

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-201			Issued on Date	27/03/2023
Assessment Reference	As Built	Prop Type Ref	A Semi Op		
Property	13, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	87 B	DER	13.40	TER	18.76
Environmental	90 B	% DER<TER	28.57		
CO ₂ Emissions (t/year)	0.80	DFEE	43.37	TFEE	51.74
General Requirements Compliance	Pass	% DFEE<TFEE	16.17		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 78 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.76 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.4 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.31 (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 North:	5.33 m ² , No overhang
Windows facing South:	3.33 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Photovoltaic array	0.66 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												4.3100
Infiltration rate												0.2155 (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) =	0.1993 (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												
	0.2542	0.2492	0.2442	0.2193	0.2143	0.1894	0.1894	0.1844	0.1993	0.2143	0.2243	0.2342 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5042	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.0460	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.1353	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8856 (39)
HLP	Jan 1.0631	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0599 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
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)

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.5300	10.6334	0.7200	0.7000		0.7700		5.6823 (74)	
South				3.3300	46.7521	0.7200	0.7000		0.7700		54.3762 (78)	
North				3.8000	10.6334	0.7200	0.7000		0.7700		14.1130 (74)	
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	445.6570	496.0500	533.2281	565.1516	584.3320	568.0012	541.5962	515.4118	490.2728	457.5984	430.5572	423.9461 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.4300	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	
alpha	2.6953	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	
util living area	0.9678	0.9554	0.9348	0.8946	0.8214	0.7043	0.5749	0.6128	0.7832	0.9061	0.9549	0.9716 (86)	
MIT	18.7076	18.9371	19.3139	19.8079	20.3029	20.6875	20.8724	20.8433	20.5496	19.9276	19.2237	18.6492 (87)	
Th 2	20.0311	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)	
util rest of house	0.9631	0.9490	0.9248	0.8768	0.7875	0.6406	0.4771	0.5183	0.7309	0.8868	0.9472	0.9675 (89)	
MIT 2	17.9266	18.1553	18.5270	19.0097	19.4814	19.8267	19.9712	19.9525	19.7140	19.1323	18.4417	17.8710 (90)	
Living area fraction									fLA = Living area / (4) =				0.1036 (91)
MIT	18.0075	18.2363	18.6085	19.0924	19.5665	19.9158	20.0645	20.0447	19.8006	19.2147	18.5227	17.9516 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.8575	18.0863	18.4585	18.9424	19.4165	19.7658	19.9145	19.8947	19.6506	19.0647	18.3727	17.8016 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9488	0.9316	0.9036	0.8518	0.7618	0.6203	0.4637	0.5030	0.7061	0.8619	0.9294	0.9543 (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	1127.1064	1092.6577	990.9149	832.1416	639.4082	428.0568	274.6529	289.5852	459.9388	701.4113	934.0892	1127.0658 (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	523.9901	423.7141	378.7439	252.5564	144.5469	0.0000	0.0000	0.0000	0.0000	228.4129	384.4196	537.5376 (98)
Space heating												2873.9216 (98)
Space heating per m2										(98) / (4) =		36.7509 (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													3175.6040 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.9901	423.7141	378.7439	252.5564	144.5469	0.0000	0.0000	0.0000	0.0000	228.4129	384.4196	537.5376	(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)	578.9946	468.1924	418.5015	279.0679	159.7204	0.0000	0.0000	0.0000	0.0000	252.3899	424.7731	593.9642	(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	89.7162	89.6672	89.5717	89.3784	88.9739	87.3000	87.3000	87.3000	87.3000	89.2761	89.5904	87.3000	(216)
Fuel for water heating, kWh/month	182.7604	160.3606	166.6846	147.0986	142.8794	127.3000	119.5890	134.9162	135.8416	152.8487	164.3727	177.4142	(219)
Water heating fuel used												1812.0659	(219)
Annual totals kWh/year													
Space heating fuel - main system												3175.6040	(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 * 1080 * 1.00) =													-569.9890 (233)
Total delivered energy for all uses													4931.5259 (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	3175.6040	0.2160	685.9305	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.0659	0.2160	391.4062	(264)
Space and water heating			1077.3367	(265)
Pumps and fans	130.2921	0.5190	67.6216	(267)
Energy for lighting	383.5529	0.5190	199.0640	(268)
Energy saving/generation technologies				
PV Unit	-569.9890	0.5190	-295.8243	(269)
Total CO2, kg/year			1048.1980	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4000	(273)

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

DER		13.4000	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		32.0073	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		32.0073	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 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	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												
22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.8180	47.7474	44.3952	44.0025	40.7711	42.1301	44.0025	44.3952	47.7474	48.0193	50.9589 (61)
Solar input	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (64)
	62.5647	54.7817	56.9047	50.3028	48.6178	42.6535	40.6122	45.5175	46.0279	52.6434	56.4391	60.9925 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	84.0923	81.5204	76.4847	69.8650	65.3465	59.2410	54.5863	61.1794	63.9276	70.7572	78.3877	81.9792	(72)
Total internal gains	383.8654	381.1029	366.8261	344.3909	321.7205	299.9902	286.4246	293.2084	305.1977	327.8427	353.6252	372.8414	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					5.3300	10.6334	0.6300		0.7000	0.7700		17.3209
South					3.3300	46.7521	0.6300		0.7000	0.7700		47.5792 (74)
Solar gains	64.9001	111.0236	155.5063	202.5316	238.6090	242.7931	231.5648	203.2576	171.3152	123.4492	77.7651	55.5524 (83)
Total gains	448.7655	492.1264	522.3324	546.9226	560.3295	542.7833	517.9893	496.4660	476.5129	451.2919	431.3903	428.3938 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4944	62.6999	62.9025	63.8722	64.0570	64.9314	64.9314	65.0959	64.5918	64.0570	63.6843	63.2993	
alpha	5.1663	5.1800	5.1935	5.2581	5.2705	5.3288	5.3288	5.3397	5.3061	5.2705	5.2456	5.2200	
util living area	0.9984	0.9971	0.9937	0.9828	0.9458	0.8361	0.6728	0.7178	0.9115	0.9855	0.9968	0.9988	(86)
MIT	19.7867	19.9061	20.1125	20.4032	20.6858	20.9007	20.9763	20.9666	20.8225	20.4689	20.0830	19.7710	(87)
Th 2	19.9917	19.9947	19.9976	20.0113	20.0138	20.0258	20.0258	20.0280	20.0212	20.0138	20.0086	20.0032	(88)
util rest of house	0.9978	0.9960	0.9914	0.9754	0.9198	0.7582	0.5423	0.5919	0.8592	0.9778	0.9955	0.9983	(89)
MIT 2	18.3694	18.5460	18.8491	19.2796	19.6766	19.9504	20.0158	20.0123	19.8636	19.3786	18.8149	18.3548	(90)
Living area fraction	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(91)
MIT	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5162	18.6869	18.9800	19.3959	19.7811	20.0488	20.1153	20.1112	19.9629	19.4916	18.9462	18.5015	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9940	0.9879	0.9691	0.9119	0.7603	0.5552	0.6038	0.8553	0.9720	0.9934	0.9973	(94)
Ext temp.	447.2349	489.1817	515.9966	529.9979	510.9639	412.6932	287.6108	299.7463	407.5692	438.6605	428.5277	427.2443	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1235.3410	1194.1090	1077.4303	892.3875	685.0911	455.7133	294.0050	309.6013	492.9240	753.7991	1010.1637	1226.9483	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	586.3509	473.7112	417.7067	260.9205	129.5507	0.0000	0.0000	0.0000	0.0000	234.4631	418.7779	594.9798	(98)
Space heating per m2												3116.4609	(98)
												39.8524	(99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3336.6819 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.3509	473.7112	417.7067	260.9205	129.5507	0.0000	0.0000	0.0000	0.0000	234.4631	418.7779	594.9798	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	627.7847	507.1854	447.2234	279.3582	138.7052	0.0000	0.0000	0.0000	0.0000	251.0312	448.3703	637.0234	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801	(64)
Efficiency of water heater (217)m	87.5895	87.4228	87.0641	86.2402	84.5697	80.3000	80.3000	80.3000	80.3000	85.8583	87.0861	87.6668	(217)
Fuel for water heating, kWh/month	229.2607	201.1800	210.1773	188.1975	185.8076	172.3505	165.1249	184.0755	186.1085	198.2021	208.5940	223.6651	(219)
Water heating fuel used												2352.7436	(219)
Annual totals kWh/year													
Space heating fuel - main system												3336.6819	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												383.5529	(232)
Total delivered energy for all uses												6147.9783	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3336.6819	0.2160	720.7233 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2352.7436	0.2160	508.1926 (264)
Space and water heating			1228.9159 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Total CO2, kg/m2/year			1466.9048 (272)
Emissions per m2 for space and water heating			15.7150 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5456 (272b)
Emissions per m2 for pumps and fans			0.4978 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7150 * 1.00) + 2.5456 + 0.4978, rounded to 2 d.p.			18.7600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	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										4.3100							
Infiltration rate										0.3665 (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) =					0.3390 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4323	0.4238	0.4153	0.3730	0.3645	0.3221	0.3221	0.3136	0.3390	0.3645	0.3814	0.3984	(22b)				
Effective ac	0.5934	0.5898	0.5863	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5794	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)
Total net area of external elements Aum (m ²)			168.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.2502		(33)
Timber Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)
Timber GF			62.6100			9.0000	563.4900 (32c)
Timber FF			75.8400			9.0000	682.5600 (32c)
Internal Floor			39.1000			18.0000	703.8000 (32d)
Internal Ceiling			39.1000			9.0000	351.9000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7258.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							92.8256 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)
Total fabric heat loss					(33) + (36) =		50.0893 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.8980	38.6602	38.4271	37.3322	37.1273	36.1737	36.1737	35.9971	36.5410	37.1273	37.5417	37.9750 (38)
Heat transfer coeff	88.9873	88.7495	88.5164	87.4215	87.2166	86.2630	86.2630	86.0864	86.6303	87.2166	87.6311	88.0643 (39)
Average = Sum(39)m / 12 =												87.4205 (39)
HLP	1.1379	1.1349	1.1319	1.1179	1.1153	1.1031	1.1031	1.1008	1.1078	1.1153	1.1206	1.1261 (40)
HLP (average)												1.1179 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1445.3269 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.5300	10.6334	0.7200	0.7000	0.7700	5.6823 (74)			
South				3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)			
North				3.8000	10.6334	0.7200	0.7000	0.7700	14.1130 (74)			
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	413.7444	464.9101	503.6902	537.7895	558.3832	544.0403	519.3223	490.9735	465.0632	430.1373	400.5534	392.7999 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.6592	22.7199	22.7797	23.0650	23.1192	23.3748	23.3748	23.4227	23.2757	23.1192	23.0099	22.8967	
alpha	2.5106	2.5147	2.5186	2.5377	2.5413	2.5583	2.5583	2.5615	2.5517	2.5413	2.5340	2.5264	
util living area	0.9706	0.9591	0.9402	0.9028	0.8355	0.7242	0.5997	0.6384	0.8017	0.9150	0.9591	0.9740	(86)
MIT	18.3992	18.6401	19.0534	19.6175	20.1668	20.6160	20.8345	20.7993	20.4547	19.7584	18.9875	18.3582	(87)
Th 2	19.9700	19.9724	19.9748	19.9862	19.9884	19.9983	19.9983	20.0001	19.9945	19.9884	19.9840	19.9795	(88)
util rest of house	0.9662	0.9531	0.9308	0.8860	0.8030	0.6611	0.4990	0.5423	0.7512	0.8970	0.9521	0.9702	(89)
MIT 2	17.5846	17.8248	18.2350	18.7960	19.3246	19.7408	19.9157	19.8940	19.6033	18.9414	18.1796	17.5505	(90)
Living area fraction	17.6690	17.9092	18.3198	18.8810	19.4118	19.8315	20.0109	19.9878	19.6915	19.0260	18.2633	17.6342	(91)
MIT	17.6690	17.9092	18.3198	18.8810	19.4118	19.8315	20.0109	19.9878	19.6915	19.0260	18.2633	17.6342	(92)
Temperature adjustment	17.6690	17.9092	18.3198	18.8810	19.4118	19.8315	20.0109	19.9878	19.6915	19.0260	18.2633	17.6342	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	394.2322	435.5135	458.8277	464.0612	435.9579	353.1046	259.8722	265.6130	340.8528	376.3349	374.8395	376.2741	(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	1189.6729	1154.5631	1046.2425	872.5583	672.5970	451.2824	294.2318	308.8604	484.3960	734.8882	978.2512	1183.0723	(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	591.8079	483.2013	437.0366	294.1179	176.0595	0.0000	0.0000	0.0000	0.0000	266.7637	434.4564	600.2579	(98)
Space heating													3283.7013 (98)
Space heating per m2													(98) / (4) = 41.9911 (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	810.8724	638.3464	654.2569	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	0.6789	0.7497	0.7253	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	550.5177	478.5495	474.5358	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	727.4072	696.7418	665.4715	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	127.3605	162.3351	142.0562	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												431.7518 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	31.8401	40.5838	35.5140	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												107.9379 (107)
Space cooling per m2												1.3803 (108)
Energy for space heating												41.9911 (99)
Energy for space cooling												1.3803 (108)
Total												43.3713 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.4 (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)
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												
0.0000	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(73)

6. Solar gains

[Jan]													
				Area m2			Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
North				5.3300			10.6334	0.6300		0.7000	0.7700		17.3209 (74)
South				3.3300			46.7521	0.6300		0.7000	0.7700		47.5792 (78)
Solar gains	64.9001	111.0236	155.5063	202.5316	238.6090	242.7931	231.5648	203.2576	171.3152	123.4492	77.7651	55.5524 (83)	
Total gains	404.4729	449.0496	481.4751	508.8564	524.2962	509.3556	486.2416	461.9367	440.5896	412.5017	389.4441	384.8639 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4944	62.6999	62.9025	63.8722	64.0570	64.9314	64.9314	65.0959	64.5918	64.0570	63.6843	63.2993	
alpha	5.1663	5.1800	5.1935	5.2581	5.2705	5.3288	5.3288	5.3397	5.3061	5.2705	5.2456	5.2200	
util living area	0.9990	0.9981	0.9957	0.9874	0.9577	0.8621	0.7065	0.7552	0.9322	0.9902	0.9980	0.9993	(86)
MIT	19.7335	19.8547	20.0645	20.3606	20.6520	20.8828	20.9702	20.9574	20.7937	20.4248	20.0328	19.7186	(87)
Th 2	19.9917	19.9947	19.9976	20.0113	20.0138	20.0258	20.0258	20.0280	20.0212	20.0138	20.0086	20.0032	(88)
util rest of house	0.9987	0.9974	0.9940	0.9818	0.9362	0.7896	0.5743	0.6298	0.8880	0.9848	0.9972	0.9990	(89)
MIT 2	18.8310	18.9544	19.1659	19.4705	19.7537	19.9629	20.0169	20.0137	19.8914	19.5375	19.1437	18.8254	(90)
Living area fraction	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(91)
MIT	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9245	19.0476	19.2590	19.5627	19.8468	20.0582	20.1157	20.1115	19.9849	19.6294	19.2358	18.9179	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9965	0.9923	0.9784	0.9315	0.7925	0.5876	0.6419	0.8859	0.9819	0.9963	0.9986	(94)
Useful gains	403.7278	447.4770	477.7687	497.8447	488.3628	403.6676	285.7245	296.5339	390.3278	405.0347	387.9988	384.3215	(95)
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	1270.8195	1225.3550	1101.5196	906.5666	690.6571	456.5006	294.0347	309.6275	494.7734	765.4889	1034.8551	1262.6709	(97)
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	645.1162	522.7340	464.0707	294.2798	150.5069	0.0000	0.0000	0.0000	0.0000	268.1780	465.7365	653.4919	(98)
Space heating												3464.1140	(98)
Space heating per m2												44.2981	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	786.1722	618.9015	634.0219	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7801	0.8666	0.8406	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.3316	536.3687	532.9607	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	686.8666	658.0761	631.5324	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	52.9452	90.5503	73.3374	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												216.8329	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	13.2363	22.6376	18.3343	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											54.2082 (107)
Space cooling per m2											0.6932 (108)
Energy for space heating											44.2981 (99)
Energy for space cooling											0.6932 (108)
Total											44.9913 (109)
Target Fabric Energy Efficiency (TFEE)											51.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.3100		
Number of sides sheltered															0.2155 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1993 (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																	
	0.2193	0.2043	0.2043	0.1944	0.1944	0.1844	0.1844	0.1744	0.1744	0.1894	0.1844	0.1944 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0596 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
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												
Solar input	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												
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)
												1611 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.5300	13.4839	0.7200	0.7000	0.7700		7.2056 (74)	
South					3.3300	56.7559	0.7200	0.7000	0.7700		66.0114 (78)	
North					3.8000	13.4839	0.7200	0.7000	0.7700		17.8963 (74)	
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9177	0.9019	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)
MIT	19.3139	19.4690	19.8188	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9065	0.8887	0.8465	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)
MIT 2	18.5226	18.6734	19.0122	19.4097	19.7773	19.9757	20.0234	20.0228	19.9235	19.5694	19.0051	18.4842 (90)
Living area fraction	18.6046	18.7558	19.0958	19.4954	19.8669	20.0705	20.1212	20.1204	20.0159	19.6556	19.0881	0.1036 (91)
MIT	18.6046	18.7558	19.0958	19.4954	19.8669	20.0705	20.1212	20.1204	20.0159	19.6556	19.0881	18.5660 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4546	18.6058	18.9458	19.3454	19.7169	19.9205	19.9712	19.9704	19.8659	19.5056	18.9381	18.4160 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	567.7604	587.4789	586.0507	552.8639	453.7064	310.8722	184.1904	183.8924	336.8487	456.6119	519.4071	544.6110 (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	1081.7426	1052.8390	940.1433	774.3899	548.2961	333.1529	188.1968	188.1346	378.3400	621.9377	873.2184	1070.2553 (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	382.4028	312.7220	263.4448	159.4987	70.3747	0.0000	0.0000	0.0000	0.0000	123.0024	254.7441	391.0794 (98)
Space heating												1957.2689 (98)
RHI space heating demand												1957 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.3100
Infiltration rate												0.2155 (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) =	0.1993 (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												
	0.2542	0.2492	0.2442	0.2193	0.2143	0.1894	0.1894	0.1844	0.1993	0.2143	0.2243	0.2342 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5042	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.0460	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.1353	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8856 (39)
HLP	Jan 1.0631	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0599 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.5300	10.6334	0.7200	0.7000	0.7700	5.6823 (74)			
South				3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)			
North				3.8000	10.6334	0.7200	0.7000	0.7700	14.1130 (74)			
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744	63.4884 (83)
Total gains	625.5779	673.4306	702.4278	722.7221	729.9408	704.5212	674.3354	650.6913	633.7331	612.6879	597.6083	600.0861 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.4300	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.6953	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9324	0.9151	0.8871	0.8358	0.7493	0.6199	0.4881	0.5194	0.6912	0.8396	0.9103	0.9387 (86)
MIT	19.0716	19.2784	19.6128	20.0441	20.4635	20.7755	20.9150	20.8964	20.6794	20.1669	19.5424	19.0122 (87)
Th 2	20.0311	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9235	0.9040	0.8717	0.8117	0.7093	0.5541	0.3972	0.4298	0.6320	0.8115	0.8968	0.9306 (89)
MIT 2	18.2823	18.4865	18.8128	19.2282	19.6194	19.8902	19.9939	19.9826	19.8153	19.3516	18.7489	18.2265 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.3641	18.5685	18.8957	19.3127	19.7068	19.9819	20.0893	20.0772	19.9048	19.4360	18.8311	18.3079 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2141	18.4185	18.7457	19.1627	19.5568	19.8319	19.9393	19.9272	19.7548	19.2860	18.6811	18.1579 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9023	0.8810	0.8468	0.7861	0.6868	0.5389	0.3877	0.4191	0.6127	0.7856	0.8730	0.9103 (94)
Ext temp.	564.4810	593.2932	594.7840	568.1278	501.3443	379.6722	261.4266	272.7281	388.2803	481.3057	521.7255	546.2683 (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	1156.7519	1120.1822	1014.7111	850.3965	651.0388	433.5312	276.7071	292.2750	468.5708	719.7511	959.6410	1156.5921 (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	440.6496	354.0694	312.4258	203.2334	111.3727	0.0000	0.0000	0.0000	0.0000	177.4034	315.2991	454.0809 (98)
Space heating per m2												2368.5343 (98)
										(98) / (4) =		30.2882 (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													2617.1650 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	440.6496	354.0694	312.4258	203.2334	111.3727	0.0000	0.0000	0.0000	0.0000	177.4034	315.2991	454.0809	(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)	486.9056	391.2369	345.2218	224.5673	123.0638	0.0000	0.0000	0.0000	0.0000	196.0258	348.3968	501.7468	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater	89.6092	89.5519	89.4399	89.2155	88.7657	87.3000	87.3000	87.3000	87.3000	89.0804	89.4561	87.3000	(216)
Fuel for water heating, kWh/month	182.9786	160.5670	166.9301	147.3672	143.2146	127.3000	119.5890	134.9162	135.8416	153.1846	164.6195	177.6147	(219)
Water heating fuel used												1814.1232	(219)
Annual totals kWh/year													
Space heating fuel - main system												2617.1650	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =										-569.9890			-569.9890 (233)
Total delivered energy for all uses													4375.1442 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2617.1650	3.4800	91.0773 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1814.1232	3.4800	63.1315 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-569.9890	13.1900	-75.1815 (252)
Total energy cost			266.8034 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.9096 (257)
SAP rating (Section 12)		87.3117
SAP band		B (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2617.1650	0.2160	565.3076 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1814.1232	0.2160	391.8506 (264)
Space and water heating			957.1582 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			928.0195 (272)
CO2 emissions per m2			11.8700 (273)
EI value			89.9063
EI rating			90 (274)

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EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8866 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8866 = 0.2436$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.3100		
Number of sides sheltered															0.2155 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1993 (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																	
	0.2193	0.2043	0.2043	0.1944	0.1944	0.1844	0.1844	0.1744	0.1744	0.1894	0.1844	0.1944 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0596 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.5300	13.4839	0.7200	0.7000		0.7700		7.2056 (74)	
South				3.3300	56.7559	0.7200	0.7000		0.7700		66.0114 (78)	
North				3.8000	13.4839	0.7200	0.7000		0.7700		17.8963 (74)	
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	
util living area	0.9177	0.9019	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)	
MIT	19.3139	19.4690	19.8188	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)	
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)	
util rest of house	0.9065	0.8887	0.8465	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)	
MIT 2	18.5226	18.6734	19.0122	19.4097	19.7773	19.9757	20.0234	20.0228	19.9235	19.5694	19.0051	18.4842 (90)	
Living area fraction									fLA = Living area / (4) =				0.1036 (91)
MIT	18.6046	18.7558	19.0958	19.4954	19.8669	20.0705	20.1212	20.1204	20.0159	19.6556	19.0881	18.5660 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.4546	18.6058	18.9458	19.3454	19.7169	19.9205	19.9712	19.9704	19.8659	19.5056	18.9381	18.4160 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8836	0.8645	0.8210	0.7453	0.6143	0.4191	0.2635	0.2697	0.5125	0.7254	0.8410	0.8922 (94)
Ext temp.	567.7604	587.4789	586.0507	552.8639	453.7064	310.8722	184.1904	183.8924	336.8487	456.6119	519.4071	544.6110 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1081.7426	1052.8390	940.1433	774.3899	548.2961	333.1529	188.1968	188.1346	378.3400	621.9377	873.2184	1070.2553 (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	382.4028	312.7220	263.4448	159.4987	70.3747	0.0000	0.0000	0.0000	0.0000	123.0024	254.7441	391.0794 (98)
Space heating per m2												1957.2689 (98)
										(98) / (4) =		25.0290 (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													2162.7281 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	382.4028	312.7220	263.4448	159.4987	70.3747	0.0000	0.0000	0.0000	0.0000	123.0024	254.7441	391.0794	(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)	422.5445	345.5492	291.0993	176.2417	77.7621	0.0000	0.0000	0.0000	0.0000	135.9142	281.4852	432.1319	(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	89.5153	89.4671	89.3157	89.0255	88.4140	87.3000	87.3000	87.3000	87.3000	88.7883	89.3009	87.3000	(216)
Fuel for water heating, kWh/month	183.1706	160.7194	167.1622	147.6816	143.7843	127.3000	119.5890	134.9162	135.8416	153.6885	164.9056	177.8064	(219)
Water heating fuel used												1816.5652	(219)
Annual totals kWh/year													
Space heating fuel - main system												2162.7281	(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 * 1201 * 1.00) =										-633.9128			-633.9128 (233)
Total delivered energy for all uses													3859.2256 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2162.7281	9.7400	210.6497 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1816.5652	9.7400	176.9335 (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	-633.9128	36.8500	-233.5969 (252)
Total energy cost			447.3382 (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	2162.7281	0.2160	467.1493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.5652	0.2160	392.3781 (264)
Space and water heating			859.5274 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	0.5190	-329.0007 (269)
Total kg/year			797.2122 (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	2162.7281	1.2200	2638.5282 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.5652	1.2200	2216.2096 (264)
Space and water heating			4854.7379 (265)
Pumps and fans	130.2921	3.0700	399.9969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
 PV Unit -633.9128 3.0700 -1946.1123 (269)
 Primary energy kWh/year 4486.1298 (272)
 Primary energy kWh/m2/year 57.3674 (273)

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 76	-184 kg (23.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76 2.35 kg/m²	B 89	A 92
Total Savings	£76 2.35 kg/m²		

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

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£189	£208	-£18
Mains gas	£492	£397	£95
Space heating	£363	£363	£0
Water heating	£177	£101	£76
Lighting	£141	£141	£0
Generated (PV)	-£234	-£234	£0
Total cost of fuels	£447	£371	£77
Total cost of uses	£447	£371	£76
Delivered energy	49 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	57 kWh/m²	44 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												4.3100
Infiltration rate												0.2155 (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) =	0.1993 (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												
	0.2542	0.2492	0.2442	0.2193	0.2143	0.1894	0.1894	0.1844	0.1993	0.2143	0.2243	0.2342 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5042	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.0460	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	83.1353	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8856 (39)
HLP	Jan 1.0631	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0599 (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
North				1.5300	10.6334		0.7200		0.7000		0.7700		5.6823 (74)
South				3.3300	46.7521		0.7200		0.7000		0.7700		54.3762 (78)
North				3.8000	10.6334		0.7200		0.7000		0.7700		14.1130 (74)
Solar gains	74.1715	126.8841	177.7215	231.4647	272.6960	277.4778	264.6454	232.2944	195.7888	141.0849	88.8744		63.4884 (83)
Total gains	625.5779	673.4306	702.4278	722.7221	729.9408	704.5212	674.3354	650.6913	633.7331	612.6879	597.6083		600.0861 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.4300	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	
alpha	2.6953	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	
util living area	0.9324	0.9151	0.8871	0.8358	0.7493	0.6199	0.4881	0.5194	0.6912	0.8396	0.9103	0.9387 (86)	
MIT	19.0716	19.2784	19.6128	20.0441	20.4635	20.7755	20.9150	20.8964	20.6794	20.1669	19.5424	19.0122 (87)	
Th 2	20.0311	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)	
util rest of house	0.9235	0.9040	0.8717	0.8117	0.7093	0.5541	0.3972	0.4298	0.6320	0.8115	0.8968	0.9306 (89)	
MIT 2	18.2823	18.4865	18.8128	19.2282	19.6194	19.8902	19.9939	19.9826	19.8153	19.3516	18.7489	18.2265 (90)	
Living area fraction													0.1036 (91)
MIT	18.3641	18.5685	18.8957	19.3127	19.7068	19.9819	20.0893	20.0772	19.9048	19.4360	18.8311	18.3079 (92)	
Temperature adjustment													-0.1500
adjusted MIT	18.2141	18.4185	18.7457	19.1627	19.5568	19.8319	19.9393	19.9272	19.7548	19.2860	18.6811	18.1579 (93)	

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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	0.9023	0.8810	0.8468	0.7861	0.6868	0.5389	0.3877	0.4191	0.6127	0.7856	0.8730	0.9103	(94)
Useful gains	564.4810	593.2932	594.7840	568.1278	501.3443	379.6722	261.4266	272.7281	388.2803	481.3057	521.7255	546.2683	(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	1156.7519	1120.1822	1014.7111	850.3965	651.0388	433.5312	276.7071	292.2750	468.5708	719.7511	959.6410	1156.5921	(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	440.6496	354.0694	312.4258	203.2334	111.3727	0.0000	0.0000	0.0000	0.0000	177.4034	315.2991	454.0809	(98)
Space heating												2368.5343	(98)
Space heating per m2												(98) / (4) =	30.2882 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2617.1650 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	440.6496	354.0694	312.4258	203.2334	111.3727	0.0000	0.0000	0.0000	0.0000	177.4034	315.2991	454.0809	(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)	486.9056	391.2369	345.2218	224.5673	123.0638	0.0000	0.0000	0.0000	0.0000	196.0258	348.3968	501.7468	(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	89.7089	89.7579	89.8285	89.9730	90.1677	87.3000	87.3000	87.3000	87.3000	89.4425	89.6036	87.3000	(216)
Fuel for water heating, kWh/month	155.6089	114.8905	89.1038	42.9575	13.8065	0.0000	0.0000	23.5711	48.6361	94.4398	132.0874	154.7222	(219)
Water heating fuel used												869.8239	(219)
Annual totals kWh/year													
Space heating fuel - main system												2617.1650	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1080 * 1.00) =									-569.9890			-569.9890	(233)
Total delivered energy for all uses												3480.8449	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2617.1650	3.4800	91.0773	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	869.8239	3.4800	30.2699	(247)
Mechanical ventilation fans	55.2921	13.1900	7.2930	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	383.5529	13.1900	50.5906	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-569.9890	13.1900	-75.1815	(252)
Total energy cost			240.5368	(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] =	0.8200 (257)
SAP value		88.5608
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2617.1650	0.2160	565.3076 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	869.8239	0.2160	187.8820 (264)
Space and water heating			753.1896 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-569.9890	0.5190	-295.8243 (269)
Total kg/year			750.0009 (272)
CO2 emissions per m2			9.5900 (273)
EI value			91.8425
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.3100		
Number of sides sheltered															0.2155 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1993 (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																	
	0.2193	0.2043	0.2043	0.1944	0.1944	0.1844	0.1844	0.1744	0.1744	0.1894	0.1844	0.1944 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1700	6.6470	75.0000	2932.5000 (28a)					
140mm Timber Frame	90.0700	10.7800	79.2900	0.1900	15.0651	9.0000	713.6100 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			168.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2502		(33)					
Timebr Frame			47.9600	0.0000	0.0000	20.0000	959.2000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7610.8600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.3256 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8392 (36)					
Total fabric heat loss						(33) + (36) =	50.0893 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630	82.8630 (39)
Average = Sum(39)m / 12 =												82.8630 (39)
HLP	Jan 1.0596	Feb 1.0596	Mar 1.0596	Apr 1.0596	May 1.0596	Jun 1.0596	Jul 1.0596	Aug 1.0596	Sep 1.0596	Oct 1.0596	Nov 1.0596	Dec 1.0596 (40)
HLP (average)												1.0596 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
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	1445.3269 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3955 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-870.5009 (H17)
Solar input	-28.5766	-40.6341	-69.8403	-94.2308	-110.1318	-118.7419	-113.0330	-103.0222	-80.5017	-55.3617	-33.7986	-22.6280 (63)
Solar input (sum of months) = Sum (63)m =												-870.5009 (63)
Output from w/h	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981 (64)
Total per year (kWh/year) = Sum (64)m =												756.2498 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.5300	13.4839	0.7200	0.7000	0.7700	7.2056 (74)			
South				3.3300	56.7559	0.7200	0.7000	0.7700	66.0114 (78)			
North				3.8000	13.4839	0.7200	0.7000	0.7700	17.8963 (74)			
Solar gains	91.1132	132.9925	189.1508	250.5679	281.2996	314.6551	289.2216	263.4363	219.3811	157.8720	108.8761	73.7995 (83)
Total gains	642.5196	679.5390	713.8572	741.8253	738.5444	741.6984	698.9116	681.8331	657.3254	629.4751	617.6100	610.3972 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135	25.5135
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9177	0.9019	0.8655	0.7999	0.6844	0.5085	0.3718	0.3800	0.6012	0.7883	0.8845	0.9248 (86)
MIT	19.3139	19.4690	19.8188	20.2371	20.6423	20.8910	20.9673	20.9655	20.8150	20.4015	19.8062	19.2736 (87)
Th 2	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339	20.0339 (88)
util rest of house	0.9065	0.8887	0.8465	0.7700	0.6331	0.4291	0.2704	0.2768	0.5267	0.7499	0.8663	0.9144 (89)
MIT 2	18.5226	18.6734	19.0122	19.4097	19.7773	19.9757	20.0234	20.0228	19.9235	19.5694	19.0051	18.4842 (90)
Living area fraction												fLA = Living area / (4) = 0.1036 (91)
MIT	18.6046	18.7558	19.0958	19.4954	19.8669	20.0705	20.1212	20.1204	20.0159	19.6556	19.0881	18.5660 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4546	18.6058	18.9458	19.3454	19.7169	19.9205	19.9712	19.9704	19.8659	19.5056	18.9381	18.4160 (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	0.8836	0.8645	0.8210	0.7453	0.6143	0.4191	0.2635	0.2697	0.5125	0.7254	0.8410	0.8922	(94)
Useful gains	567.7604	587.4789	586.0507	552.8639	453.7064	310.8722	184.1904	183.8924	336.8487	456.6119	519.4071	544.6110	(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	1081.7426	1052.8390	940.1433	774.3899	548.2961	333.1529	188.1968	188.1346	378.3400	621.9377	873.2184	1070.2553	(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	382.4028	312.7220	263.4448	159.4987	70.3747	0.0000	0.0000	0.0000	0.0000	123.0024	254.7441	391.0794	(98)
Space heating												1957.2689	(98)
Space heating per m2												25.0290	(99)

(98) / (4) = 25.0290 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2162.7281 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	382.4028	312.7220	263.4448	159.4987	70.3747	0.0000	0.0000	0.0000	0.0000	123.0024	254.7441	391.0794	(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)	422.5445	345.5492	291.0993	176.2417	77.7621	0.0000	0.0000	0.0000	0.0000	135.9142	281.4852	432.1319	(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	89.6408	89.6846	89.7378	89.8764	89.8593	87.3000	87.3000	87.3000	87.3000	89.2008	89.4892	87.3000	(216)
Fuel for water heating, kWh/month	151.0350	115.0217	88.5489	41.4387	18.9113	0.0000	0.0000	16.9068	43.6289	90.9137	126.7903	152.3693	(219)
Water heating fuel used												845.5645	(219)
Annual totals kWh/year													
Space heating fuel - main system												2162.7281	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1201 * 1.00) =										-633.9128		-633.9128	(233)
Total delivered energy for all uses												2938.2248	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2162.7281	9.7400	210.6497 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	845.5645	9.7400	82.3580 (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	-633.9128	36.8500	-233.5969 (252)
Total energy cost			371.1877 (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	2162.7281	0.2160	467.1493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.5645	0.2160	182.6419 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space and water heating			649.7912 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	0.5190	-329.0007 (269)
Total kg/year			613.4260 (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	2162.7281	1.2200	2638.5282 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	845.5645	1.2200	1031.5887 (264)
Space and water heating			3670.1169 (265)
Pumps and fans	180.2921	3.0700	553.4969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)
Energy saving/generation technologies			
PV Unit	-633.9128	3.0700	-1946.1123 (269)
Primary energy kWh/year			3455.0089 (272)
Primary energy kWh/m2/year			44.1817 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	97.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	262.19 (P1)
Transmission heat loss coefficient	50.09 (37)
Summer heat loss coefficient	312.28 (P2)

Overhangs

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

Solar shading

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

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

	Jun	Jul	Aug	
Solar gains	377	351	313	(P3)
Internal gains	424	407	415	
Total summer gains	801	758	728	(P5)
Summer gain/loss ratio	2.57	2.43	2.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 97.3)	1.32	1.32	1.32	
Threshold temperature	19.28	21.04	20.95	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			