

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-210			Issued on Date	09/06/2023
Assessment Reference	As Built	Prop Type Ref	AB Det As		
Property	14, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	86 B	DER	16.46	TER	24.54
Environmental	88 B	% DER<TER	32.93		
CO ₂ Emissions (t/year)	0.87	DFEE	73.17	TFEE	81.63
General Requirements Compliance	Pass	% DFEE<TFEE	10.36		
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

Detached House, total floor area 70 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) 24.54 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.46 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)81.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)73.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.39 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.30 (max. 0.35)	OK
Openings	1.49 (max. 2.00)	1.80 (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: 4.71 (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): Medium OK
Based on:
Overshading:
Average
Windows facing North: 7.07 m², No overhang
Windows facing East: 0.60 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Exposed floor U-value 0.12 W/m²K
Photovoltaic array 0.99 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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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												4.7100
Infiltration rate												0.2355 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2355 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3003	0.2944	0.2885	0.2591	0.2532	0.2237	0.2237	0.2178	0.2355	0.2532	0.2649	0.2767 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5503	0.5444	0.5385	0.5091	0.5032	0.5000	0.5000	0.5000	0.5000	0.5032	0.5149	0.5267 (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)			4.3400	1.3258	5.7538		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)
Total net area of external elements Aum(A, m ²)			263.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.0118		(33)
Timber GF			5.9700			9.0000	53.7300 (32c)
Timber FF			102.4400			9.0000	921.9600 (32c)
Internal Floor			6.0200			18.0000	108.3600 (32d)
Internal Ceiling			6.0200			18.0000	108.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8164.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							116.2335 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)
Total fabric heat loss						(33) + (36) =	92.6436 (37)

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

(38)m	Jan 30.9500	Feb 30.6189	Mar 30.2877	Apr 28.6320	May 28.3008	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.3008	Nov 28.9631	Dec 29.6254 (38)
Heat transfer coeff	123.5937	123.2625	122.9314	121.2756	120.9445	120.7666	120.7666	120.7666	120.7666	120.9445	121.6068	122.2691 (39)
Average = Sum(39)m / 12 =												121.6579 (39)
HLP	Jan 1.7596	Feb 1.7549	Mar 1.7502	Apr 1.7266	May 1.7219	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7219	Nov 1.7313	Dec 1.7407 (40)
HLP (average)												1.7320 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1807	16.1479	13.1324	9.9421	7.4318	6.2742	6.7795	8.8123	11.8279	15.0182	17.5284	18.6860 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597 (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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	344.4738	342.4613	330.0551	310.1196	289.9843	270.5214	257.8473	263.5306	273.7486	293.8843	316.9958	334.2286 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c			Access factor Table 6d		Gains W
North				3.7400	10.6334	0.7200			0.7000			0.7700		13.8902 (74)
East				0.6000	19.6403	0.7200			0.7000			0.7700		4.1159 (76)
North				3.3300	10.6334	0.7200			0.7000			0.7700		12.3674 (74)
South				3.5800	47.0123	0.6300			0.7000			1.0000		66.7999 (82)
Solar gains	97.1734	177.4429	272.9074	386.1169	474.4467	488.9875	463.9930	395.6693	311.8992	204.3828	118.5995	81.7110 (83)		
Total gains	441.6472	519.9042	602.9624	696.2365	764.4311	759.5089	721.8403	659.2000	585.6478	498.2672	435.5953	415.9396 (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	18.3492	18.3985	18.4481	18.6999	18.7511	18.7787	18.7787	18.7787	18.7787	18.7511	18.6490	18.5480
alpha	2.2233	2.2266	2.2299	2.2467	2.2501	2.2519	2.2519	2.2519	2.2519	2.2501	2.2433	2.2365
util living area	0.9743	0.9621	0.9391	0.8920	0.8121	0.6985	0.5816	0.6315	0.8032	0.9209	0.9641	0.9775 (86)
MIT	17.8252	18.1119	18.6306	19.3407	20.0107	20.5239	20.7810	20.7265	20.2871	19.4317	18.5127	17.7822 (87)
Th 2	19.4984	19.5018	19.5051	19.5218	19.5252	19.5270	19.5270	19.5270	19.5270	19.5252	19.5185	19.5118 (88)
util rest of house	0.9691	0.9544	0.9260	0.8666	0.7624	0.6047	0.4342	0.4895	0.7304	0.8971	0.9555	0.9729 (89)
MIT 2	15.3750	15.7907	16.5396	17.5569	18.4805	19.1367	19.4118	19.3689	18.8726	17.7081	16.3837	15.3178 (90)
Living area fraction	15.9687	16.3531	17.0463	17.9891	18.8512	19.4728	19.7436	19.6979	19.2154	18.1258	16.8996	15.9149 (92)
Temperature adjustment	15.8187	16.2031	16.8963	17.8391	18.7012	19.3228	19.5936	19.5479	19.0654	17.9758	16.7496	-0.1500
adjusted MIT	15.8187	16.2031	16.8963	17.8391	18.7012	19.3228	19.5936	19.5479	19.0654	17.9758	16.7496	15.7649 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9477	0.9272	0.8915	0.8265	0.7269	0.5890	0.4419	0.4919	0.7006	0.8598	0.9291	0.9534 (94)
Ext temp.	418.5405	482.0330	537.5323	575.4395	555.6657	447.3735	319.0064	324.2293	410.3213	428.4229	404.6965	396.5514 (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)

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Month fraction	1423.6388	1393.2528	1278.0260	1084.0958	846.7625	570.3600	361.5231	380.1559	599.6491	892.0606	1173.4548	1414.0352 (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 requirement	747.7931	612.3397	550.9274	366.2325	216.5760	0.0000	0.0000	0.0000	0.0000	344.9464	553.5060	757.0079 (98)
Space heating requirement												4149.3290 (98)
Space heating requirement per m2											(98) / (4) =	59.0736 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4584.8939 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	747.7931	612.3397	550.9274	366.2325	216.5760	0.0000	0.0000	0.0000	0.0000	344.9464	553.5060	757.0079 (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)	826.2907	676.6185	608.7595	404.6768	239.3105	0.0000	0.0000	0.0000	0.0000	381.1563	611.6089	836.4728 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Efficiency of water heater	89.9277	89.8947	89.8211	89.6583	89.3205	87.3000	87.3000	87.3000	87.3000	89.5967	89.8309	87.3000 (216)
Fuel for water heating, kWh/month	174.7216	153.2949	159.3449	140.6340	136.5420	122.1950	114.8586	129.4869	130.3466	146.0610	157.1369	169.6549 (219)
Water heating fuel used												1734.2773 (219)
Annual totals kWh/year												
Space heating fuel - main system												4584.8939 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												46.9844 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												121.9844 (231)
Electricity for lighting (calculated in Appendix L)												321.0769 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												5916.3207 (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	4584.8939	0.2160	990.3371 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1734.2773	0.2160	374.6039 (264)
Space and water heating			1364.9410 (265)
Pumps and fans	121.9844	0.5190	63.3099 (267)
Energy for lighting	321.0769	0.5190	166.6389 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total CO2, kg/year			1155.8616 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4600 (273)

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

DER			16.4600 ZC1
Total Floor Area		TFA	70.2400
Assumed number of occupants		N	2.2519
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6921 ZC2
CO2 emissions from cooking, equation (L16)			2.4636 ZC3
Total CO2 emissions			35.6158 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			35.6158 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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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) = 0.1760 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4260 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4260 (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	0.5432	0.5325	0.5219	0.4686	0.4580	0.4047	0.4047	0.3941	0.4260	0.4580	0.4793	0.5006 (22b)
Effective ac	0.6475	0.6418	0.6362	0.6098	0.6049	0.5819	0.5819	0.5776	0.5907	0.6049	0.6148	0.6253 (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
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.6700	1.3258	10.1686		(27)
TER Room Window (Uw = 1.70)			3.5800	1.5918	5.6985		(27a)
150mm EPS B&B			6.0200	0.1300	0.7826		(28a)
Exposed Floor to Garage			57.1700	0.1300	7.4321		(28b)
FOG Exposed Floor			1.0300	0.1300	0.1339		(28b)
140mm Timber Frame	80.0400	9.1900	70.8500	0.1800	12.7530		(29a)
Wall to Garage TBC	15.9300		15.9300	0.1800	2.8674		(29a)
GF Masonry External TBC	21.1100	0.6000	20.5100	0.1800	3.6918		(29a)
Rooflight Stud Wall	16.7500		16.7500	0.1800	3.0150		(29a)
500mm Mineral Wool	62.0700		62.0700	0.1300	8.0691		(30)
Rooflight Sloping	3.6800	3.5800	0.1000	0.1300	0.0130		(30)
Total net area of external elements Aum(A, m ²)			263.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.7450		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5624 (36)
Total fabric heat loss						(33) + (36) =	81.3074 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.4201	36.0979	35.7821	34.2987	34.0212	32.7293	32.7293	32.4900	33.2269	34.0212	34.5826	35.1696 (38)
Heat transfer coeff	117.7274	117.4052	117.0894	115.6061	115.3286	114.0366	114.0366	113.7974	114.5343	115.3286	115.8900	116.4770 (39)
Average = Sum(39)m / 12 =												115.6048 (39)
HLP	1.6761	1.6715	1.6670	1.6459	1.6419	1.6235	1.6235	1.6201	1.6306	1.6419	1.6499	1.6583 (40)
HLP (average)												1.6459 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1379.6031 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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	49.1508	42.7799	45.5762	42.3764	42.0016	38.9171	40.2143	42.0016	42.3764	45.5762	45.8357	49.1508 (61)
Total heat required for water heating calculated for each month	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729 (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	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729 (64)
Heat gains from water heating, kWh/month	59.8470	52.2906	54.3170	48.0154	46.4070	40.7139	38.7654	43.4477	43.9349	50.2495	53.8727	58.3463 (65)
Total per year (kWh/year) = Sum(64)m = 1905.5601 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1807	16.1479	13.1324	9.9421	7.4318	6.2742	6.7795	8.8123	11.8279	15.0182	17.5284	18.6860	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	80.4394	77.8134	73.0067	66.6880	62.3750	56.5471	52.1041	58.3974	61.0206	67.5396	74.8232	78.4224	(72)
Total internal gains	356.2558	353.6501	340.6540	320.1305	299.4035	279.3505	266.6827	272.9557	283.7683	304.4921	328.1897	346.0141	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.0700				10.6334		0.6300		0.7000		0.7700		22.9754 (74)	
East	0.6000				19.6403		0.6300		0.7000		0.7700		3.6014 (76)	
South	3.5800				47.0123		0.6300		0.7000		1.0000		66.7999 (82)	
Solar gains	93.3767	170.1640	260.5915	366.5794	448.4218	461.2658	438.0554	374.9018	297.1566	195.7221	113.9090	78.5517	(83)	
Total gains	449.6324	523.8141	601.2455	686.7100	747.8253	740.6163	704.7382	647.8575	580.9249	500.2142	442.0987	424.5658	(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	41.4328	41.5465	41.6586	42.1931	42.2946	42.7738	42.7738	42.8637	42.5879	42.2946	42.0897	41.8776
alpha	3.7622	3.7698	3.7772	3.8129	3.8196	3.8516	3.8516	3.8576	3.8392	3.8196	3.8060	3.7918
util living area	0.9970	0.9943	0.9871	0.9651	0.9073	0.7880	0.6434	0.7023	0.8951	0.9790	0.9947	0.9976 (86)
MIT	19.1481	19.3278	19.6505	20.0973	20.5165	20.8200	20.9405	20.9157	20.6677	20.1291	19.5648	19.1236 (87)
Th 2	19.5580	19.5613	19.5646	19.5799	19.5827	19.5961	19.5961	19.5986	19.5910	19.5827	19.5769	19.5709 (88)
util rest of house	0.9959	0.9921	0.9820	0.9496	0.8620	0.6795	0.4690	0.5335	0.8236	0.9670	0.9923	0.9967 (89)
MIT 2	17.1481	17.4123	17.8834	18.5335	19.1074	19.4763	19.5760	19.5655	19.3200	18.5901	17.7690	17.1204 (90)
Living area fraction	17.6327	17.8764	18.3116	18.9125	19.4489	19.8019	19.9066	19.8926	fLA = Living area / (4) = 19.6466	18.9630	18.2042	0.2423 (91)
MIT	17.6327	17.8764	18.3116	18.9125	19.4489	19.8019	19.9066	19.8926	19.6466	18.9630	18.2042	17.6058 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6327	17.8764	18.3116	18.9125	19.4489	19.8019	19.9066	19.8926	19.6466	18.9630	18.2042	17.6058 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9935	0.9882	0.9752	0.9395	0.8566	0.6981	0.5116	0.5738	0.8272	0.9591	0.9887	0.9948	(94)
Ext temp.	446.7166	517.6345	586.3521	645.1934	640.5927	517.0303	360.5132	371.7282	480.5675	479.7390	437.0953	422.3458	(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	1569.6293	1523.5008	1383.0109	1157.5010	893.6651	593.2036	377.0771	397.4540	635.2730	964.4976	1286.8628	1561.4640	(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	835.4471	675.9422	592.7141	368.8615	188.2859	0.0000	0.0000	0.0000	0.0000	360.6604	611.8326	847.5040	(98)
Space heating per m2												4481.2477	(98)
												63.7991	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)

93.4000 (206)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

Space heating requirement

4797.9098 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	835.4471	675.9422	592.7141	368.8615	188.2859	0.0000	0.0000	0.0000	0.0000	360.6604	611.8326	847.5040	(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)	894.4829	723.7068	634.5975	394.9266	201.5909	0.0000	0.0000	0.0000	0.0000	386.1460	655.0671	907.3918	(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	192.1861	167.8796	174.6678	154.9215	149.9914	132.1040	126.5657	141.0911	142.6493	162.4347	173.3958	187.6729	(64)
Efficiency of water heater (217)m	88.3224	88.1931	87.8840	87.1576	85.6247	80.3000	80.3000	80.3000	80.3000	87.0019	87.9570	88.3846	(216)
Fuel for water heating, kWh/month	217.5961	190.3546	198.7482	177.7488	175.1730	164.5131	157.6161	175.7050	177.6455	186.7024	197.1370	212.3367	(219)
Water heating fuel used												2231.2766	(219)
Annual totals kWh/year													
Space heating fuel - main system												4797.9098	(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)												321.0769	(232)
Total delivered energy for all uses												7425.2633	(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	4797.9098	0.2160	1036.3485 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2231.2766	0.2160	481.9557 (264)
Space and water heating			1518.3042 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	321.0769	0.5190	166.6389 (268)
Total CO2, kg/m2/year			1723.8682 (272)
Emissions per m2 for space and water heating			21.6159 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3724 (272b)
Emissions per m2 for pumps and fans			0.5542 (272c)
Target Carbon Dioxide Emission Rate (TER) = (21.6159 * 1.00) + 2.3724 + 0.5542, rounded to 2 d.p.			24.5400 (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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1760 (8)
Pressure test					Yes
Measured/design AP50					4.7100
Infiltration rate					0.4115 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4115 (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	0.5247	0.5144	0.5041	0.4527	0.4424	0.3909	0.3909	0.3806	0.4115	0.4424	0.4630	0.4835 (22b)
Effective ac	0.6376	0.6323	0.6271	0.6025	0.5978	0.5764	0.5764	0.5724	0.5847	0.5978	0.6072	0.6169 (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)			4.3400	1.3258	5.7538		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)
Total net area of external elements Aum(A, m ²)			263.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0118		(33)
Timber GF			5.9700			9.0000	53.7300 (32c)
Timber FF			102.4400			9.0000	921.9600 (32c)
Internal Floor			6.0200			18.0000	108.3600 (32d)
Internal Ceiling			6.0200			9.0000	54.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8110.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							115.4621 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)
Total fabric heat loss						(33) + (36) =	92.6436 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.8649	35.5642	35.2696	33.8855	33.6265	32.4210	32.4210	32.1978	32.8854	33.6265	34.1504	34.6981 (38)
Average = Sum(39)m / 12 =	128.5085	128.2079	127.9132	126.5291	126.2702	125.0647	125.0647	124.8414	125.5290	126.2702	126.7940	127.3417 (39)
												126.5279 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8296	1.8253	1.8211	1.8014	1.7977	1.7805	1.7805	1.7774	1.7871	1.7977	1.8052	1.8130 (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	2.2519 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (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	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1807	16.1479	13.1324	9.9421	7.4318	6.2742	6.7795	8.8123	11.8279	15.0182	17.5284	18.6860 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597 (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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644 (72)
Total internal gains	313.6698	312.3957	301.5182	283.6590	264.8723	247.3064	236.2422	239.8601	249.3421	267.3294	288.0145	304.1561 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			3.7400		10.6334		0.7200		0.7000		0.7700		13.8902 (74)
East			0.6000		19.6403		0.7200		0.7000		0.7700		4.1159 (76)
North			3.3300		10.6334		0.7200		0.7000		0.7700		12.3674 (74)
South			3.5800		47.0123		0.6300		0.7000		1.0000		66.7999 (82)
Solar gains	97.1734	177.4429	272.9074	386.1169	474.4467	488.9875	463.9930	395.6693	311.8992	204.3828	118.5995		81.7110 (83)
Total gains	410.8432	489.8386	574.4256	669.7759	739.3191	736.2939	700.2352	635.5294	561.2413	471.7122	406.6140		385.8671 (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	17.5303	17.5714	17.6119	17.8046	17.8411	18.0130	18.0130	18.0452	17.9464	17.8411	17.7674	17.6909
alpha	2.1687	2.1714	2.1741	2.1870	2.1894	2.2009	2.2009	2.2030	2.1964	2.1894	2.1845	2.1794
util living area	0.9775	0.9661	0.9447	0.9006	0.8256	0.7158	0.6017	0.6523	0.8191	0.9292	0.9685	0.9803 (86)
MIT	17.6599	17.9506	18.4823	19.2105	19.9113	20.4698	20.7499	20.6900	20.2131	19.3109	18.3628	17.6135 (87)
Th 2	19.4494	19.4524	19.4553	19.4690	19.4716	19.4837	19.4837	19.4859	19.4790	19.4716	19.4664	19.4609 (88)
util rest of house	0.9728	0.9590	0.9324	0.8763	0.7769	0.6214	0.4492	0.5070	0.7480	0.9070	0.9606	0.9762 (89)
MIT 2	16.4871	16.7766	17.3031	18.0217	18.6860	19.1864	19.3942	19.3635	18.9845	18.1348	17.1977	16.4483 (90)
Living area fraction	16.7713	17.0611	17.5888	18.3098	18.9829	19.4974	19.7227	19.6849	19.2822	18.4198	17.4800	16.7307 (92)
MIT	16.7713	17.0611	17.5888	18.3098	18.9829	19.4974	19.7227	19.6849	19.2822	18.4198	17.4800	16.7307 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9606	0.9430	0.9116	0.8520	0.7575	0.6224	0.4770	0.5297	0.7362	0.8855	0.9456	0.9653 (94)
Ext temp.	394.6683	461.9396	523.6511	570.6656	560.0496	458.2496	334.0412	336.6153	413.1756	417.7085	384.4938	372.4585 (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	1602.6696	1559.1440	1418.4099	1190.6132	919.6100	612.4887	390.5402	410.0955	650.5143	987.4063	1316.1243	1595.6757 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	898.7530	737.3213	665.7006	446.3622	267.5130	0.0000	0.0000	0.0000	0.0000	423.8552	670.7739	910.0736 (98)
												5020.3528 (98)
												(98) / (4) = 71.4743 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1175.6080	925.4786	948.7950	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5919	0.6609	0.6218	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	695.7904	611.6764	590.0075	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	899.3760	857.3657	787.7150	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	146.5817	182.7929	147.0944	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													476.4689 (104)
Intermittency factor (Table 10b)													1.0000 (105)
	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													
	0.0000	0.0000	0.0000	0.0000	0.0000	36.6454	45.6982	36.7736	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													119.1172 (107)
Space cooling per m2													1.6959 (108)
Energy for space heating													71.4743 (99)
Energy for space cooling													1.6959 (108)
Total													73.1701 (109)
Dwelling Fabric Energy Efficiency (DFEE)													73.2 (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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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) = 0.1760 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4260 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4260 (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	0.5432	0.5325	0.5219	0.4686	0.4580	0.4047	0.4047	0.3941	0.4260	0.4580	0.4793	0.5006 (22b)
Effective ac	0.6475	0.6418	0.6362	0.6098	0.6049	0.5819	0.5819	0.5776	0.5907	0.6049	0.6148	0.6253 (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
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.6700	1.3258	10.1686		(27)
TER Room Window (Uw = 1.70)			3.5800	1.5918	5.6985		(27a)
150mm EPS B&B			6.0200	0.1300	0.7826		(28a)
Exposed Floor to Garage			57.1700	0.1300	7.4321		(28b)
FOG Exposed Floor			1.0300	0.1300	0.1339		(28b)
140mm Timber Frame	80.0400	9.1900	70.8500	0.1800	12.7530		(29a)
Wall to Garage TBC	15.9300		15.9300	0.1800	2.8674		(29a)
GF Masonry External TBC	21.1100	0.6000	20.5100	0.1800	3.6918		(29a)
Rooflight Stud Wall	16.7500		16.7500	0.1800	3.0150		(29a)
500mm Mineral Wool	62.0700		62.0700	0.1300	8.0691		(30)
Rooflight Sloping	3.6800	3.5800	0.1000	0.1300	0.0130		(30)
Total net area of external elements Aum(A, m ²)			263.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.7450		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5624 (36)
Total fabric heat loss						(33) + (36) =	81.3074 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.4201	36.0979	35.7821	34.2987	34.0212	32.7293	32.7293	32.4900	33.2269	34.0212	34.5826	35.1696 (38)
Heat transfer coeff	117.7274	117.4052	117.0894	115.6061	115.3286	114.0366	114.0366	113.7974	114.5343	115.3286	115.8900	116.4770 (39)
Average = Sum(39)m / 12 =												115.6048 (39)
HLP	1.6761	1.6715	1.6670	1.6459	1.6419	1.6235	1.6235	1.6201	1.6306	1.6419	1.6499	1.6583 (40)
HLP (average)												1.6459 (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												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy conte	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1379.6031 (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	30.3950	26.5837	27.4320	23.9159	22.9478	19.8022	18.3497	21.0565	21.3080	24.8324	27.1065	29.4359 (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	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	112.5969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1807	16.1479	13.1324	9.9421	7.4318	6.2742	6.7795	8.8123	11.8279	15.0182	17.5284	18.6860	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8566	199.9097	194.7359	183.7214	169.8176	156.7500	148.0201	145.9669	151.1408	162.1552	176.0590	189.1266	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	34.2597	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	40.8535	39.5590	36.8709	33.2165	30.8439	27.5031	24.6635	28.3018	29.5945	33.3769	37.6480	39.5644	(72)
Total internal gains	313.6698	312.3957	301.5182	283.6590	264.8723	247.3064	236.2422	239.8601	249.3421	267.3294	288.0145	304.1561	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			7.0700		10.6334		0.6300		0.7000		0.7700		22.9754 (74)
East			0.6000		19.6403		0.6300		0.7000		0.7700		3.6014 (76)
South			3.5800		47.0123		0.6300		0.7000		1.0000		66.7999 (82)
Solar gains	93.3767	170.1640	260.5915	366.5794	448.4218	461.2658	438.0554	374.9018	297.1566	195.7221	113.9090		78.5517 (83)
Total gains	407.0465	482.5597	562.1097	650.2384	713.2941	708.5722	674.2976	614.7618	546.4987	463.0515	401.9235		382.7078 (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	41.4328	41.5465	41.6586	42.1931	42.2946	42.7738	42.7738	42.8637	42.5879	42.2946	42.0897	41.8776	
alpha	3.7622	3.7698	3.7772	3.8129	3.8196	3.8516	3.8516	3.8576	3.8392	3.8196	3.8060	3.7918	
util living area	0.9979	0.9957	0.9897	0.9704	0.9180	0.8054	0.6640	0.7260	0.9101	0.9836	0.9962	0.9983	(86)
MIT	19.0967	19.2786	19.6051	20.0584	20.4874	20.8041	20.9335	20.9050	20.6398	20.0871	19.5166	19.0729	(87)
Th 2	19.5580	19.5613	19.5646	19.5799	19.5827	19.5961	19.5961	19.5986	19.5910	19.5827	19.5769	19.5709	(88)
util rest of house	0.9971	0.9940	0.9855	0.9570	0.8763	0.6999	0.4878	0.5574	0.8451	0.9739	0.9945	0.9977	(89)
MIT 2	17.8615	18.0452	18.3722	18.8289	19.2342	19.5053	19.5804	19.5723	19.3855	18.8649	18.2948	17.8472	(90)
Living area fraction	18.1608	18.3440	18.6709	19.1268	19.5378	19.8200	19.9083	19.8953	19.6895	19.1610	18.5908	18.1442	(91)
MIT	18.1608	18.3440	18.6709	19.1268	19.5378	19.8200	19.9083	19.8953	19.6895	19.1610	18.5908	18.1442	(92)
Temperature adjustment	18.1608	18.3440	18.6709	19.1268	19.5378	19.8200	19.9083	19.8953	19.6895	19.1610	18.5908	18.1442	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	405.3986	478.7011	551.8525	618.5099	623.8635	509.9994	358.3876	367.9819	465.0656	449.0509	398.9763	381.4883	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1631.7964	1578.4014	1425.0861	1182.2814	903.9262	595.2702	377.2665	397.7507	640.1866	987.3331	1331.6717	1624.1752	(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	912.4400	738.9986	649.6858	405.9155	208.3666	0.0000	0.0000	0.0000	0.0000	400.4820	671.5407	924.5591	(98)
Space heating													(98) / (4) =
Space heating per m2													69.9315 (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	1071.9444	843.8711	864.8602	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7026	0.7858	0.7419	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	753.0992	663.1255	641.6738	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	866.9741	827.0491	763.4412	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	81.9899	121.9592	90.5950	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												294.5441 (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	20.4975	30.4898	22.6487	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												73.6360 (107)
Space cooling per m2												1.0483 (108)
Energy for space heating												69.9315 (99)
Energy for space cooling												1.0483 (108)
Total												70.9798 (109)
Target Fabric Energy Efficiency (TFEE)												81.6 (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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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												4.7100
Infiltration rate												0.2355 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2355 (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	0.2591	0.2414	0.2414	0.2296	0.2296	0.2178	0.2178	0.2061	0.2061	0.2237	0.2178	0.2296 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5091	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)			4.3400	1.3258	5.7538		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)					
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)					
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)					
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)					
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)					
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)					
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)					
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)					
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)					
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)					
Total net area of external elements Aum(A, m2)			263.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0118		(33)					
Timber GF			5.9700			9.0000	53.7300 (32c)					
Timber FF			102.4400			9.0000	921.9600 (32c)					
Internal Floor			6.0200			18.0000	108.3600 (32d)					
Internal Ceiling			6.0200			18.0000	108.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8164.2400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							116.2335 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)					
Total fabric heat loss						(33) + (36) =	92.6436 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.6320	Feb 28.1230	Mar 28.1230	Apr 28.1230	May 28.1230	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.1230	Nov 28.1230	Dec 28.1230 (38)
Heat transfer coeff	121.2756	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666 (39)
Average = Sum(39)m / 12 =												120.8090 (39)
HLP	Jan 1.7266	Feb 1.7193	Mar 1.7193	Apr 1.7193	May 1.7193	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7193	Nov 1.7193	Dec 1.7193 (40)
HLP (average)												1.7199 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2519 (42)
Average daily hot water use (litres/day)													87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
RHI water heating demand	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(65)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(65)
Total per year (kWh/year) = Sum(64)m =													1545 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.4518	40.3699	32.8310	24.8552	18.5795	15.6856	16.9489	22.0308	29.5697	37.5455	43.8211	46.7150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	508.2198	504.1694	484.6916	454.5456	423.7968	396.1612	379.9453	387.6665	404.9561	435.3023	469.0273	494.4328	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.7400	13.4839	0.7200	0.7000	0.7700		17.6137 (74)	
East					0.6000	25.1925	0.7200	0.7000	0.7700		5.2794 (76)	
North					3.3300	13.4839	0.7200	0.7000	0.7700		15.6828 (74)	
South					3.5800	58.5609	0.6300	0.7000	1.0000		83.2093 (82)	
Solar gains	121.7852	190.0217	296.3166	423.8059	493.3352	557.5807	510.4217	453.7917	355.8044	233.6612	148.3177	96.8385 (83)
Total gains	630.0051	694.1911	781.0082	878.3515	917.1320	953.7419	890.3670	841.4582	760.7605	668.9635	617.3451	591.2713 (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	18.6999	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	
alpha	2.2467	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	
util living area	0.9420	0.9265	0.8893	0.8195	0.7060	0.5332	0.4039	0.4228	0.6572	0.8376	0.9177	0.9477	(86)
MIT	18.4545	18.6813	19.1857	19.8046	20.3979	20.7890	20.9237	20.9160	20.6300	19.9657	19.1239	18.4238	(87)
Th 2	19.5218	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	(88)
util rest of house	0.9305	0.9119	0.8664	0.7795	0.6330	0.4125	0.2397	0.2526	0.5473	0.7902	0.8981	0.9371	(89)
MIT 2	16.2898	16.6156	17.3312	18.1877	18.9646	19.3987	19.5062	19.5037	19.2565	18.4334	17.2576	16.2497	(90)
Living area fraction	16.8143	17.1161	17.7806	18.5795	19.3119	19.7356	19.8496	19.8460	19.5893	18.8047	17.7098	16.7765	(92)
Temperature adjustment	16.6643	16.9661	17.6306	18.4295	19.1619	19.5856	19.6996	19.6960	19.4393	18.6547	17.5598	16.6265	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8970	0.8752	0.8260	0.7418	0.6116	0.4179	0.2606	0.2740	0.5396	0.7532	0.8602	0.9053	(94)
Useful gains	565.0947	607.5786	645.1421	651.5673	560.8952	398.5229	232.0340	230.5640	410.4874	503.8642	531.0346	535.2591	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1366.0871	1336.4196	1211.3598	1018.0024	732.0764	445.0991	241.4893	241.0446	499.8867	803.6614	1106.2005	1343.7132 (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												
Space heating	595.9384	489.7811	421.2660	263.8333	127.3588	0.0000	0.0000	0.0000	0.0000	223.0491	414.1195	601.4899 (98)
RHI space heating demand												3136.8361 (98)
												3137 (98)

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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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												4.7100
Infiltration rate												0.2355 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2355 (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												
	0.3003	0.2944	0.2885	0.2591	0.2532	0.2237	0.2237	0.2178	0.2355	0.2532	0.2649	0.2767 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5503	0.5444	0.5385	0.5091	0.5032	0.5000	0.5000	0.5000	0.5000	0.5032	0.5149	0.5267 (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)			4.3400	1.3258	5.7538		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)					
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)					
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)					
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)					
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)					
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)					
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)					
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)					
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)					
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)					
Total net area of external elements Aum(A, m2)			263.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0118		(33)					
Timber GF			5.9700			9.0000	53.7300 (32c)					
Timber FF			102.4400			9.0000	921.9600 (32c)					
Internal Floor			6.0200			18.0000	108.3600 (32d)					
Internal Ceiling			6.0200			18.0000	108.3600 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8164.2400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							116.2335 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)					
Total fabric heat loss						(33) + (36) =	92.6436 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 30.9500	Feb 30.6189	Mar 30.2877	Apr 28.6320	May 28.3008	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.3008	Nov 28.9631	Dec 29.6254 (38)
Heat transfer coeff	123.5937	123.2625	122.9314	121.2756	120.9445	120.7666	120.7666	120.7666	120.7666	120.9445	121.6068	122.2691 (39)
Average = Sum(39)m / 12 =												121.6579 (39)
HLP	Jan 1.7596	Feb 1.7549	Mar 1.7502	Apr 1.7266	May 1.7219	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7219	Nov 1.7313	Dec 1.7407 (40)
HLP (average)												1.7320 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.4518	40.3699	32.8310	24.8552	18.5795	15.6856	16.9489	22.0308	29.5697	37.5455	43.8211	46.7150 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636 (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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	508.2198	504.1694	484.6916	454.5456	423.7968	396.1612	379.9453	387.6665	404.9561	435.3023	469.0273	494.4328 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.7400	10.6334	0.7200			0.7000		0.7700		13.8902 (74)
East				0.6000	19.6403	0.7200			0.7000		0.7700		4.1159 (76)
North				3.3300	10.6334	0.7200			0.7000		0.7700		12.3674 (74)
South				3.5800	47.0123	0.6300			0.7000		1.0000		66.7999 (82)
Solar gains	97.1734	177.4429	272.9074	386.1169	474.4467	488.9875	463.9930	395.6693	311.8992	204.3828	118.5995	81.7110 (83)	
Total gains	605.3932	681.6123	757.5989	840.6625	898.2435	885.1487	843.9383	783.3359	716.8553	639.6852	587.6269	576.1438 (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	18.3492	18.3985	18.4481	18.6999	18.7511	18.7787	18.7787	18.7787	18.7787	18.7511	18.6490	18.5480
alpha	2.2233	2.2266	2.2299	2.2467	2.2501	2.2519	2.2519	2.2519	2.2519	2.2501	2.2433	2.2365
util living area	0.9529	0.9372	0.9089	0.8539	0.7658	0.6444	0.5239	0.5678	0.7428	0.8793	0.9370	0.9574 (86)
MIT	18.1100	18.3816	18.8689	19.5304	20.1425	20.6022	20.8247	20.7825	20.4091	19.6350	18.7684	18.0655 (87)
Th 2	19.4984	19.5018	19.5051	19.5218	19.5252	19.5270	19.5270	19.5270	19.5270	19.5252	19.5185	19.5118 (88)
util rest of house	0.9439	0.9252	0.8907	0.8224	0.7102	0.5480	0.3824	0.4288	0.6609	0.8464	0.9229	0.9493 (89)
MIT 2	15.7827	16.1734	16.8715	17.8094	18.6389	19.2108	19.4386	19.4071	19.0049	17.9795	16.7451	15.7243 (90)
Living area fraction	16.3466	16.7085	17.3555	18.2265	19.0032	19.5480	19.7744	19.7404	19.3451	18.3807	17.2354	16.2916 (92)
Temperature adjustment	16.1966	16.5585	17.2055	18.0765	18.8532	19.3980	19.6244	19.5904	19.1951	18.2307	17.0854	-0.1500
adjusted MIT	16.1966	16.5585	17.2055	18.0765	18.8532	19.3980	19.6244	19.5904	19.1951	18.2307	17.0854	16.1416 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	552.8638	606.7930	644.8142	657.4950	610.1049	476.3747	331.6182	341.2998	457.4700	516.0811	521.8558	530.2962 (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	0.9132	0.8902	0.8511	0.7821	0.6792	0.5382	0.3929	0.4357	0.6382	0.8068	0.8881	0.9204 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	1470.3479	1437.0565	1316.0382	1112.8811	865.1438	579.4361	365.2504	385.2885	615.3194	922.8874	1214.2877	1460.0904 (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	682.6082	557.9371	499.3907	327.8780	189.7489	0.0000	0.0000	0.0000	0.0000	302.6639	498.5509	691.7669 (98)
Space heating												3750.5446 (98)
Space heating per m2											(98) / (4) =	53.3961 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4144.2482 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	682.6082	557.9371	499.3907	327.8780	189.7489	0.0000	0.0000	0.0000	0.0000	302.6639	498.5509	691.7669 (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)	754.2632	616.5051	551.8129	362.2961	209.6673	0.0000	0.0000	0.0000	0.0000	334.4353	550.8850	764.3834 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Efficiency of water heater	89.8835	89.8477	89.7670	89.5879	89.2204	87.3000	87.3000	87.3000	87.3000	89.5096	89.7739	87.3000 (216)
(217)m	89.8835	89.8477	89.7670	89.5879	89.2204	87.3000	87.3000	87.3000	87.3000	89.5096	89.7739	89.9044 (217)
Fuel for water heating, kWh/month	174.8073	153.3751	159.4408	140.7445	136.6951	122.1950	114.8586	129.4869	130.3466	146.2032	157.2367	169.7350 (219)
Water heating fuel used												1735.1249 (219)
Annual totals kWh/year												
Space heating fuel - main system												4144.2482 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												46.9844 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												121.9844 (231)
Electricity for lighting (calculated in Appendix L)												321.0769 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												5476.5226 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	4144.2482	3.4800	144.2198 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1735.1249	3.4800	60.3823 (247)
Mechanical ventilation fans	46.9844	13.1900	6.1972 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	321.0769	13.1900	42.3500 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-845.9118	13.1900	-111.5758 (252)
Total energy cost			271.4662 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.9894 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	86.1982
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4144.2482	0.2160	895.1576 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1735.1249	0.2160	374.7870 (264)
Space and water heating			1269.9446 (265)
Pumps and fans	121.9844	0.5190	63.3099 (267)
Energy for lighting	321.0769	0.5190	166.6389 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1060.8652 (272)
CO2 emissions per m2			15.1000 (273)
EI value			87.6644
EI rating			88 (274)
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	$3.48 / 0.8889 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8889 = 0.2430$, 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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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															4.7100		
Infiltration rate															0.2355 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2355 (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	0.2591	0.2414	0.2414	0.2296	0.2296	0.2178	0.2178	0.2061	0.2061	0.2237	0.2178	0.2296 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5091	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)			4.3400	1.3258	5.7538		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)					
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)					
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)					
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)					
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)					
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)					
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)					
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)					
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)					
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)					
Total net area of external elements Aum(A, m2)			263.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0118		(33)					
Timber GF			5.9700			9.0000	53.7300 (32c)					
Timber FF			102.4400			9.0000	921.9600 (32c)					
Internal Floor			6.0200			18.0000	108.3600 (32d)					
Internal Ceiling			6.0200			18.0000	108.3600 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8164.2400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							116.2335 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)					
Total fabric heat loss						(33) + (36) =	92.6436 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.6320	Feb 28.1230	Mar 28.1230	Apr 28.1230	May 28.1230	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.1230	Nov 28.1230	Dec 28.1230 (38)
Heat transfer coeff	121.2756	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666 (39)
Average = Sum(39)m / 12 =												120.8090 (39)
HLP	Jan 1.7266	Feb 1.7193	Mar 1.7193	Apr 1.7193	May 1.7193	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7193	Nov 1.7193	Dec 1.7193 (40)
HLP (average)												1.7199 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2519 (42)
Average daily hot water use (litres/day)													87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519	(44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783	(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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772	(61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Output from w/h	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993	(64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779	(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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.4518	40.3699	32.8310	24.8552	18.5795	15.6856	16.9489	22.0308	29.5697	37.5455	43.8211	46.7150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	(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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	(71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370	(72)
Total internal gains	508.2198	504.1694	484.6916	454.5456	423.7968	396.1612	379.9453	387.6665	404.9561	435.3023	469.0273	494.4328	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				3.7400	13.4839	0.7200	0.7000	0.7700	17.6137 (74)				
East				0.6000	25.1925	0.7200	0.7000	0.7700	5.2794 (76)				
North				3.3300	13.4839	0.7200	0.7000	0.7700	15.6828 (74)				
South				3.5800	58.5609	0.6300	0.7000	1.0000	83.2093 (82)				
Solar gains	121.7852	190.0217	296.3166	423.8059	493.3352	557.5807	510.4217	453.7917	355.8044	233.6612	148.3177	96.8385	(83)
Total gains	630.0051	694.1911	781.0082	878.3515	917.1320	953.7419	890.3670	841.4582	760.7605	668.9635	617.3451	591.2713	(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	18.6999	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	
alpha	2.2467	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	
util living area	0.9420	0.9265	0.8893	0.8195	0.7060	0.5332	0.4039	0.4228	0.6572	0.8376	0.9177	0.9477	(86)
MIT	18.4545	18.6813	19.1857	19.8046	20.3979	20.7890	20.9237	20.9160	20.6300	19.9657	19.1239	18.4238	(87)
Th 2	19.5218	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	(88)
util rest of house	0.9305	0.9119	0.8664	0.7795	0.6330	0.4125	0.2397	0.2526	0.5473	0.7902	0.8981	0.9371	(89)
MIT 2	16.2898	16.6156	17.3312	18.1877	18.9646	19.3987	19.5062	19.5037	19.2565	18.4334	17.2576	16.2497	(90)
Living area fraction	16.8143	17.1161	17.7806	18.5795	19.3119	19.7356	19.8496	19.8460	19.5893	18.8047	17.7098	16.7765	(91)
MIT	16.8143	17.1161	17.7806	18.5795	19.3119	19.7356	19.8496	19.8460	19.5893	18.8047	17.7098	16.7765	(92)
Temperature adjustment	16.6643	16.9661	17.6306	18.4295	19.1619	19.5856	19.6996	19.6960	19.4393	18.6547	17.5598	16.6265	(93)

8. Space heating requirement

Utilisation	0.8970	0.8752	0.8260	0.7418	0.6116	0.4179	0.2606	0.2740	0.5396	0.7532	0.8602	0.9053	(94)
Useful gains	565.0947	607.5786	645.1421	651.5673	560.8952	398.5229	232.0340	230.5640	410.4874	503.8642	531.0346	535.2591	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fracti	1366.0871	1336.4196	1211.3598	1018.0024	732.0764	445.0991	241.4893	241.0446	499.8867	803.6614	1106.2005	1343.7132 (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	595.9384	489.7811	421.2660	263.8333	127.3588	0.0000	0.0000	0.0000	0.0000	223.0491	414.1195	601.4899 (98)
Space heating												3136.8361 (98)
Space heating per m2											(98) / (4) =	44.6588 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3466.1172 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.9384	489.7811	421.2660	263.8333	127.3588	0.0000	0.0000	0.0000	0.0000	223.0491	414.1195	601.4899 (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)	658.4954	541.1946	465.4873	291.5285	140.7280	0.0000	0.0000	0.0000	0.0000	246.4631	457.5906	664.6297 (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	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (64)
Efficiency of water heater	89.8131	89.7774	89.6665	89.4398	88.9059	87.3000	87.3000	87.3000	87.3000	89.2898	89.6645	87.3000 (216)
(217)m	89.8131	89.7774	89.6665	89.4398	88.9059	87.3000	87.3000	87.3000	87.3000	89.2898	89.6645	89.8336 (217)
Fuel for water heating, kWh/month	174.9444	153.4951	159.6195	140.9775	137.1788	122.1950	114.8586	129.4869	130.3466	146.5631	157.4285	169.8688 (219)
Water heating fuel used												1736.9629 (219)
Annual totals kWh/year												
Space heating fuel - main system												3466.1172 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												46.9844 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												121.9844 (231)
Electricity for lighting (calculated in Appendix L)												321.0769 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290		-933.8290 (233)
Total delivered energy for all uses												4712.3125 (238)

10a. Fuel costs - using BEDF prices (519)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3466.1172	9.7400	337.5998 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1736.9629	9.7400	169.1802 (247)
Mechanical ventilation fans	46.9844	36.8500	17.3138 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (250)
Energy for lighting	321.0769	36.8500	118.3168 (251)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-933.8290	36.8500	-344.1160 (252)
Total energy cost			429.9321 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3466.1172	0.2160	748.6813 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1736.9629	0.2160	375.1840 (264)
Space and water heating			1123.8653 (265)
Pumps and fans	121.9844	0.5190	63.3099 (267)
Energy for lighting	321.0769	0.5190	166.6389 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			869.1569 (272)

13a. Primary energy - Individual heating systems including micro-CHP

Energy Primary energy factor Primary energy

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	3466.1172	1.2200	4228.6630 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1736.9629	1.2200	2119.0947 (264)
Space and water heating			6347.7577 (265)
Pumps and fans	121.9844	3.0700	374.4922 (267)
Energy for lighting	321.0769	3.0700	985.7062 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			4841.1011 (272)
Primary energy kWh/m2/year			68.9223 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(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	-£ 73	-178 kg (20.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£73 2.53 kg/m²	B 87	B 90
Total Savings	£73 2.53 kg/m²		

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

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 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	£163	£182	-£18
Mains gas	£611	£519	£92
Space heating	£487	£487	£0
Water heating	£169	£96	£73
Lighting	£118	£118	£0
Generated (PV)	-£344	-£344	£0
Total cost of fuels	£430	£357	£74
Total cost of uses	£430	£357	£73
Delivered energy	67 kWh/m²	54 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	3 kg/m²
Primary energy	69 kWh/m²	55 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 170.4422 (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												4.7100
Infiltration rate												0.2355 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2355 (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												
	0.3003	0.2944	0.2885	0.2591	0.2532	0.2237	0.2237	0.2178	0.2355	0.2532	0.2649	0.2767 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5503	0.5444	0.5385	0.5091	0.5032	0.5000	0.5000	0.5000	0.5000	0.5032	0.5149	0.5267 (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)			4.3400	1.3258	5.7538		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)
Total net area of external elements Aum(A, m ²)			263.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.0118		(33)
Timber GF			5.9700			9.0000	53.7300 (32c)
Timber FF			102.4400			9.0000	921.9600 (32c)
Internal Floor			6.0200			18.0000	108.3600 (32d)
Internal Ceiling			6.0200			18.0000	108.3600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8164.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							116.2335 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)
Total fabric heat loss						(33) + (36) =	92.6436 (37)

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

(38)m	Jan 30.9500	Feb 30.6189	Mar 30.2877	Apr 28.6320	May 28.3008	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.3008	Nov 28.9631	Dec 29.6254 (38)
Heat transfer coeff	123.5937	123.2625	122.9314	121.2756	120.9445	120.7666	120.7666	120.7666	120.7666	120.9445	121.6068	122.2691 (39)
Average = Sum(39)m / 12 =												121.6579 (39)
HLP	Jan 1.7596	Feb 1.7549	Mar 1.7502	Apr 1.7266	May 1.7219	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7219	Nov 1.7313	Dec 1.7407 (40)
HLP (average)												1.7320 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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												1.3146 (H8)
Utilisation factor												0.5327 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6835 (H14)
Volume ratio Veff/V												0.8553 (H15)
Solar storage volume factor												0.9688 (H16)
Solar input												-822.8824 (H17)
Solar input	-23.8620	-39.8187	-67.8159	-90.8866	-112.2828	-110.3918	-108.9330	-95.1753	-74.5413	-50.9030	-28.3037	-19.9684 (63)
Solar input (sum of months) = Sum(63)m =												-822.8824 (63)
Output from w/h	133.2610	97.9852	75.3094	35.2035	9.6772	0.0000	0.0000	17.8668	39.2512	79.9629	112.8538	132.6309 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (65)
Total per year (kWh/year) = Sum(64)m =												734.0020 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.4518	40.3699	32.8310	24.8552	18.5795	15.6856	16.9489	22.0308	29.5697	37.5455	43.8211	46.7150 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636 (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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	508.2198	504.1694	484.6916	454.5456	423.7968	396.1612	379.9453	387.6665	404.9561	435.3023	469.0273	494.4328 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				3.7400	10.6334	0.7200		0.7000		0.7700	13.8902 (74)	
East				0.6000	19.6403	0.7200		0.7000		0.7700	4.1159 (76)	
North				3.3300	10.6334	0.7200		0.7000		0.7700	12.3674 (74)	
South				3.5800	47.0123	0.6300		0.7000		1.0000	66.7999 (82)	

Solar gains	97.1734	177.4429	272.9074	386.1169	474.4467	488.9875	463.9930	395.6693	311.8992	204.3828	118.5995	81.7110 (83)
Total gains	605.3932	681.6123	757.5989	840.6625	898.2435	885.1487	843.9383	783.3359	716.8553	639.6852	587.6269	576.1438 (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	18.3492	18.3985	18.4481	18.6999	18.7511	18.7787	18.7787	18.7787	18.7787	18.7511	18.6490	18.5480
alpha	2.2233	2.2266	2.2299	2.2467	2.2501	2.2519	2.2519	2.2519	2.2519	2.2501	2.2433	2.2365
util living area	0.9529	0.9372	0.9089	0.8539	0.7658	0.6444	0.5239	0.5678	0.7428	0.8793	0.9370	0.9574 (86)
MIT	18.1100	18.3816	18.8689	19.5304	20.1425	20.6022	20.8247	20.7825	20.4091	19.6350	18.7684	18.0655 (87)
Th 2	19.4984	19.5018	19.5051	19.5218	19.5252	19.5270	19.5270	19.5270	19.5270	19.5252	19.5185	19.5118 (88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9439	0.9252	0.8907	0.8224	0.7102	0.5480	0.3824	0.4288	0.6609	0.8464	0.9229	0.9493 (89)
MIT 2	15.7827	16.1734	16.8715	17.8094	18.6389	19.2108	19.4386	19.4071	19.0049	17.9795	16.7451	15.7243 (90)
Living area fraction									fLA = Living area / (4) =			0.2423 (91)
MIT	16.3466	16.7085	17.3555	18.2265	19.0032	19.5480	19.7744	19.7404	19.3451	18.3807	17.2354	16.2916 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.1966	16.5585	17.2055	18.0765	18.8532	19.3980	19.6244	19.5904	19.1951	18.2307	17.0854	16.1416 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9132	0.8902	0.8511	0.7821	0.6792	0.5382	0.3929	0.4357	0.6382	0.8068	0.8881	0.9204	(94)
Useful gains	552.8638	606.7930	644.8142	657.4950	610.1049	476.3747	331.6182	341.2998	457.4700	516.0811	521.8558	530.2962	(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													
	1470.3479	1437.0565	1316.0382	1112.8811	865.1438	579.4361	365.2504	385.2885	615.3194	922.8874	1214.2877	1460.0904	(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													
	682.6082	557.9371	499.3907	327.8780	189.7489	0.0000	0.0000	0.0000	0.0000	302.6639	498.5509	691.7669	(98)
Space heating												3750.5446	(98)
Space heating per m2											(98) / (4) =	53.3961	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4144.2482 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	682.6082	557.9371	499.3907	327.8780	189.7489	0.0000	0.0000	0.0000	0.0000	302.6639	498.5509	691.7669	(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)	754.2632	616.5051	551.8129	362.2961	209.6673	0.0000	0.0000	0.0000	0.0000	334.4353	550.8850	764.3834	(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	133.2610	97.9852	75.3094	35.2035	9.6772	0.0000	0.0000	17.8668	39.2512	79.9629	112.8538	132.6309	(64)
Efficiency of water heater (217)m	89.9614	90.0071	90.0674	90.1795	90.3393	87.3000	87.3000	87.3000	87.3000	89.8120	89.8918	89.9694	(216)
Fuel for water heating, kWh/month	148.1314	108.8638	83.6145	39.0371	10.7121	0.0000	0.0000	20.4660	44.9613	89.0337	125.5440	147.4178	(219)
Water heating fuel used												817.7816	(219)
Annual totals kWh/year													
Space heating fuel - main system												4144.2482	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													46.9844 (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													171.9844 (231)
Electricity for lighting (calculated in Appendix L)													321.0769 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118	(233)
Total delivered energy for all uses												4609.1793	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4144.2482	3.4800	144.2198	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	817.7816	3.4800	28.4588	(247)
Mechanical ventilation fans	46.9844	13.1900	6.1972	(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	321.0769	13.1900	42.3500	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-845.9118	13.1900	-111.5758	(252)
Total energy cost			246.1377	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8971 (257)
SAP value		87.4859
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4144.2482	0.2160	895.1576	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	817.7816	0.2160	176.6408	(264)
Space and water heating			1071.7984	(265)
Pumps and fans	171.9844	0.5190	89.2599	(267)
Energy for lighting	321.0769	0.5190	166.6389	(268)
Energy saving/generation technologies				
PV Unit	-845.9118	0.5190	-439.0282	(269)
Total kg/year			888.6690	(272)
CO2 emissions per m2			12.6500	(273)
EI value			89.6666	
EI rating			90	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.0200 (1b)	x 2.7100 (2b)	= 16.3142 (1b) - (3b)
First floor	64.2200 (1c)	x 2.4000 (2c)	= 154.1280 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2400		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	170.4422 (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															4.7100		
Infiltration rate															0.2355 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2355 (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	0.2591	0.2414	0.2414	0.2296	0.2296	0.2178	0.2178	0.2061	0.2061	0.2237	0.2178	0.2296 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5091	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)			4.3400	1.3258	5.7538		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			3.5800	1.6791	6.0112		(27a)					
150mm EPS B&B			6.0200	0.2000	1.2040	75.0000	451.5000 (28a)					
Exposed Floor to Garage			57.1700	0.1200	6.8604	20.0000	1143.4000 (28b)					
FOG Exposed Floor			1.0300	0.1700	0.1751	20.0000	20.6000 (28b)					
140mm Timber Frame	80.0400	9.1900	70.8500	0.1900	13.4615	9.0000	637.6500 (29a)					
Wall to Garage TBC	15.9300		15.9300	0.3600	5.7348	110.0000	1752.3000 (29a)					
GF Masonry External TBC	21.1100	0.6000	20.5100	0.3900	7.9989	110.0000	2256.1000 (29a)					
Rooflight Stud Wall	16.7500		16.7500	0.3000	5.0250	9.0000	150.7500 (29a)					
500mm Mineral Wool	62.0700		62.0700	0.0900	5.5863	9.0000	558.6300 (30)					
Rooflight Sloping	3.6800	3.5800	0.1000	0.3000	0.0300	9.0000	0.9000 (30)					
Total net area of external elements Aum(A, m2)			263.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.0118		(33)					
Timber GF			5.9700			9.0000	53.7300 (32c)					
Timber FF			102.4400			9.0000	921.9600 (32c)					
Internal Floor			6.0200			18.0000	108.3600 (32d)					
Internal Ceiling			6.0200			18.0000	108.3600 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8164.2400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							116.2335 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6319 (36)					
Total fabric heat loss						(33) + (36) =	92.6436 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 28.6320	Feb 28.1230	Mar 28.1230	Apr 28.1230	May 28.1230	Jun 28.1230	Jul 28.1230	Aug 28.1230	Sep 28.1230	Oct 28.1230	Nov 28.1230	Dec 28.1230 (38)
Heat transfer coeff	121.2756	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666	120.7666 (39)
Average = Sum(39)m / 12 =												120.8090 (39)
HLP	Jan 1.7266	Feb 1.7193	Mar 1.7193	Apr 1.7193	May 1.7193	Jun 1.7193	Jul 1.7193	Aug 1.7193	Sep 1.7193	Oct 1.7193	Nov 1.7193	Dec 1.7193 (40)
HLP (average)												1.7199 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2519 (42)
Average daily hot water use (litres/day)												87.6835 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4519	92.9445	89.4372	85.9298	82.4225	78.9152	78.9152	82.4225	85.9298	89.4372	92.9445	96.4519 (44)
Energy content (annual)	143.0353	125.0996	129.0916	112.5452	107.9898	93.1870	86.3514	99.0895	100.2730	116.8585	127.5602	138.5221 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4553	18.7649	19.3637	16.8818	16.1985	13.9780	12.9527	14.8634	15.0409	17.5288	19.1340	20.7783 (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	14.0877	12.7043	14.0337	13.5449	13.9702	13.4893	13.9201	13.9526	13.5196	14.0074	13.5973	14.0772 (61)
Total heat required for water heating calculated for each month	157.1230	137.8039	143.1252	126.0901	121.9600	106.6763	100.2715	113.0421	113.7926	130.8659	141.1575	152.5993 (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												1.4620 (H8)
Utilisation factor												0.4954 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6835 (H14)
Volume ratio Veff/V												0.8553 (H15)
Solar storage volume factor												0.9688 (H16)
Solar input												-851.1514 (H17)
Solar input	-27.9414	-39.7309	-68.2879	-92.1362	-107.6838	-116.1025	-110.5205	-100.7322	-78.7123	-54.1311	-33.0473	-22.1250 (63)
Solar input (sum of months) = Sum(63)m =												-851.1514 (63)
Output from w/h	129.1816	98.0730	74.8373	33.9539	14.2762	0.0000	0.0000	12.3099	35.0803	76.7348	108.1102	130.4743 (64)
Heat gains from water heating, kWh/month	51.0812	44.7717	46.4314	40.8075	39.3991	34.3570	32.1919	36.4354	36.7207	42.3573	45.8131	49.5779 (65)
Total per year (kWh/year) = Sum(64)m =												713.0312 (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	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162	135.1162 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.4518	40.3699	32.8310	24.8552	18.5795	15.6856	16.9489	22.0308	29.5697	37.5455	43.8211	46.7150 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.3083	298.3727	290.6505	274.2110	253.4591	233.9553	220.9255	217.8611	225.5832	242.0227	262.7746	282.2785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636	50.7636 (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)	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775	-90.0775 (71)
Water heating gains (Table 5)	68.6575	66.6246	62.4078	56.6771	52.9558	47.7180	43.2687	48.9723	51.0009	56.9318	63.6293	66.6370 (72)
Total internal gains	508.2198	504.1694	484.6916	454.5456	423.7968	396.1612	379.9453	387.6665	404.9561	435.3023	469.0273	494.4328 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					3.7400	13.4839		0.7200	0.7000	0.7700	17.6137 (74)	
East					0.6000	25.1925		0.7200	0.7000	0.7700	5.2794 (76)	
North					3.3300	13.4839		0.7200	0.7000	0.7700	15.6828 (74)	
South					3.5800	58.5609		0.6300	0.7000	1.0000	83.2093 (82)	
Solar gains	121.7852	190.0217	296.3166	423.8059	493.3352	557.5807	510.4217	453.7917	355.8044	233.6612	148.3177	96.8385 (83)
Total gains	630.0051	694.1911	781.0082	878.3515	917.1320	953.7419	890.3670	841.4582	760.7605	668.9635	617.3451	591.2713 (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	18.6999	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787	18.7787
alpha	2.2467	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519	2.2519
util living area	0.9420	0.9265	0.8893	0.8195	0.7060	0.5332	0.4039	0.4228	0.6572	0.8376	0.9177	0.9477 (86)
MIT	18.4545	18.6813	19.1857	19.8046	20.3979	20.7890	20.9237	20.9160	20.6300	19.9657	19.1239	18.4238 (87)
Th 2	19.5218	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270	19.5270 (88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

util rest of house	0.9305	0.9119	0.8664	0.7795	0.6330	0.4125	0.2397	0.2526	0.5473	0.7902	0.8981	0.9371 (89)
MIT 2	16.2898	16.6156	17.3312	18.1877	18.9646	19.3987	19.5062	19.5037	19.2565	18.4334	17.2576	16.2497 (90)
Living area fraction									fLA = Living area / (4) =			0.2423 (91)
MIT	16.8143	17.1161	17.7806	18.5795	19.3119	19.7356	19.8496	19.8460	19.5893	18.8047	17.7098	16.7765 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6643	16.9661	17.6306	18.4295	19.1619	19.5856	19.6996	19.6960	19.4393	18.6547	17.5598	16.6265 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8970	0.8752	0.8260	0.7418	0.6116	0.4179	0.2606	0.2740	0.5396	0.7532	0.8602	0.9053	(94)
Useful gains	565.0947	607.5786	645.1421	651.5673	560.8952	398.5229	232.0340	230.5640	410.4874	503.8642	531.0346	535.2591	(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													
	1366.0871	1336.4196	1211.3598	1018.0024	732.0764	445.0991	241.4893	241.0446	499.8867	803.6614	1106.2005	1343.7132	(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													
	595.9384	489.7811	421.2660	263.8333	127.3588	0.0000	0.0000	0.0000	0.0000	223.0491	414.1195	601.4899	(98)
Space heating													3136.8361 (98)
Space heating per m2													(98) / (4) = 44.6588 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3466.1172 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.9384	489.7811	421.2660	263.8333	127.3588	0.0000	0.0000	0.0000	0.0000	223.0491	414.1195	601.4899 (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)	658.4954	541.1946	465.4873	291.5285	140.7280	0.0000	0.0000	0.0000	0.0000	246.4631	457.5906	664.6297 (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	129.1816	98.0730	74.8373	33.9539	14.2762	0.0000	0.0000	12.3099	35.0803	76.7348	108.1102	130.4743 (64)	
Efficiency of water heater (217)m	89.9129	89.9499	90.0023	90.1233	90.1669	87.3000	87.3000	87.3000	87.3000	89.6588	89.8184	89.9125 (217)	
Fuel for water heating, kWh/month	143.6742	109.0307	83.1504	37.6749	15.8331	0.0000	0.0000	14.1006	40.1836	85.5853	120.3652	145.1125 (219)	
Water heating fuel used												794.7104 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3466.1172 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													46.9844 (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													171.9844 (231)
Electricity for lighting (calculated in Appendix L)													321.0769 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.99 + 1179 + 1.00) =										-933.8290			-933.8290 (233)
Total delivered energy for all uses													3820.0600 (238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3466.1172	9.7400	337.5998 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	794.7104	9.7400	77.4048 (247)	
Mechanical ventilation fans	46.9844	36.8500	17.3138 (249)	
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)	
Pump for solar water heating	50.0000	36.8500	18.4250 (249)	
Energy for lighting	321.0769	36.8500	118.3168 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-933.8290	36.8500	-344.1160 (252)	
Total energy cost			356.5817 (255)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3466.1172	0.2160	748.6813 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	794.7104	0.2160	171.6575 (264)
Space and water heating			920.3388 (265)
Pumps and fans	171.9844	0.5190	89.2599 (267)
Energy for lighting	321.0769	0.5190	166.6389 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			691.5804 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	3466.1172	1.2200	4228.6630 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	794.7104	1.2200	969.5467 (264)
Space and water heating			5198.2097 (265)
Pumps and fans	171.9844	3.0700	527.9922 (267)
Energy for lighting	321.0769	3.0700	985.7062 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			3845.0532 (272)
Primary energy kWh/m ² /year			54.7416 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	No
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	116.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.50 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	140.61 (P1)
Transmission heat loss coefficient	92.64 (37)
Summer heat loss coefficient	233.26 (P2)

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

Solar shading	Z_blinds	Solar access	Z_overhangs	Z_summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.7400	87.1704	0.7200	0.7000	0.9000	133.0934
East	0.6000	125.2818	0.7200	0.7000	0.9000	30.6870
North	3.3300	87.1704	0.7200	0.7000	0.9000	118.5029
South	3.5800	202.9386	0.6300	0.7000	1.0000	288.3559

total: 570.6392

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	617	571	495	
Total summer gains	393	377	385	
	1010	948	879	(P5)

Summer gain/loss ratio	4.33	4.06	3.77	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 116.2)	1.19	1.19	1.19	
Threshold temperature	20.92	22.55	22.26	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

Assessment of likelihood of high internal temperature: Medium