18.5837	18.0186 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9069	0.8868	0.8507	0.7816	0.6734	0.5175	0.3701	0.4066	0.6101	0.7918	0.8785	0.9140	(94)
Useful gains	557.9232	587.2496	596.7282	579.4078	515.6602	385.9158	263.4493	274.4524	390.3601	478.6001	515.1634	539.5802	(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	1206.2738	1166.6654	1054.1396	868.8920	663.5722	434.7604	277.1062	292.6151	470.6068	729.8994	980.3653	1191.3046	(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	482.3729	389.3674	340.3141	208.4287	110.0465	0.0000	0.0000	0.0000	0.0000	186.9667	334.9453	484.8829	(98)
Space heating												2537.3244	(98)
Space heating per m2												32.4466	(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													2803.6734 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	482.3729	389.3674	340.3141	208.4287	110.0465	0.0000	0.0000	0.0000	0.0000	186.9667	334.9453	484.8829	(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)	533.0087	430.2402	376.0376	230.3079	121.5983	0.0000	0.0000	0.0000	0.0000	206.5930	370.1053	535.7822	(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	89.7615	89.8107	89.8727	89.9840	90.1641	87.3000	87.3000	87.3000	87.3000	89.4793	89.6421	87.3000	(216)
Fuel for water heating, kWh/month	155.5177	114.8230	89.0599	42.9523	13.8070	0.0000	0.0000	23.5711	48.6361	94.4010	132.0307	154.6572	(219)
Water heating fuel used												869.4560	(219)
Annual totals kWh/year													
Space heating fuel - main system												2803.6734	(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												3693.5638	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2803.6734	3.4800	97.5678 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	869.4560	3.4800	30.2571 (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 (250)
Energy for lighting	383.5529	13.1900	50.5906 (251)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-543.4106	13.1900	-71.6759 (252)
Total energy cost			250.5202 (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] =	0.8540 (257)
SAP value		88.0861
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	2803.6734	0.2160	605.5935 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	869.4560	0.2160	187.8025 (264)
Space and water heating			793.3959 (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			804.0014 (272)
CO2 emissions per m2			10.2800 (273)
EI value			91.2552
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.5400
Infiltration rate												0.2770 (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) =	0.2562 (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												
	0.2818	0.2626	0.2626	0.2498	0.2498	0.2370	0.2370	0.2242	0.2242	0.2434	0.2370	0.2498 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5318	0.5126	0.5126	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.8611	Feb 33.6015	Mar 33.6015	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	84.9505	83.6909	83.6909	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												83.1749 (39)
HLP	Jan 1.0863	Feb 1.0702	Mar 1.0702	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)												1.0636 (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)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)		
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	24.8866	25.2612	25.2612	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6591	2.6841	2.6841	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9220	0.9053	0.8657	0.7897	0.6639	0.4835	0.3522	0.3652	0.5946	0.7915	0.8887	0.9274 (86)
MIT	19.2345	19.4302	19.8027	20.2647	20.6696	20.9037	20.9714	20.9687	20.8201	20.3945	19.7869	19.2546 (87)
Th 2	20.0120	20.0252	20.0252	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9111	0.8923	0.8467	0.7590	0.6120	0.4062	0.2553	0.2654	0.5202	0.7534	0.8710	0.9173 (89)
MIT 2	18.4296	18.6296	18.9903	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	18.5130	18.7125	19.0744	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	18.3630	18.5625	18.9244	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	0.8883	0.8682	0.8209	0.7347	0.5945	0.3973	0.2490	0.2586	0.5063	0.7287	0.8458	0.8954	(94)
Useful gains	560.6388	581.8223	588.2141	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	1101.2102	1059.7359	947.7512	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	402.1851	321.1579	267.4956	153.8344	64.9811	0.0000	0.0000	0.0000	0.0000	124.4423	258.8083	395.3362	(98)
Space heating												1988.2408	(98)
Space heating per m2												25.4251	(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													2196.9512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.1851	321.1579	267.4956	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)	444.4035	354.8707	295.5752	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	89.6722	89.7006	89.7466	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	150.9822	115.0011	88.5402	41.4471	18.9201	0.0000	0.0000	16.9068	43.6289	90.9045	126.7748	152.3579	(219)
Water heating fuel used												845.4636	(219)
Annual totals kWh/year													
Space heating fuel - main system												2196.9512	(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												2999.5761	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2196.9512	9.7400	213.9830 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	845.4636	9.7400	82.3482 (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			384.5451 (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	2196.9512	0.2160	474.5415 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.4636	0.2160	182.6201 (264)

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

Space and water heating			657.1616 (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			634.9283 (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	2196.9512	1.2200	2680.2805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.4636	1.2200	1031.4656 (264)
Space and water heating			3711.7461 (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			3580.2312 (272)
Primary energy kWh/m2/year			45.7830 (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			