

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-228			Issued on Date	30/08/2023
Assessment Reference	As Built	Prop Type Ref	A Mid Op		
Property	10, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT				
SAP Rating	88 B	DER	11.39	TER	17.32
Environmental	91 B	% DER<TER	34.25		
CO ₂ Emissions (t/year)	0.67	DFEE	36.98	TFEE	44.30
General Requirements Compliance	Pass	% DFEE<TFEE	16.52		
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

Mid-Terrace 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) 17.32 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.39 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)44.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.0 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	0.15 (max. 0.25)	0.15 (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: 4.49 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

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

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.66 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	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) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50																4.4900	
Infiltration rate																0.2245 (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) =		0.2077 (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																	
	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5148	0.5096	0.5044	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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.7417	Feb 33.4014	Mar 33.0611	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	72.5909	72.2506	71.9103	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.7798 (39)
HLP	Jan 0.9283	Feb 0.9239	Mar 0.9196	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9179 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Southeast				3.3300	36.7938	0.7200	0.7000	0.7700		42.7940 (77)		
Northwest				1.5300	11.2829	0.7200	0.7000	0.7700		6.0294 (81)		
Northwest				3.8000	11.2829	0.7200	0.7000	0.7700		14.9751 (81)		
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761 (83)
Total gains	435.2840	484.8153	532.2750	583.7736	620.1059	609.2338	579.0317	539.7352	496.3421	449.3274	419.3693	414.2338 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.1444	31.2910	31.4391	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	
alpha	3.0763	3.0861	3.0959	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	
util living area	0.9721	0.9597	0.9348	0.8807	0.7827	0.6406	0.5034	0.5512	0.7547	0.9055	0.9593	0.9758 (86)	
MIT	19.0977	19.3148	19.6817	20.1463	20.5623	20.8350	20.9427	20.9227	20.7104	20.1815	19.5633	19.0649 (87)	
Th 2	20.1435	20.1472	20.1509	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)	
util rest of house	0.9681	0.9539	0.9251	0.8620	0.7473	0.5799	0.4197	0.4677	0.7031	0.8868	0.9525	0.9723 (89)	
MIT 2	17.5706	17.8869	18.4179	19.0799	19.6500	19.9962	20.1132	20.0957	19.8538	19.1403	18.2545	17.5296 (90)	
Living area fraction									fLA = Living area / (4) =				0.1036 (91)
MIT	17.7288	18.0348	18.5488	19.1904	19.7445	20.0831	20.1991	20.1813	19.9426	19.2481	18.3901	17.6886 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.5788	17.8848	18.3988	19.0404	19.5945	19.9331	20.0491	20.0313	19.7926	19.0981	18.2401	17.5386 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9505	0.9324	0.8986	0.8318	0.7204	0.5626	0.4087	0.4546	0.6777	0.8567	0.9306	0.9563 (94)
Ext temp.	413.7522	452.0629	478.2808	485.5594	446.7211	342.7518	236.6549	245.3780	336.3505	384.9605	390.2815	396.1182 (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	963.9213	938.1607	855.6498	726.2820	565.4229	381.9704	247.0328	260.0851	407.7166	608.6596	797.8862	955.3482 (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	409.3258	326.6577	280.7625	173.3203	88.3141	0.0000	0.0000	0.0000	0.0000	166.4321	293.4754	416.0671 (98)
Space heating per m2												2154.3552 (98)
										(98) / (4) =		27.5493 (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													2380.5029 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	409.3258	326.6577	280.7625	173.3203	88.3141	0.0000	0.0000	0.0000	0.0000	166.4321	293.4754	416.0671	(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)	452.2937	360.9478	310.2348	191.5141	97.5847	0.0000	0.0000	0.0000	0.0000	183.9029	324.2822	459.7427	(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	89.5611	89.4973	89.3628	89.0913	88.5840	87.3000	87.3000	87.3000	87.3000	89.0298	89.4050	87.3000	(216)
Fuel for water heating, kWh/month	183.0770	160.6650	167.0741	147.5725	143.5083	127.3000	119.5890	134.9162	135.8416	153.2717	164.7136	177.7254	(219)
Water heating fuel used												1815.2543	(219)
Annual totals kWh/year													
Space heating fuel - main system												2380.5029	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =													-543.4106 (233)
Total delivered energy for all uses													4166.1917 (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	2380.5029	0.2160	514.1886 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.2543	0.2160	392.0949 (264)
Space and water heating			906.2836 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-543.4106	0.5190	-282.0301 (269)
Total CO2, kg/year			890.9390 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.3900 (273)

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

DER			11.3900 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			29.9973 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			29.9973 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1510 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4010 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3710 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359	(22b)				
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6600	1.3258	11.4811		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1800	5.6484		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4155		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2602 (36)					
Total fabric heat loss						(33) + (36) =	37.6757 (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	77.7808	77.4961	77.2171	75.9064	75.6611	74.5195	74.5195	74.3081	74.9593	75.6611	76.1572	76.6759 (39)
Average = Sum(39)m / 12 =												75.9052 (39)
HLP	Jan 0.9946	Feb 0.9910	Mar 0.9874	Apr 0.9707	May 0.9675	Jun 0.9529	Jul 0.9529	Aug 0.9502	Sep 0.9586	Oct 0.9675	Nov 0.9739	Dec 0.9805 (40)
HLP (average)												0.9707 (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				
Southeast			3.3300	36.7938	0.6300	0.7000	0.7700	37.4448 (77)				
Northwest			5.3300	11.2829	0.6300	0.7000	0.7700	18.3790 (81)				
Solar gains	55.8237	101.1932	154.6723	218.8259	269.9112	278.8716	264.3208	224.5406	176.6258	116.2121	67.9757	47.0541 (83)
Total gains	439.6892	482.2961	521.4984	563.2168	591.6317	578.8618	550.7454	517.7489	481.8235	444.0548	421.6009	419.8956 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.8187	70.0752	70.3284	71.5428	71.7747	72.8742	72.8742	73.0816	72.4468	71.7747	71.3072	70.8248	
alpha	5.6546	5.6717	5.6886	5.7695	5.7850	5.8583	5.8583	5.8721	5.8298	5.7850	5.7538	5.7217	
util living area	0.9986	0.9972	0.9930	0.9761	0.9156	0.7604	0.5835	0.6394	0.8820	0.9838	0.9970	0.9989	(86)
MIT	19.9372	20.0517	20.2552	20.5422	20.7988	20.9542	20.9918	20.9866	20.8852	20.5652	20.2081	19.9235	(87)
Th 2	20.0878	20.0908	20.0938	20.1078	20.1105	20.1227	20.1227	20.1250	20.1180	20.1105	20.1052	20.0996	(88)
util rest of house	0.9981	0.9962	0.9905	0.9667	0.8818	0.6801	0.4734	0.5282	0.8240	0.9756	0.9958	0.9985	(89)
MIT 2	18.6593	18.8287	19.1274	19.5509	19.9019	20.0902	20.1195	20.1190	20.0195	19.5895	19.0682	18.6479	(90)
Living area fraction	18.7916	18.9554	19.2442	19.6536	19.9948	20.1797	20.2098	20.2089	20.1092	19.6905	19.1862	18.7800	(91)
MIT	18.7916	18.9554	19.2442	19.6536	19.9948	20.1797	20.2098	20.2089	20.1092	19.6905	19.1862	18.7800	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7916	18.9554	19.2442	19.6536	19.9948	20.1797	20.2098	20.2089	20.1092	19.6905	19.1862	18.7800	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9970	0.9945	0.9871	0.9603	0.8765	0.6858	0.4846	0.5394	0.8234	0.9703	0.9939	0.9977	(94)
Ext temp.	438.3788	479.6381	514.7856	540.8813	518.5945	396.9910	266.9184	279.2704	396.7097	430.8566	419.0306	418.9274	(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	1127.1716	1089.2386	984.0736	816.2630	627.5931	415.7955	269.0018	283.0286	450.4418	687.8007	920.4549	1117.9341	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	512.4619	409.6515	349.1503	198.2749	81.0949	0.0000	0.0000	0.0000	0.0000	191.1664	361.0255	520.0610	(98)
												2622.8864	(98)
												33.5407	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2808.2295 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.4619	409.6515	349.1503	198.2749	81.0949	0.0000	0.0000	0.0000	0.0000	191.1664	361.0255	520.0610	(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)	548.6744	438.5990	373.8226	212.2857	86.8254	0.0000	0.0000	0.0000	0.0000	204.6749	386.5370	556.8105	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801	(64)
Efficiency of water heater	87.3084	87.1090	86.6521	85.5562	83.4747	80.3000	80.3000	80.3000	80.3000	85.3446	86.7477	87.3904	(217)
Fuel for water heating, kWh/month	229.9990	201.9049	211.1765	189.7021	188.2450	172.3505	165.1249	184.0755	186.1085	199.3952	209.4077	224.3725	(219)
Water heating fuel used												2361.8623	(219)
Annual totals kWh/year													
Space heating fuel - main system												2808.2295	(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												5628.6447	(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	2808.2295	0.2160	606.5776 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2361.8623	0.2160	510.1623 (264)
Space and water heating			1116.7398 (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			1354.7288 (272)
Emissions per m2 for space and water heating			14.2806 (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) = (14.2806 * 1.00) + 2.5456 + 0.4978, rounded to 2 d.p.			17.3200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1510 (8)
Pressure test					Yes
Measured/design AP50					4.4900
Infiltration rate					0.3755 (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) =	0.3474 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4429	0.4342	0.4255	0.3821	0.3734	0.3300	0.3300	0.3213	0.3474	0.3734	0.3908	0.4082 (22b)
	0.5981	0.5943	0.5905	0.5730	0.5697	0.5545	0.5545	0.5516	0.5603	0.5697	0.5764	0.5833 (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	0.1500	5.8650	75.0000	2932.5000 (28a)
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (28a)
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			120.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)
Timber Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) = 7786.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							99.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)
Total fabric heat loss							(33) + (36) = 38.8492 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.2024	38.9528	38.7081	37.5588	37.3437	36.3427	36.3427	36.1573	36.7283	37.3437	37.7788	38.2335 (38)
Heat transfer coeff	78.0516	77.8020	77.5573	76.4080	76.1929	75.1919	75.1919	75.0065	75.5775	76.1929	76.6279	77.0827 (39)
Average = Sum(39)m / 12 =												76.4069 (39)
HLP	0.9981	0.9949	0.9918	0.9771	0.9743	0.9615	0.9615	0.9592	0.9665	0.9743	0.9799	0.9857 (40)
HLP (average)												0.9771 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (77)			
Northwest				1.5300	11.2829	0.7200	0.7000	0.7700	6.0294 (81)			
Northwest				3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)			
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761 (83)
Total gains	403.3714	453.6755	502.7371	556.4115	594.1572	585.2729	556.7578	515.2968	471.1324	421.8664	389.3655	383.0876 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.7130	27.8020	27.8897	28.3092	28.3891	28.7670	28.7670	28.8381	28.6203	28.3891	28.2279	28.0614	
alpha	2.8475	2.8535	2.8593	2.8873	2.8926	2.9178	2.9178	2.9225	2.9080	2.8926	2.8819	2.8708	
util living area	0.9753	0.9641	0.9421	0.8933	0.8045	0.6680	0.5335	0.5831	0.7806	0.9174	0.9644	0.9785	(86)
MIT	18.7994	19.0265	19.4223	19.9582	20.4375	20.7788	20.9172	20.8907	20.6239	20.0111	19.3212	18.7649	(87)
Th 2	20.0849	20.0876	20.0902	20.1025	20.1048	20.1155	20.1155	20.1175	20.1114	20.1048	20.1001	20.0953	(88)
util rest of house	0.9716	0.9589	0.9332	0.8758	0.7702	0.6066	0.4448	0.4958	0.7304	0.9004	0.9583	0.9753	(89)
MIT 2	18.0535	18.2801	18.6727	19.2042	19.6590	19.9691	20.0746	20.0602	19.8418	19.2648	18.5834	18.0266	(90)
Living area fraction	18.1308	18.3574	18.7503	19.2823	19.7397	20.0530	20.1619	20.1462	19.9228	19.3421	18.6599	18.1031	(91)
MIT	18.1308	18.3574	18.7503	19.2823	19.7397	20.0530	20.1619	20.1462	19.9228	19.3421	18.6599	18.1031	(92)
Temperature adjustment	18.1308	18.3574	18.7503	19.2823	19.7397	20.0530	20.1619	20.1462	19.9228	19.3421	18.6599	18.1031	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9612	0.9457	0.9166	0.8567	0.7543	0.6018	0.4498	0.4989	0.7182	0.8823	0.9453	0.9658	(94)
Ext temp.	387.7011	429.0516	460.7838	476.6515	448.1892	352.2182	250.4018	257.0604	338.3779	372.2005	368.0665	370.0017	(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	1079.5138	1047.0150	950.1006	793.2876	612.5653	410.0221	267.8230	280.9913	440.0743	666.0867	885.8077	1071.6880	(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	514.7087	415.2714	364.0516	227.9780	122.2958	0.0000	0.0000	0.0000	0.0000	218.6514	372.7736	522.0546	(98)
Space heating per m2												2757.7850	(98)
												35.2658	(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	706.8038	556.4201	570.0496	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	0.7782	0.8397	0.8131	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	550.0683	467.2328	463.4970	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.6012	740.4976	693.9014	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	162.3837	203.3090	171.4209	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												537.1135 (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	40.5959	50.8272	42.8552	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												134.2784 (107)
Space cooling per m2												1.7171 (108)
Energy for space heating												35.2658 (99)
Energy for space cooling												1.7171 (108)
Total												36.9829 (109)
Dwelling Fabric Energy Efficiency (DFEE)												37.0 (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		(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	42.1600	10.7800	31.3800	0.1800	5.6484		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		29.4155		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2602 (36)					
Total fabric heat loss						(33) + (36) =	37.6757 (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	77.7808	77.4961	77.2171	75.9064	75.6611	74.5195	74.5195	74.3081	74.9593	75.6611	76.1572	76.6759 (39)
Average = Sum(39)m / 12 =												75.9052 (39)
HLP	Jan 0.9946	Feb 0.9910	Mar 0.9874	Apr 0.9707	May 0.9675	Jun 0.9529	Jul 0.9529	Aug 0.9502	Sep 0.9586	Oct 0.9675	Nov 0.9739	Dec 0.9805 (40)
HLP (average)												0.9707 (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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d	W	
Southeast					3.3300	36.7938	0.6300		0.7000	0.7700	37.4448 (77)	
Northwest					5.3300	11.2829	0.6300		0.7000	0.7700	18.3790 (81)	
Solar gains	55.8237	101.1932	154.6723	218.8259	269.9112	278.8716	264.3208	224.5406	176.6258	116.2121	67.9757	47.0541 (83)
Total gains	395.3966	439.2193	480.6411	525.1507	555.5984	545.4341	518.9976	483.2196	445.9002	405.2646	379.6547	376.3656 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.8187	70.0752	70.3284	71.5428	71.7747	72.8742	72.8742	73.0816	72.4468	71.7747	71.3072	70.8248
alpha	5.6546	5.6717	5.6886	5.7695	5.7850	5.8583	5.8583	5.8721	5.8298	5.7850	5.7538	5.7217
util living area	0.9992	0.9983	0.9953	0.9826	0.9328	0.7912	0.6153	0.6775	0.9089	0.9894	0.9982	0.9994 (86)
MIT	19.8829	19.9991	20.2064	20.5003	20.7697	20.9435	20.9893	20.9820	20.8607	20.5206	20.1568	19.8698 (87)
Th 2	20.0878	20.0908	20.0938	20.1078	20.1105	20.1227	20.1227	20.1250	20.1180	20.1105	20.1052	20.0996 (88)
util rest of house	0.9989	0.9977	0.9936	0.9754	0.9038	0.7129	0.5012	0.5633	0.8585	0.9839	0.9975	0.9992 (89)
MIT 2	19.0582	19.1768	19.3858	19.6876	19.9438	20.0945	20.1197	20.1193	20.0330	19.7119	19.3461	19.0549 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	19.1436	19.2620	19.4708	19.7718	20.0293	20.1824	20.2098	20.2087	20.1187	19.7957	19.4301	19.1393 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1436	19.2620	19.4708	19.7718	20.0293	20.1824	20.2098	20.2087	20.1187	19.7957	19.4301	19.1393 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9969	0.9920	0.9719	0.9006	0.7188	0.5129	0.5749	0.8585	0.9812	0.9967	0.9988	(94)
Useful gains	394.7888	437.8538	476.7749	510.3837	500.3818	392.0752	266.2128	277.8147	382.8234	397.6471	378.4174	375.9320	(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	1154.5501	1112.9980	1001.5643	825.2355	630.2068	415.9992	269.0009	283.0143	451.1607	695.7559	939.0271	1145.4817	(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	565.2624	453.6969	390.4433	226.6933	96.5899	0.0000	0.0000	0.0000	0.0000	221.7930	403.6390	572.5450	(98)
Space heating												2930.6628	(98)
Space heating per m2												37.4765	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	700.4837	551.4446	564.7418	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8707	0.9335	0.9104	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	609.9042	514.7955	514.1350	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	729.0363	696.3624	656.4085	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	85.7751	135.0858	105.8515	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												326.7124	(104)
												1.0000	(105)

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

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Calculation Type: New Build (As Built)



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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	21.4438	33.7714	26.4629	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											81.6781 (107)
Space cooling per m2											1.0445 (108)
Energy for space heating											37.4765 (99)
Energy for space cooling											1.0445 (108)
Total											38.5210 (109)
Target Fabric Energy Efficiency (TFEE)											44.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2077 (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												
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025 (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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (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	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

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

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

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
Southeast		3.3300	45.1778	0.7200	0.7000	0.7700	52.5452 (77)
Northwest		1.5300	14.6176	0.7200	0.7000	0.7700	7.8115 (81)
Northwest		3.8000	14.6176	0.7200	0.7000	0.7700	19.4010 (81)

Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242	63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581	600.1634 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9183	0.8999	0.8536	0.7669	0.6258	0.4382	0.3121	0.3242	0.5516	0.7690	0.8816	0.9260 (86)
MIT	19.6978	19.8414	20.1570	20.5146	20.8096	20.9549	20.9887	20.9874	20.9040	20.5995	20.1076	19.6574 (87)
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9075	0.8869	0.8344	0.7364	0.5773	0.3727	0.2347	0.2441	0.4850	0.7312	0.8638	0.9160 (89)
MIT 2	18.4376	18.6411	19.0854	19.5752	19.9561	20.1189	20.1486	20.1479	20.0705	19.6990	19.0237	18.3813 (90)
Living area fraction	18.5681	18.7654	19.1964	19.6725	20.0445	20.2055	20.2356	20.2349	fLA = Living area / (4) =	19.7923	19.1359	0.1036 (91)
MIT	18.5681	18.7654	19.1964	19.6725	20.0445	20.2055	20.2356	20.2349	20.1568	19.7923	19.1359	18.5134 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4181	18.6154	19.0464	19.5225	19.8945	20.0555	20.0856	20.0849	20.0068	19.6423	18.9859	18.3634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	555.1028	574.7552	576.5622	544.4798	436.9847	288.5356	169.4842	169.2687	315.8628	439.5380	504.9182	533.3595 (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	932.3950	910.7143	819.8239	682.0271	486.6401	297.6304	170.8627	170.8113	337.1151	547.3623	758.1952	921.3160 (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	280.7053	225.7645	180.9867	99.0341	36.9437	0.0000	0.0000	0.0000	0.0000	80.2213	182.3594	288.6396 (98)
Space heating												1374.6546 (98)
RHI space heating demand												1375 (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	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															4.4900		
Number of sides sheltered															0.2245 (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) =					0.2077 (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																	
	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5148	0.5096	0.5044	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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.7417	Feb 33.4014	Mar 33.0611	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	72.5909	72.2506	71.9103	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.7798 (39)
HLP	Jan 0.9283	Feb 0.9239	Mar 0.9196	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9179 (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	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast				3.3300	36.7938	0.7200		0.7000	0.7700	42.7940 (77)		
Northwest				1.5300	11.2829	0.7200		0.7000	0.7700	6.0294 (81)		
Northwest				3.8000	11.2829	0.7200		0.7000	0.7700	14.9751 (81)		
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865	53.7761 (83)
Total gains	615.2049	662.1959	701.4747	741.3441	765.7148	745.7537	711.7709	675.0147	639.8024	604.4170	586.4204	590.3739 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.1444	31.2910	31.4391	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.0763	3.0861	3.0959	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9348	0.9159	0.8805	0.8118	0.7014	0.5542	0.4224	0.4596	0.6517	0.8288	0.9103	0.9410 (86)
MIT	19.4639	19.6557	19.9721	20.3588	20.6875	20.8908	20.9649	20.9535	20.8130	20.4093	19.8818	19.4314 (87)
Th 2	20.1435	20.1472	20.1509	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9264	0.9052	0.8651	0.7870	0.6617	0.4951	0.3480	0.3842	0.5959	0.8011	0.8972	0.9333 (89)
MIT 2	18.0950	18.3713	18.8233	19.3645	19.8034	20.0528	20.1298	20.1203	19.9682	19.4443	18.7040	18.0555 (90)
Living area fraction	18.2368	18.5043	18.9423	19.4675	19.8950	20.1396	20.2163	20.2066	20.0557	19.5442	18.8260	18.1980 (91)
MIT	18.0868	18.3543	18.7923	19.3175	19.7450	19.9896	20.0663	20.0566	19.9057	19.3942	18.6760	18.0480 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0868	18.3543	18.7923	19.3175	19.7450	19.9896	20.0663	20.0566	19.9057	19.3942	18.6760	18.0480 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9000	0.8768	0.8352	0.7588	0.6406	0.4830	0.3401	0.3752	0.5779	0.7717	0.8683	0.9082 (94)
Ext temp.	553.6894	580.6409	585.8425	562.5203	490.5521	360.1749	242.0384	253.2377	369.7600	466.4421	509.2024	536.1907 (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	1000.7980	972.0835	883.9451	746.1299	576.2054	386.0158	248.2677	261.8961	415.8232	629.8680	829.1080	991.8346 (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	332.6487	263.0494	221.7884	132.1989	63.7260	0.0000	0.0000	0.0000	0.0000	121.5889	230.3320	338.9991 (98)
Space heating per m2												1704.3314 (98)
												(98) / (4) = 21.7945 (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													1883.2391 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.6487	263.0494	221.7884	132.1989	63.7260	0.0000	0.0000	0.0000	0.0000	121.5889	230.3320	338.9991	(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)	367.5677	290.6624	245.0700	146.0761	70.4155	0.0000	0.0000	0.0000	0.0000	134.3523	254.5105	374.5846	(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	89.4178	89.3426	89.1847	88.8756	88.3430	87.3000	87.3000	87.3000	87.3000	88.7791	89.2245	87.3000	(216)
Fuel for water heating, kWh/month	183.3702	160.9433	167.4077	147.9307	143.8998	127.3000	119.5890	134.9162	135.8416	153.7044	165.0468	178.0015	(219)
Water heating fuel used												1817.9513	(219)
Annual totals kWh/year													
Space heating fuel - main system												1883.2391	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												55.2921	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												130.2921	(231)
Electricity for lighting (calculated in Appendix L)												383.5529	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =											-543.4106	-543.4106	(233)
Total delivered energy for all uses												3671.6248	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1883.2391	3.4800	65.5367 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1817.9513	3.4800	63.2647 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-543.4106	13.1900	-71.6759 (252)
Total energy cost			244.9017 (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] =	0.8349 (257)
SAP value		88.3533
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1883.2391	0.2160	406.7796 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1817.9513	0.2160	392.6775 (264)
Space and water heating			799.4571 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-543.4106	0.5190	-282.0301 (269)
Total kg/year			784.1126 (272)
CO2 emissions per m2			10.0300 (273)
EI value			91.4715
EI rating			91 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8848 = 3.933$, stars = 4
Water heating environmental impact	$0.216 / 0.8848 = 0.2441$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2077 (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												
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025 (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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (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	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (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	
Southeast				3.3300	45.1778	0.7200	0.7000		0.7700		52.5452 (77)	
Northwest				1.5300	14.6176	0.7200	0.7000		0.7700		7.8115 (81)	
Northwest				3.8000	14.6176	0.7200	0.7000		0.7700		19.4010 (81)	
Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242	63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581	600.1634 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9183	0.8999	0.8536	0.7669	0.6258	0.4382	0.3121	0.3242	0.5516	0.7690	0.8816	0.9260 (86)
MIT	19.6978	19.8414	20.1570	20.5146	20.8096	20.9549	20.9887	20.9874	20.9040	20.5995	20.1076	19.6574 (87)
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9075	0.8869	0.8344	0.7364	0.5773	0.3727	0.2347	0.2441	0.4850	0.7312	0.8638	0.9160 (89)
MIT 2	18.4376	18.6411	19.0854	19.5752	19.9561	20.1189	20.1486	20.1479	20.0705	19.6990	19.0237	18.3813 (90)
Living area fraction										fLA = Living area / (4) =		
MIT	18.5681	18.7654	19.1964	19.6725	20.0445	20.2055	20.2356	20.2349	20.1568	19.7923	19.1359	18.5134 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.4181	18.6154	19.0464	19.5225	19.8945	20.0555	20.0856	20.0849	20.0068	19.6423	18.9859	18.3634 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8795	0.8576	0.8047	0.7108	0.5614	0.3648	0.2283	0.2374	0.4727	0.7053	0.8337	0.8887 (94)
Useful gains	555.1028	574.7552	576.5622	544.4798	436.9847	288.5356	169.4842	169.2687	315.8628	439.5380	504.9182	533.3595 (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	932.3950	910.7143	819.8239	682.0271	486.6401	297.6304	170.8627	170.8113	337.1151	547.3623	758.1952	921.3160 (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	280.7053	225.7645	180.9867	99.0341	36.9437	0.0000	0.0000	0.0000	0.0000	80.2213	182.3594	288.6396 (98)
Space heating												1374.6546 (98)
Space heating per m2										(98) / (4) =		17.5787 (99)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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													1518.9554 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	280.7053	225.7645	180.9867	99.0341	36.9437	0.0000	0.0000	0.0000	0.0000	80.2213	182.3594	288.6396	(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)	310.1716	249.4635	199.9853	109.4299	40.8217	0.0000	0.0000	0.0000	0.0000	88.6423	201.5022	318.9388	(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	89.2931	89.2274	89.0249	88.6467	88.0006	87.3000	87.3000	87.3000	87.3000	88.4580	89.0418	87.3000	(216)
Fuel for water heating, kWh/month	183.6264	161.1510	167.7083	148.3128	144.4596	127.3000	119.5890	134.9162	135.8416	154.2624	165.3854	178.2332	(219)
Water heating fuel used													1820.7858 (219)
Annual totals kWh/year													
Space heating fuel - main system													1518.9554 (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 * 1149 * 1.00) =													-606.6838 (233)
Total delivered energy for all uses													3246.9024 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1518.9554	10.2300	155.3891 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1820.7858	10.2300	186.2664 (247)
Mechanical ventilation fans	55.2921	36.7200	20.3033 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	383.5529	36.7200	140.8406 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-606.6838	36.7200	-222.7743 (252)
Total energy cost			410.5651 (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	1518.9554	0.2160	328.0944 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1820.7858	0.2160	393.2897 (264)
Space and water heating			721.3841 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	0.5190	-314.8689 (269)
Total kg/year			673.2008 (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	1518.9554	1.2200	1853.1255 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1820.7858	1.2200	2221.3587 (264)
Space and water heating			4074.4842 (265)
Pumps and fans	130.2921	3.0700	399.9969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
 PV Unit -606.6838 3.0700 -1862.5192 (269)
 Primary energy kWh/year 3789.4693 (272)
 Primary energy kWh/m2/year 48.4587 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 81	-184 kg (27.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 2.36 kg/m²	B 90	A 93
Total Savings	£81 2.36 kg/m²		

Potential energy efficiency rating: B 90
 Potential environmental impact rating: A 93

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

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

	Current	Potential	Saving
Electricity	£189	£207	-£18
Mains gas	£445	£345	£100
Space heating	£306	£306	£0
Water heating	£186	£105	£81
Lighting	£141	£141	£0
Generated (PV)	-£223	-£223	£0
Total cost of fuels	£411	£329	£82
Total cost of uses	£410	£329	£81
Delivered energy	42 kWh/m²	30 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	6 kg/m²	2 kg/m²
Primary energy	48 kWh/m²	35 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												4.4900
Infiltration rate												0.2245 (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) =	0.2077 (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												
	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5148	0.5096	0.5044	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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.7417	Feb 33.4014	Mar 33.0611	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	72.5909	72.2506	71.9103	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.7798 (39)
HLP	Jan 0.9283	Feb 0.9239	Mar 0.9196	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9179 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2548 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-840.4246 (H17)
Solar input	-24.3706	-40.6676	-69.2616	-92.8241	-114.6764	-112.7452	-111.2552	-97.2042	-76.1304	-51.9881	-28.9071	-20.3941 (63)
Solar input (sum of months) = Sum (63)m =												-840.4246 (63)
Output from w/h	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320 (64)
Total per year (kWh/year) = Sum (64)m =												778.5514 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				3.3300	36.7938		0.7200		0.7000		0.7700		42.7940 (77)
Northwest				1.5300	11.2829		0.7200		0.7000		0.7700		6.0294 (81)
Northwest				3.8000	11.2829		0.7200		0.7000		0.7700		14.9751 (81)
Solar gains	63.7986	115.6494	176.7684	250.0867	308.4700	318.7104	302.0809	256.6178	201.8580	132.8139	77.6865		53.7761 (83)
Total gains	615.2049	662.1959	701.4747	741.3441	765.7148	745.7537	711.7709	675.0147	639.8024	604.4170	586.4204		590.3739 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.1444	31.2910	31.4391	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.0763	3.0861	3.0959	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9348	0.9159	0.8805	0.8118	0.7014	0.5542	0.4224	0.4596	0.6517	0.8288	0.9103	0.9410 (86)
MIT	19.4639	19.6557	19.9721	20.3588	20.6875	20.8908	20.9649	20.9535	20.8130	20.4093	19.8818	19.4314 (87)
Th 2	20.1435	20.1472	20.1509	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9264	0.9052	0.8651	0.7870	0.6617	0.4951	0.3480	0.3842	0.5959	0.8011	0.8972	0.9333 (89)
MIT 2	18.0950	18.3713	18.8231	19.3645	19.8034	20.0528	20.1298	20.1203	19.9682	19.4443	18.7040	18.0555 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.2368	18.5043	18.9423	19.4675	19.8950	20.1396	20.2163	20.2066	20.0557	19.5442	18.8260	18.1980 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0868	18.3543	18.7923	19.3175	19.7450	19.9896	20.0663	20.0566	19.9057	19.3942	18.6760	18.0480 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9000	0.8768	0.8352	0.7588	0.6406	0.4830	0.3401	0.3752	0.5779	0.7717	0.8683	0.9082	(94)
Useful gains	553.6894	580.6409	585.8425	562.5203	490.5521	360.1749	242.0384	253.2377	369.7600	466.4421	509.2024	536.1907	(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	1000.7980	972.0835	883.9451	746.1299	576.2054	386.0158	248.2677	261.8961	415.8232	629.8680	829.1080	991.8346	(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	332.6487	263.0494	221.7884	132.1989	63.7260	0.0000	0.0000	0.0000	0.0000	121.5889	230.3320	338.9991	(98)
Space heating												1704.3314	(98)
Space heating per m2												21.7945	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1883.2391 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.6487	263.0494	221.7884	132.1989	63.7260	0.0000	0.0000	0.0000	0.0000	121.5889	230.3320	338.9991	(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)	367.5677	290.6624	245.0700	146.0761	70.4155	0.0000	0.0000	0.0000	0.0000	134.3523	254.5105	374.5846	(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	89.5299	89.5753	89.6288	89.7557	89.9611	87.3000	87.3000	87.3000	87.3000	89.1603	89.3878	87.3000	(216)
Fuel for water heating, kWh/month	155.9200	115.1247	89.3024	43.0615	13.8382	0.0000	0.0000	23.5711	48.6361	94.7388	132.4063	155.0393	(219)
Water heating fuel used												871.6383	(219)
Annual totals kWh/year													
Space heating fuel - main system												1883.2391	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1029 * 1.00) =										-543.4106		-543.4106	(233)
Total delivered energy for all uses												2775.3118	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1883.2391	3.4800	65.5367 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	871.6383	3.4800	30.3330 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-543.4106	13.1900	-71.6759 (252)
Total energy cost			218.5650 (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] =	0.7451 (257)
SAP value		89.6057
SAP rating (Section 12)		90 (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	1883.2391	0.2160	406.7796 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	871.6383	0.2160	188.2739 (264)
Space and water heating			595.0535 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-543.4106	0.5190	-282.0301 (269)
Total kg/year			605.6590 (272)
CO2 emissions per m2			7.7400 (273)
EI value			93.4125
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2077 (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												
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025 (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	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (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)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (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) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (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	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3955 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-870.5009 (H17)
Solar input	-28.5766	-40.6341	-69.8403	-94.2308	-110.1318	-118.7419	-113.0330	-103.0222	-80.5017	-55.3617	-33.7986	-22.6280 (63)
Solar input (sum of months) = Sum (63)m =												-870.5009 (63)
Output from w/h	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981 (64)
Total per year (kWh/year) = Sum (64)m =												756.2498 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
				3.3300	45.1778	0.7200	0.7000		0.7700		52.5452 (77)	
				1.5300	14.6176	0.7200	0.7000		0.7700		7.8115 (81)	
				3.8000	14.6176	0.7200	0.7000		0.7700		19.4010 (81)	
Solar gains	79.7577	123.6142	191.8197	274.7163	321.2027	363.9671	332.8005	294.6455	230.2783	151.6206	96.9242	63.5657 (83)
Total gains	631.1641	670.1606	716.5260	765.9737	778.4476	791.0104	742.4904	713.0424	668.2226	623.2236	605.6581	600.1634 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9183	0.8999	0.8536	0.7669	0.6258	0.4382	0.3121	0.3242	0.5516	0.7690	0.8816	0.9260 (86)
MIT	19.6978	19.8414	20.1570	20.5146	20.8096	20.9549	20.9887	20.9874	20.9040	20.5995	20.1076	19.6574 (87)
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9075	0.8869	0.8344	0.7364	0.5773	0.3727	0.2347	0.2441	0.4850	0.7312	0.8638	0.9160 (89)
MIT 2	18.4376	18.6411	19.0854	19.5752	19.9561	20.1189	20.1486	20.1479	20.0705	19.6990	19.0237	18.3813 (90)
Living area fraction									fLA = Living area / (4) =			0.1036 (91)
MIT	18.5681	18.7654	19.1964	19.6725	20.0445	20.2055	20.2356	20.2349	20.1568	19.7923	19.1359	18.5134 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4181	18.6154	19.0464	19.5225	19.8945	20.0555	20.0856	20.0849	20.0068	19.6423	18.9859	18.3634 (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	0.8795	0.8576	0.8047	0.7108	0.5614	0.3648	0.2283	0.2374	0.4727	0.7053	0.8337	0.8887	(94)
Useful gains	555.1028	574.7552	576.5622	544.4798	436.9847	288.5356	169.4842	169.2687	315.8628	439.5380	504.9182	533.3595	(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	932.3950	910.7143	819.8239	682.0271	486.6401	297.6304	170.8627	170.8113	337.1151	547.3623	758.1952	921.3160	(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	280.7053	225.7645	180.9867	99.0341	36.9437	0.0000	0.0000	0.0000	0.0000	80.2213	182.3594	288.6396	(98)
Space heating												1374.6546	(98)
Space heating per m2												17.5787	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1518.9554 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	280.7053	225.7645	180.9867	99.0341	36.9437	0.0000	0.0000	0.0000	0.0000	80.2213	182.3594	288.6396	(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)	310.1716	249.4635	199.9853	109.4299	40.8217	0.0000	0.0000	0.0000	0.0000	88.6423	201.5022	318.9388	(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	89.4333	89.4714	89.4991	89.6024	89.4668	87.3000	87.3000	87.3000	87.3000	88.8625	89.2453	87.3000	(216)
Fuel for water heating, kWh/month	151.3854	115.2957	88.7851	41.5654	18.9943	0.0000	0.0000	16.9068	43.6289	91.2598	127.1368	152.7143	(219)
Water heating fuel used												847.6724	(219)
Annual totals kWh/year													
Space heating fuel - main system												1518.9554	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.66 * 1149 * 1.00) =										-606.6838		-606.6838	(233)
Total delivered energy for all uses												2323.7890	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1518.9554	10.2300	155.3891 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	847.6724	10.2300	86.7169 (247)
Mechanical ventilation fans	55.2921	36.7200	20.3033 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	383.5529	36.7200	140.8406 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-606.6838	36.7200	-222.7743 (252)
Total energy cost			329.3756 (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	1518.9554	0.2160	328.0944 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	847.6724	0.2160	183.0972 (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			511.1916 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	0.5190	-314.8689 (269)
Total kg/year			488.9583 (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	1518.9554	1.2200	1853.1255 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	847.6724	1.2200	1034.1603 (264)
Space and water heating			2887.2858 (265)
Pumps and fans	180.2921	3.0700	553.4969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)
Energy saving/generation technologies			
PV Unit	-606.6838	3.0700	-1862.5192 (269)
Primary energy kWh/year			2755.7709 (272)
Primary energy kWh/m2/year			35.2400 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	104.1 (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	38.85 (37)
Summer heat loss coefficient	301.04 (P2)

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

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

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

total: 403.8294

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

	2.86	2.69	2.54	(P6)
Summer gain/loss ratio				
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 104.1)	1.27	1.27	1.27	
Threshold temperature	19.53	21.26	21.11	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			