

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-221			Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	K Mid As		
Property	57, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	89 B	DER	11.41	TER	14.79
Environmental	90 B	% DER<TER	22.88		
CO ₂ Emissions (t/year)	1.10	DFEE	38.79	TFEE	44.92
General Requirements Compliance	Pass	% DFEE<TFEE	13.64		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 123 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) 14.79 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.41 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 38.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.42 (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: 4.87 (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 HEAT H18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.76 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing East: 6.20 m², No overhang
Windows facing West: 7.26 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.8700					
Infiltration rate							0.2435	(18)				
Number of sides sheltered							2	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2070 (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)
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	0.2639	0.2587	0.2535	0.2277	0.2225	0.1966	0.1966	0.1915	0.2070	0.2225	0.2328	0.2432 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5139	0.5087	0.5035	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)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)			(28) ... (30) + (32) + (32a) ... (32e) =				11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss			(33) + (36) =				63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.9870	Feb 52.4534	Mar 51.9199	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	116.6985	116.1650	115.6315	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.4908 (39)
HLP	Jan 0.9495	Feb 0.9451	Mar 0.9408	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9396 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1612.0146 (45)
25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787	(46)
Water storage loss:												250.0000 (47)
Store volume												1.7600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9504 (55)
Enter (49) or (54) in (55)												
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	517.7895	515.2525	498.0811	470.3407	441.7844	414.7878	397.6344	404.4565	419.0766	447.0511	479.0783	503.4709 (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				
East			2.8700	19.6403	0.7200	0.7000	0.7700	19.6876 (76)				
West			7.2600	19.6403	0.7200	0.7000	0.7700	49.8021 (80)				
East			3.3300	19.6403	0.7200	0.7000	0.7700	22.8431 (76)				
East			1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)				
Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888	626.4643	535.7984	413.6375	254.3695	135.8605	89.3820 (83)
Total gains	626.6126	729.0910	852.6596	991.3243	1083.7309	1073.4766	1024.0987	940.2550	832.7141	701.4205	614.9389	592.8529 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.6845	27.8116	27.9399	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8456	2.8541	2.8627	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9728	0.9574	0.9235	0.8518	0.7374	0.5915	0.4596	0.5105	0.7242	0.8980	0.9595	0.9765 (86)
MIT	18.8326	19.0998	19.5561	20.1054	20.5566	20.8330	20.9406	20.9184	20.6875	20.0752	19.3546	18.7931 (87)
Th 2	20.1257	20.1293	20.1330	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9690	0.9516	0.9128	0.8309	0.7000	0.5318	0.3804	0.4302	0.6717	0.8789	0.9530	0.9732 (89)
MIT 2	17.1874	17.5762	18.2350	19.0132	19.6268	19.9756	20.0927	20.0733	19.8108	18.9864	17.9533	17.1359 (90)
Living area fraction	17.3644	17.7401	18.3771	19.1307	19.7268	20.0678	20.1839	20.1642	19.9051	19.1035	18.1040	17.3141 (92)
MIT	17.2144	17.5901	18.2271	18.9807	19.5768	19.9178	20.0339	20.0142	19.7551	18.9535	17.9540	17.1641 (93)
Temperature adjustment												-0.1500
adjusted MIT	17.2144	17.5901	18.2271	18.9807	19.5768	19.9178	20.0339	20.0142	19.7551	18.9535	17.9540	17.1641 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9502	0.9274	0.8820	0.7972	0.6728	0.5156	0.3706	0.4181	0.6452	0.8451	0.9292	0.9562	(94)
Useful gains	595.4153	676.1786	752.0261	790.2387	729.1282	553.4527	379.5164	393.1309	537.2848	592.7664	571.3846	566.9080	(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	1507.0888	1474.1477	1356.0212	1161.9613	907.9246	612.9592	395.8147	416.5964	651.8380	962.8769	1251.0971	1494.3243	(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	678.2851	536.2352	449.3723	267.6402	133.0245	0.0000	0.0000	0.0000	0.0000	275.3622	489.3930	689.9977	(98)
Space heating												3519.3103	(98)
Space heating per m2											(98) / (4) =	28.6332	(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 %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3884.4484	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	678.2851	536.2352	449.3723	267.6402	133.0245	0.0000	0.0000	0.0000	0.0000	275.3622	489.3930	689.9977	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	748.6591	591.8711	495.9959	295.4086	146.8262	0.0000	0.0000	0.0000	0.0000	303.9318	540.1688	761.5869	(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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)	
Efficiency of water heater	87.7243	87.4897	86.9690	85.9339	84.1376	79.9000	79.9000	79.9000	79.9000	85.9133	87.2109	87.8105	(216)	
Fuel for water heating, kWh/month	250.6219	221.5078	234.0645	212.4062	212.6360	200.1370	192.2693	210.8976	210.4996	220.3030	229.4131	244.3702	(219)	
Water heating fuel used												2639.1266	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3884.4484	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													87.7670	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.7670	(231)
Electricity for lighting (calculated in Appendix L)													500.5042	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =													-675.5997	(233)
Total delivered energy for all uses													6511.2465	(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	3884.4484	0.2160	839.0409	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2639.1266	0.2160	570.0513	(264)
Space and water heating			1409.0922	(265)
Pumps and fans	162.7670	0.5190	84.4761	(267)
Energy for lighting	500.5042	0.5190	259.7617	(268)
Energy saving/generation technologies				
PV Unit	-675.5997	0.5190	-350.6362	(269)
Total CO2, kg/year			1402.6937	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4100	(273)

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

DER			11.4100	ZC1
Total Floor Area		TFA	122.9100	
Assumed number of occupants		N	2.8739	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.9312	ZC2
CO2 emissions from cooking, equation (L16)			1.5294	ZC3
Total CO2 emissions			26.8706	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			26.8706	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3780 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3213 (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	0.4097	0.4016	0.3936	0.3534	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713 (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)			13.4600	1.3258	17.8447		(27)
TER Room Window (Uw = 1.70)			1.5700	1.5918	2.4991		(27a)
150mm EPS B&B			45.3000	0.1300	5.8890		(28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1800	9.1476		(29a)
Wall to Void	21.6200		21.6200	0.1800	3.8916		(29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.1800	0.6336		(29a)
400mm Mineral Wool	18.2900		18.2900	0.1300	2.3777		(30)
Sloping	11.9200	1.5700	10.3500	0.1300	1.3455		(30)
C2V	12.9900		12.9900	0.1300	1.6887		(30)
Dormer Roof	4.5600		4.5600	0.1300	0.5928		(30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.0303		(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)							10.7023 (36)
Total fabric heat loss						(33) + (36) =	58.7326 (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	60.2072	59.8712	59.5419	57.9949	57.7055	56.3582	56.3582	56.1087	56.8772	57.7055	58.2910	58.9031 (38)
Heat transfer coeff	118.9398	118.6038	118.2744	116.7275	116.4381	115.0908	115.0908	114.8413	115.6097	116.4381	117.0236	117.6357 (39)
Average = Sum(39)m / 12 =												116.7261 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9677	0.9650	0.9623	0.9497	0.9473	0.9364	0.9364	0.9344	0.9406	0.9473	0.9521	0.9571 (40)
HLP (average)												0.9497 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)

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Energy content (annual)												Total = Sum(45)m =	1612.0146 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(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													
	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(64)
Total per year (kWh/year) = Sum(64)m =												2258.4977	(64)
Heat gains from water heating, kWh/month													
	99.4966	88.2775	94.0793	86.2338	85.8810	78.7129	77.4742	82.4231	81.4659	89.3266	92.0674	97.7432	(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	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	(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)													
	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	(71)
Water heating gains (Table 5)													
	133.7320	131.3653	126.4507	119.7692	115.4314	109.3235	104.1319	110.7837	113.1471	120.0626	127.8713	131.3752	(72)
Total internal gains													
	520.1357	517.5987	500.4273	472.6869	444.1306	417.1340	399.9807	406.8027	421.4229	449.3973	481.4246	505.8171	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF	Access		Gains	
				m2	Table 6a		Specific data	Specific data	factor	W		
					W/m2		or Table 6b	or Table 6c	Table 6d			
East				6.2000	19.6403		0.6300	0.7000	0.7700	37.2144 (76)		
West				7.2600	19.6403		0.6300	0.7000	0.7700	43.5768 (80)		
East				1.5700	26.4634		0.6300	0.7000	1.0000	16.4902 (82)		
Solar gains	97.2815	191.2606	317.3960	466.7552	575.4876	590.6563	561.6945	480.1622	370.3928	227.5790	121.4695	79.8908 (83)
Total gains	617.4172	708.8594	817.8234	939.4421	1019.6182	1007.7903	961.6752	886.9649	791.8156	676.9763	602.8941	585.7079 (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	71.7625	71.9658	72.1662	73.1226	73.3043	74.1625	74.1625	74.3236	73.8296	73.3043	72.9376	72.5581	
alpha	5.7842	5.7977	5.8111	5.8748	5.8870	5.9442	5.9442	5.9549	5.9220	5.8870	5.8625	5.8372	
util living area	0.9992	0.9980	0.9929	0.9675	0.8792	0.6965	0.5210	0.5843	0.8587	0.9854	0.9981	0.9994	(86)
MIT	19.9177	20.0494	20.2856	20.6007	20.8521	20.9724	20.9957	20.9920	20.9064	20.5685	20.1876	19.8985	(87)
Th 2	20.1103	20.1126	20.1149	20.1255	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house	0.9989	0.9973	0.9903	0.9554	0.8379	0.6164	0.4218	0.4807	0.7961	0.9780	0.9974	0.9992	(89)
MIT 2	18.6475	18.8417	19.1874	19.6460	19.9800	20.1180	20.1350	20.1349	20.0551	19.6077	19.0521	18.6260	(90)
Living area fraction	18.7841	18.9716	19.3055	19.7487	20.0738	20.2099	20.2276	20.2271	20.1466	19.7110	19.1743	18.7628	(91)
MIT	18.7841	18.9716	19.3055	19.7487	20.0738	20.2099	20.2276	20.2271	20.1466	19.7110	19.1743	18.7628	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7841	18.9716	19.3055	19.7487	20.0738	20.2099	20.2276	20.2271	20.1466	19.7110	19.1743	18.7628	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9983	0.9960	0.9870	0.9488	0.8350	0.6236	0.4324	0.4917	0.7973	0.9731	0.9961	0.9987	(94)
Useful gains	616.3686	706.0041	807.1866	891.2975	851.3900	628.4217	415.8419	436.0988	631.2949	658.7460	600.5423	584.9742	(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	1722.7360	1668.9482	1514.5668	1266.3411	975.0252	645.6502	417.5042	439.5128	699.0504	1060.8701	1412.9742	1713.1101	(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	823.1374	647.0984	526.2909	270.0314	91.9846	0.0000	0.0000	0.0000	0.0000	299.1803	584.9509	839.3331	(98)
Space heating												4082.0070	(98)
Space heating per m2												(98) / (4) =	33.2113 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000	(201)
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														93.5000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														4365.7829	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	823.1374	647.0984	526.2909	270.0314	91.9846	0.0000	0.0000	0.0000	0.0000	299.1803	584.9509	839.3331	(98)		
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)		
Space heating fuel (main heating system)	880.3608	692.0839	562.8780	288.8037	98.3792	0.0000	0.0000	0.0000	0.0000	319.9789	625.6160	897.6824	(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	222.0382	195.7674	205.7455	184.6404	181.0888	162.0211	155.8052	170.6892	170.3008	191.4515	202.1849	216.7647	(64)		
Efficiency of water heater (217)m	87.9935	87.7667	87.2133	85.8266	83.1100	79.8000	79.8000	79.8000	79.8000	86.0003	87.4868	88.0761	(216)		
Fuel for water heating, kWh/month	252.3348	223.0544	235.9107	215.1319	217.8906	203.0339	195.2446	213.8962	213.4095	222.6173	231.1032	246.1108	(219)		
Water heating fuel used												2669.7381	(219)		
Annual totals kWh/year															
Space heating fuel - main system												4365.7829	(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)												500.5042	(232)		
Total delivered energy for all uses												7611.0252	(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	4365.7829	0.2160	943.0091 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2669.7381	0.2160	576.6634 (264)
Space and water heating			1519.6725 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Total CO2, kg/m2/year			1818.3592 (272)
Emissions per m2 for space and water heating			12.3641 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1134 (272b)
Emissions per m2 for pumps and fans			0.3167 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3641 * 1.00) + 2.1134 + 0.3167, rounded to 2 d.p.			14.7900 (273)

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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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3715 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3158 (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	0.4026	0.3947	0.3868	0.3474	0.3395	0.3000	0.3000	0.2921	0.3158	0.3395	0.3553	0.3711 (22b)
Effective ac	0.5811	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688 (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)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0182		(33)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber PF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			9.0000	407.7000 (32e)
Internal Ceiling 2			32.3100			9.0000	290.7900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10932.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							88.9444 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)
Total fabric heat loss						(33) + (36) =	63.7116 (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	59.9122	59.5876	59.2695	57.7754	57.4958	56.1944	56.1944	55.9534	56.6957	57.4958	58.0613	58.6526 (38)
Heat transfer coeff	123.6238	123.2992	122.9811	121.4869	121.2074	119.9060	119.9060	119.6650	120.4073	121.2074	121.7729	122.3642 (39)
Average = Sum(39)m / 12 =												121.4856 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0058	1.0032	1.0006	0.9884	0.9861	0.9756	0.9756	0.9736	0.9796	0.9861	0.9907	0.9956 (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 FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Energy content (annual)	Total = Sum(45)m =											1612.0146 (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	35.5154	31.0620	32.0532	27.9448	26.8137	23.1382	21.4409	24.6038	24.8976	29.0158	31.6730	34.3948 (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	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	47.7358	46.2232	43.0823	38.8122	36.0399	32.1363	28.8184	33.0696	34.5800	38.9997	43.9902	46.2296 (72)
Total internal gains	431.1395	429.4566	414.0590	388.7299	361.7391	336.9469	321.6672	326.0886	339.8558	365.3344	394.5435	417.6715 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
East	2.8700	19.6403	0.7200	0.7000	0.7700	19.6876 (76)
West	7.2600	19.6403	0.7200	0.7000	0.7700	49.8021 (80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431 (76)
East	1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)

Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888	626.4643	535.7984	413.6375	254.3695	135.8605	89.3820 (83)
Total gains	539.9625	643.2951	768.6375	909.7135	1003.6856	995.6357	948.1314	861.8870	753.4933	619.7039	530.4040	507.0535 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.5641	24.6288	24.6925	24.9962	25.0538	25.3258	25.3258	25.3768	25.2203	25.0538	24.9375	24.8170
alpha	2.6376	2.6419	2.6462	2.6664	2.6703	2.6884	2.6884	2.6918	2.6814	2.6703	2.6625	2.6545
util living area	0.9784	0.9650	0.9356	0.8719	0.7683	0.6286	0.4988	0.5533	0.7629	0.9176	0.9683	0.9816 (86)
MIT	18.4726	18.7531	19.2458	19.8789	20.4096	20.7644	20.9089	20.8775	20.5745	19.8528	19.0487	18.4265 (87)
Th 2	20.0785	20.0807	20.0829	20.0930	20.0949	20.1038	20.1038	20.1054	20.1003	20.0949	20.0910	20.0870 (88)
util rest of house	0.9753	0.9601	0.9264	0.8530	0.7325	0.5681	0.4140	0.4688	0.7129	0.9015	0.9631	0.9790 (89)
MIT 2	17.7359	18.0153	18.5030	19.1259	19.6268	19.9467	20.0578	20.0398	19.7923	19.1130	18.3184	17.6959 (90)
Living area fraction	17.8151	18.0947	18.5829	19.2069	19.7110	20.0346	20.1493	20.1299	19.8764	19.1926	18.3970	17.7744 (91)
MIT	17.8151	18.0947	18.5829	19.2069	19.7110	20.0346	20.1493	20.1299	19.8764	19.1926	18.3970	17.7744 (92)
Temperature adjustment	17.8151	18.0947	18.5829	19.2069	19.7110	20.0346	20.1493	20.1299	19.8764	19.1926	18.3970	17.7744 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9650	0.9461	0.9073	0.8309	0.7154	0.5630	0.4186	0.4713	0.6986	0.8811	0.9499	0.9698 (94)
Ext temp.	521.0769	608.5919	697.3499	755.9088	718.0221	560.5245	396.8632	406.1956	526.3862	545.9979	503.8269	491.7537 (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	1670.7880	1626.8928	1485.9668	1252.1554	970.9935	651.6415	425.5874	446.3388	695.5216	1041.4873	1375.6628	1661.0259 (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	855.3851	684.2982	586.7310	357.2975	188.2108	0.0000	0.0000	0.0000	0.0000	368.6441	627.7219	869.9385 (98)
Space heating per m2	(98) / (4) =											36.9232 (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	1127.1163	887.3044	909.4540	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7685	0.8287	0.7969	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	866.1883	735.3219	724.7095	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1261.4337	1204.4245	1109.1202	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	284.5767	349.0124	286.0015	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													
Intermittency factor (Table 10b)													
	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	71.1442	87.2531	71.5004	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													
Energy for space heating													
Energy for space cooling													
Total													
Dwelling Fabric Energy Efficiency (DFEE)													

229.8976 (107)
1.8705 (108)
36.9232 (99)
1.8705 (108)
38.7936 (109)
38.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1280 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3780 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3213 (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	0.4097	0.4016	0.3936	0.3534	0.3454	0.3053	0.3053	0.2972	0.3213	0.3454	0.3615	0.3775 (22b)
Effective ac	0.5839	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5653	0.5713 (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)			13.4600	1.3258	17.8447		(27)
TER Room Window (Uw = 1.70)			1.5700	1.5918	2.4991		(27a)
150mm EPS B&B			45.3000	0.1300	5.8890		(28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1800	9.1476		(29a)
Wall to Void	21.6200		21.6200	0.1800	3.8916		(29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.1800	0.6336		(29a)
400mm Mineral Wool	18.2900		18.2900	0.1300	2.3777		(30)
Sloping	11.9200	1.5700	10.3500	0.1300	1.3455		(30)
C2V	12.9900		12.9900	0.1300	1.6887		(30)
Dormer Roof	4.5600		4.5600	0.1300	0.5928		(30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.0303		(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)							10.7023 (36)
Total fabric heat loss						(33) + (36) =	58.7326 (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	60.2072	59.8712	59.5419	57.9949	57.7055	56.3582	56.3582	56.1087	56.8772	57.7055	58.2910	58.9031 (38)
Heat transfer coeff	118.9398	118.6038	118.2744	116.7275	116.4381	115.0908	115.0908	114.8413	115.6097	116.4381	117.0236	117.6357 (39)
Average = Sum(39)m / 12 =												116.7261 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9677	0.9650	0.9623	0.9497	0.9473	0.9364	0.9364	0.9344	0.9406	0.9473	0.9521	0.9571 (40)
HLP (average)												0.9497 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4549 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy conte	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (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 = 1612.0146 (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	35.5154	31.0620	32.0532	27.9448	26.8137	23.1382	21.4409	24.6038	24.8976	29.0158	31.6730	34.3948 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	143.6945	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3406	25.1719	20.4712	15.4980	11.5849	9.7805	10.5682	13.7369	18.4376	23.4108	27.3239	29.1283	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9547	291.9531	284.3972	268.3114	248.0059	228.9217	216.1722	213.1738	220.7298	236.8156	257.1210	276.2052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	37.3695	(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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	(71)
Water heating gains (Table 5)	47.7358	46.2232	43.0823	38.8122	36.0399	32.1363	28.8184	33.0696	34.5800	38.9997	43.9902	46.2296	(72)
Total internal gains	431.1395	429.4566	414.0590	388.7299	361.7391	336.9469	321.6672	326.0886	339.8558	365.3344	394.5435	417.6715	(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			
East				6.2000	19.6403	0.6300	0.7000	0.7700	37.2144 (76)			
West				7.2600	19.6403	0.6300	0.7000	0.7700	43.5768 (80)			
East				1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)			
Solar gains	97.2815	191.2606	317.3960	466.7552	575.4876	590.6563	561.6945	480.1622	370.3928	227.5790	121.4695	79.8908 (83)
Total gains	528.4209	620.7173	731.4550	855.4851	937.2267	927.6031	883.3617	806.2508	710.2485	592.9134	516.0130	497.5622 (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	71.7625	71.9658	72.1662	73.1226	73.3043	74.1625	74.1625	74.3236	73.8296	73.3043	72.9376	72.5581	
alpha	5.7842	5.7977	5.8111	5.8748	5.8870	5.9442	5.9442	5.9549	5.9220	5.8870	5.8625	5.8372	
util living area	0.9997	0.9990	0.9959	0.9786	0.9088	0.7421	0.5641	0.6360	0.9002	0.9923	0.9992	0.9998	(86)
MIT	19.8476	19.9804	20.2195	20.5438	20.8166	20.9616	20.9936	20.9877	20.8742	20.5060	20.1193	19.8289	(87)
Th 2	20.1103	20.1126	20.1149	20.1255	20.1274	20.1367	20.1367	20.1384	20.1331	20.1274	20.1234	20.1192	(88)
util rest of house	0.9995	0.9986	0.9944	0.9700	0.8737	0.6620	0.4583	0.5266	0.8477	0.9882	0.9988	0.9997	(89)
MIT 2	19.0416	19.1761	19.4164	19.7444	19.9986	20.1183	20.1349	20.1346	20.0573	19.7121	19.3239	19.0301	(90)
Living area fraction	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(91)
MIT	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(92)
Temperature adjustment	19.1283	19.2626	19.5027	19.8304	20.0866	20.2090	20.2273	20.2264	20.1452	19.7975	19.4095	19.1160	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	528.0736	619.5833	726.3130	826.7143	817.0257	620.7939	414.8954	433.9581	602.6745	584.6240	515.2064	497.3347	(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	1763.6685	1703.4556	1537.8913	1275.8804	976.5142	645.5461	417.4673	439.4241	698.8810	1070.9438	1440.4979	1754.6587	(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	919.2826	728.3622	603.8143	323.3996	118.6594	0.0000	0.0000	0.0000	0.0000	361.8219	666.2098	935.4491	(98)
Space heating												4656.9990	(98)
Space heating per m2												37.8895	(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	1081.8532	851.6716	872.7936	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	0.8910	0.9464	0.9208	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	963.9022	806.0232	803.6548	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1181.9151	1128.7196	1044.0908	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	156.9693	240.0861	178.8844	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												575.9398 (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	39.2423	60.0215	44.7211	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.9850 (107)
Space cooling per m2												1.1715 (108)
Energy for space heating												37.8895 (99)
Energy for space cooling												1.1715 (108)
Total												39.0610 (109)
Target Fabric Energy Efficiency (TFEE)												44.9 (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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													4.8700
Number of sides sheltered													0.2435 (18)
													2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2070 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	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													
	0.2277	0.2121	0.2121	0.2018	0.2018	0.1915	0.1915	0.1811	0.1811	0.1966	0.1915	0.2018 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			10.1300	1.3258	13.4299		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)					
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)					
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)					
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)					
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)					
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)					
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)					
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)					
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)					
Total net area of external elements Aum(A, m2)			184.6000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	51.0182		(33)					
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)					
Timber GF			77.6000			9.0000	698.4000 (32c)					
Timber FF			89.5100			9.0000	805.5900 (32c)					
Timber 2F			49.0500			9.0000	441.4500 (32c)					
Internal Floor			45.3000			18.0000	815.4000 (32d)					
Internal Floor 2			32.3100			18.0000	581.5800 (32d)					
Internal Ceiling			45.3000			18.0000	815.4000 (32e)					
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =			11630.6500 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							94.6274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)					
Total fabric heat loss						(33) + (36) =	63.7116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	(39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (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	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697											
Water storage loss:	21.9261											
Store volume	22.6258											
a) If manufacturer declared loss factor is known (kWh/day):	19.7257											
Temperature factor from Table 2b	18.9273											
Enter (49) or (54) in (55)	16.3328											
Total storage loss	15.1348											
If cylinder contains dedicated solar storage	17.3674											
Primary loss	20.4817											
Total heat required for water heating calculated for each month	22.3574											
Solar input	24.2787											
Output from w/h	250.0000 (47)											
RHI water heating demand	1.7600 (48)											
Heat gains from water heating, kWh/month	0.5400 (49)											
	0.9504 (55)											
	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (62)
	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 =											
	219.8562											
	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)	2232.8066 (64)
	Total per year (kWh/year) = Sum (64)m =											
	2233 (64)											
	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (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
East					2.8700	25.1925	0.7200	0.7000	0.7700			25.2533 (76)
West					7.2600	25.1925	0.7200	0.7000	0.7700			63.8811 (80)
East					3.3300	25.1925	0.7200	0.7000	0.7700			29.3008 (76)
East					1.5700	34.2518	0.6300	0.7000	1.0000			21.3434 (82)
Solar gains	139.7786	233.6688	389.5687	573.4248	666.0084	748.3161	686.9944	614.6881	475.6420	295.8809	173.9414	108.6658 (83)
Total gains	888.8867	976.9637	1104.9194	1245.6525	1293.8090	1337.0138	1253.4406	1191.2327	1077.5794	941.1753	867.1339	838.3572 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9283	0.9063	0.8501	0.7480	0.6014	0.4153	0.2965	0.3110	0.5422	0.7764	0.8938	0.9360 (86)
MIT	19.4183	19.6099	20.0160	20.4536	20.7846	20.9471	20.9858	20.9839	20.8817	20.5015	19.8989	19.3713 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9190	0.8944	0.8312	0.7173	0.5535	0.3520	0.2216	0.2328	0.4764	0.7402	0.8779	0.9275 (89)
MIT 2	18.0364	18.3090	18.8819	19.4812	19.9098	20.0936	20.1284	20.1274	20.0306	19.5614	18.7273	17.9702 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.2206	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.0350	18.2990	18.8539	19.4358	19.8538	20.0354	20.0706	20.0695	19.9722	19.5125	18.7033	17.9709 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8890	0.8621	0.7977	0.6893	0.5368	0.3444	0.2158	0.2267	0.4631	0.7099	0.8445	0.8987	(94)
Useful gains	790.2538	842.2280	881.3747	858.6525	694.5102	460.4553	270.5364	270.0326	499.0019	668.1088	732.2533	753.4001	(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													
	1456.3883	1429.1791	1297.1953	1087.6263	778.4887	476.6730	273.2483	273.1219	538.5415	865.9334	1187.6179	1437.4686	(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													
	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)
Space heating												2410.7378	(98)
RHI space heating demand												2411	(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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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												4.8700	
Infiltration rate												0.2435 (18)	
Number of sides sheltered												2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2070 (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)	
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	0.2639	0.2587	0.2535	0.2277	0.2225	0.1966	0.1966	0.1915	0.2070	0.2225	0.2328	0.2432 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5139	0.5087	0.5035	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 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)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0182		(32)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber FF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			18.0000	815.4000 (32e)
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11630.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							94.6274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6934 (36)
Total fabric heat loss					(33) + (36) =		63.7116 (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	52.9870	52.4534	51.9199	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544 (38)
Heat transfer coeff	116.6985	116.1650	115.6315	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660 (39)
Average = Sum(39)m / 12 =												115.4908 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9495	0.9451	0.9408	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378 (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	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	1612.0146 (45)											
Water storage loss:	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787 (46)
Store volume	250.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.7600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.9504 (55)											
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (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		
East				2.8700	19.6403	0.7200	0.7000	0.7700		19.6876 (76)		
West				7.2600	19.6403	0.7200	0.7000	0.7700		49.8021 (80)		
East				3.3300	19.6403	0.7200	0.7000	0.7700		22.8431 (76)		
East				1.5700	26.4634	0.6300	0.7000	1.0000		16.4902 (82)		
Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888	626.4643	535.7984	413.6375	254.3695	135.8605	89.3820 (83)
Total gains	857.9311	957.1333	1069.9293	1193.2113	1269.7471	1247.3865	1192.9105	1112.3430	1015.5749	899.6639	829.0530	819.0735 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.6845	27.8116	27.9399	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8456	2.8541	2.8627	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9434	0.9219	0.8786	0.7962	0.6759	0.5298	0.4033	0.4451	0.6454	0.8367	0.9209	0.9493 (86)
MIT	19.1559	19.3987	19.8039	20.2772	20.6525	20.8750	20.9577	20.9429	20.7726	20.2749	19.6366	19.1160 (87)
Th 2	20.1257	20.1293	20.1330	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9362	0.9123	0.8635	0.7711	0.6362	0.4720	0.3311	0.3711	0.5902	0.8105	0.9095	0.9429 (89)
MIT 2	17.6521	18.0022	18.5812	19.2425	19.7438	20.0183	20.1057	20.0931	19.9062	19.2546	18.3533	17.6008 (90)
Living area fraction	17.8138	18.1524	18.7127	19.3538	19.8415	20.1104	20.1973	20.1845	19.9993	19.3644	18.4913	17.7638 (92)
MIT	17.8138	18.1524	18.7127	19.3538	19.8415	20.1104	20.1973	20.1845	19.9993	19.3644	18.4913	17.7638 (92)
Temperature adjustment	17.6638	18.0024	18.5627	19.2038	19.6915	19.9604	20.0473	20.0345	19.8493	19.2144	18.3413	17.6138 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9087	0.8814	0.8299	0.7398	0.6139	0.4597	0.3235	0.3620	0.5701	0.7769	0.8783	0.9169	(94)
Useful gains	779.5964	843.6106	887.9262	882.7156	779.5147	573.3724	385.8795	402.7030	578.9741	698.9296	728.1852	750.9968	(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	1559.5363	1522.0359	1394.8261	1187.6805	921.1523	617.8724	397.3595	418.9366	662.7044	992.9455	1295.7440	1546.1558	(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	580.2753	455.9018	377.1335	219.5748	105.3784	0.0000	0.0000	0.0000	0.0000	218.7478	408.6423	591.5983	(98)
Space heating												2957.2521	(98)
Space heating per m2												24.0603	(99)

(98) / (4) = 24.0603 (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 %)	90.6000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3264.0752	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.2753	455.9018	377.1335	219.5748	105.3784	0.0000	0.0000	0.0000	0.0000	218.7478	408.6423	591.5983	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	640.4804	503.2028	416.2622	242.3563	116.3117	0.0000	0.0000	0.0000	0.0000	241.4435	451.0401	652.9783	(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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)
Efficiency of water heater	87.3845	87.1199	86.5375	85.4081	83.5580	79.9000	79.9000	79.9000	79.9000	85.3010	86.7803	87.4817	(216)
Fuel for water heating, kWh/month	251.5964	222.4481	235.2315	213.7138	214.1110	200.1370	192.2693	210.8976	210.4996	221.8843	230.5516	245.2886	(219)
Water heating fuel used												2648.6289	(219)
Annual totals kWh/year												3264.0752	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)													
mechanical ventilation fans (SFP = 0.2302)													87.7670 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													162.7670 (231)
Electricity for lighting (calculated in Appendix L)													500.5042 (232)

Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =													-675.5997 (233)
Total delivered energy for all uses													5900.3756 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3264.0752	3.4800	113.5898	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2648.6289	3.4800	92.1723	(247)
Mechanical ventilation fans	87.7670	13.1900	11.5765	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	500.5042	13.1900	66.0165	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-675.5997	13.1900	-89.1116	(252)
Total energy cost			324.1360	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8108	(257)
SAP value			88.6897	
SAP rating (Section 12)			89	(258)
SAP band			B	

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3264.0752	0.2160	705.0402 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2648.6289	0.2160	572.1038 (264)
Space and water heating			1277.1441 (265)
Pumps and fans	162.7670	0.5190	84.4761 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1270.7456 (272)
CO2 emissions per m2			10.3400 (273)
EI value			89.8589
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8410 = 4.138$, stars = 4
Water heating environmental impact	$0.216 / 0.8410 = 0.2568$, 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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.2435 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2070 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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	0.2277	0.2121	0.2121	0.2018	0.2018	0.1915	0.1915	0.1811	0.1811	0.1966	0.1915	0.2018 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				51.0182		(33)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber FF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			18.0000	815.4000 (32e)
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11630.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		94.6274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.6934 (36)
Total fabric heat loss	(33) + (36) =	63.7116 (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	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544 (38)
Average = Sum(39)m / 12 =	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378 (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	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787 (46)
Water storage loss:												
Store volume	250.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.7600 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.9504 (55)											
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827 (64)
Heat gains from water heating, kWh/month	97.7510	86.7008	92.3337	84.5446	84.1354	77.0236	75.7286	80.6775	79.7766	87.5810	90.3781	95.9976 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	131.3858	129.0191	124.1044	117.4230	113.0852	106.9773	101.7857	108.4375	110.8009	117.7164	125.5251	129.0290 (72)
Total internal gains	749.1081	743.2948	715.3507	672.2277	627.8006	588.6977	566.4463	576.5446	601.9374	645.2945	693.1925	729.6914 (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
East				2.8700	25.1925		0.7200		0.7000		0.7700		25.2533 (76)
West				7.2600	25.1925		0.7200		0.7000		0.7700		63.8811 (80)
East				3.3300	25.1925		0.7200		0.7000		0.7700		29.3008 (76)
East				1.5700	34.2518		0.6300		0.7000		1.0000		21.3434 (82)
Solar gains	139.7786	233.6688	389.5687	573.4248	666.0084	748.3161	686.9944	614.6881	475.6420	295.8809	173.9414	108.6658	(83)
Total gains	888.8867	976.9637	1104.9194	1245.6525	1293.8090	1337.0138	1253.4406	1191.2327	1077.5794	941.1753	867.1339	838.3572	(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	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9283	0.9063	0.8501	0.7480	0.6014	0.4153	0.2965	0.3110	0.5422	0.7764	0.8938	0.9360 (86)
MIT	19.4183	19.6099	20.0160	20.4536	20.7846	20.9471	20.9858	20.9839	20.8817	20.5015	19.8989	19.3713 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9190	0.8944	0.8312	0.7173	0.5535	0.3520	0.2216	0.2328	0.4764	0.7402	0.8779	0.9275 (89)
MIT 2	18.0364	18.3090	18.8819	19.4812	19.9098	20.0936	20.1284	20.1274	20.0306	19.5614	18.7273	17.9702 (90)
Living area fraction	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.2206	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
MIT	18.1850	18.4490	19.0039	19.5858	20.0038	20.1854	20.2206	20.2195	20.1222	19.6625	18.8533	18.1209 (92)
Temperature adjustment	18.0350	18.2990	18.8539	19.4358	19.8538	20.0354	20.0706	20.0695	19.9722	19.5125	18.7033	17.9709 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8890	0.8621	0.7977	0.6893	0.5368	0.3444	0.2158	0.2267	0.4631	0.7099	0.8445	0.8987	(94)
Useful gains	790.2538	842.2280	881.3747	858.6525	694.5102	460.4553	270.5364	270.0326	499.0019	668.1088	732.2533	753.4001	(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	1456.3883	1429.1791	1297.1953	1087.6263	778.4887	476.6730	273.2483	273.1219	538.5415	865.9334	1187.6179	1437.4686	(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	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)
Space heating												2410.7378	(98)
Space heating per m2											(98) / (4) =	19.6138	(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 %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2660.8585	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	495.6041	394.4311	309.3706	164.8611	62.4800	0.0000	0.0000	0.0000	0.0000	147.1815	327.8625	508.9470	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	547.0244	435.3544	341.4686	181.9659	68.9625	0.0000	0.0000	0.0000	0.0000	162.4520	361.8791	561.7516	(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	219.8562	193.7966	203.5635	182.5288	178.9068	159.9095	153.6232	168.5072	168.1892	189.2696	200.0733	214.5827	(64)	
Efficiency of water heater	87.0190	86.7716	86.0279	84.6441	82.4195	79.9000	79.9000	79.9000	79.9000	84.2528	86.2240	87.1391	(217)	
Fuel for water heating, kWh/month	252.6531	223.3410	236.6249	215.6427	217.0686	200.1370	192.2693	210.8976	210.4996	224.6448	232.0389	246.2530	(219)	
Water heating fuel used												2662.0706	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2660.8585	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)														
mechanical ventilation fans (SFP = 0.2302)													87.7670	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.7670	(231)
Electricity for lighting (calculated in Appendix L)													500.5042	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =										-760.9470		-760.9470	(233)	
Total delivered energy for all uses												5225.2534	(238)	

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2660.8585	10.2300	272.2058	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2662.0706	10.2300	272.3298	(247)
Mechanical ventilation fans	87.7670	36.7200	32.2280	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	500.5042	36.7200	183.7852	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-760.9470	36.7200	-279.4197	(252)
Total energy cost			611.6691	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2660.8585	0.2160	574.7454	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2662.0706	0.2160	575.0073	(264)
Space and water heating			1149.7527	(265)
Pumps and fans	162.7670	0.5190	84.4761	(267)
Energy for lighting	500.5042	0.5190	259.7617	(268)
Energy saving/generation technologies				
PV Unit	-760.9470	0.5190	-394.9315	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total kg/year 1099.0590 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2660.8585	1.2200	3246.2474 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2662.0706	1.2200	3247.7262 (264)
Space and water heating			6493.9736 (265)
Pumps and fans	162.7670	3.0700	499.6946 (267)
Energy for lighting	500.5042	3.0700	1536.5480 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			6194.1089 (272)
Primary energy kWh/m2/year			50.3955 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 123	-272 kg (24.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£123 2.21 kg/m²	B 90	A 92
Total Savings	£123 2.21 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 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	£244	£262	-£18
Mains gas	£648	£507	£141
Space heating	£435	£438	-£3
Water heating	£272	£147	£125
Lighting	£184	£184	£0
Generated (PV)	-£279	-£279	£0
Total cost of fuels	£613	£490	£123
Total cost of uses	£612	£490	£122
Delivered energy	43 kWh/m²	32 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.8 tonnes	0.3 tonnes

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

CO2 emissions per m ²	9 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	50 kWh/m ²	38 kWh/m ²	12 kWh/m ²

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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.2435 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2070 (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	0.2639	0.2587	0.2535	0.2277	0.2225	0.1966	0.1966	0.1915	0.2070	0.2225	0.2328	0.2432 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5139	0.5087	0.5035	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 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)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0182		(32)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber FF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			18.0000	815.4000 (32e)
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11630.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		94.6274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.6934 (36)
Total fabric heat loss	(33) + (36) =	63.7116 (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	52.9870	52.4534	51.9199	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544 (38)
Heat transfer coeff	116.6985	116.1650	115.6315	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660 (39)
Average = Sum(39)m / 12 =												115.4908 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9495	0.9451	0.9408	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378 (40)
HLP (average)												0.9396 (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	2.8739 (42)											
Average daily hot water use (litres/day)	102.4549 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004 (44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0697											
Water storage loss:	25.0697											
Store volume	25.0697											
a) If manufacturer declared loss factor is known (kWh/day):	25.0697											
Temperature factor from Table 2b	25.0697											
Enter (49) or (54) in (55)	25.0697											
Total storage loss	25.0697											
If cylinder contains dedicated solar storage	25.0697											
Primary loss	25.0697											
Total heat required for water heating calculated for each month	25.0697											
Aperture area of solar collector	25.0697											
Zero-loss collector efficiency	25.0697											
Collector heat loss coefficient	25.0697											
Collector 2nd order heat loss coefficient	25.0697											
Collector effective heat loss coefficient	25.0697											
Collector performance ratio	25.0697											
Annual solar radiation per m2	25.0697											
Overshading factor	25.0697											
Solar energy available	25.0697											
Adjustment factor for showers	25.0697											
Solar-to-load ratio	25.0697											
Utilisation factor	25.0697											
Collector performance factor	25.0697											
Dedicated solar storage volume	25.0697											
Effective solar volume	25.0697											
Daily hot water demand	25.0697											
Volume ratio Veff/V	25.0697											
Solar storage volume factor	25.0697											
Solar input	25.0697											
Solar input	-27.2310	-45.4407	-77.3907	-103.7189	-128.1359	-125.9780	-124.3132	-108.6130	-85.0658	-58.0899	-32.2999	-22.7877 (63)
Output from w/h	183.7865	140.3725	115.9383	63.5028	29.1379	12.7712	7.4444	38.9590	69.1669	120.9452	159.2198	182.9562 (64)
Heat gains from water heating, kWh/month	90.6801	80.3142	84.1461	72.2988	66.8289	60.0954	58.2360	63.9294	68.6114	79.3934	83.5352	88.9266 (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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172 (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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556 (71)
Water heating gains (Table 5)	121.8818	119.5151	113.0996	100.4150	89.8238	83.4658	78.2742	85.9265	95.2937	106.7116	116.0211	119.5250 (72)
Total internal gains	739.6041	733.7908	704.3459	655.2197	604.5393	565.1862	542.9348	554.0336	586.4302	634.2897	683.6885	720.1874 (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
East	2.8700	19.6403	0.7200	0.7000	0.7700	19.6876 (76)
West	7.2600	19.6403	0.7200	0.7000	0.7700	49.8021 (80)
East	3.3300	19.6403	0.7200	0.7000	0.7700	22.8431 (76)
East	1.5700	26.4634	0.6300	0.7000	1.0000	16.4902 (82)
Solar gains	108.8231	213.8384	354.5785	520.9836	641.9465	658.6888
Total gains	848.4271	947.6293	1058.9245	1176.2033	1246.4858	1223.8750

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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.6845	27.8116	27.9399	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8456	2.8541	2.8627	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9448	0.9236	0.8810	0.8009	0.6833	0.5375	0.4104	0.4528	0.6517	0.8402	0.9228	0.9506 (86)
MIT	19.1433	19.3870	19.7923	20.2642	20.6419	20.8702	20.9557	20.9403	20.7666	20.2650	19.6249	19.1031 (87)
Th 2	20.1257	20.1293	20.1330	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9378	0.9141	0.8661	0.7761	0.6438	0.4794	0.3373	0.3780	0.5965	0.8143	0.9117	0.9443 (89)
MIT 2	17.6341	17.9856	18.5652	19.2253	19.7311	20.0134	20.1042	20.0911	19.8995	19.2416	18.3369	17.5823 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	17.7964	18.1363	18.6971	19.3370	19.8290	20.1056	20.1958	20.1824	19.9928	19.3517	18.4754	17.7459 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6464	17.9863	18.5471	19.1870	19.6790	19.9556	20.0458	20.0324	19.8428	19.2017	18.3254	17.5959 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9105	0.8834	0.8325	0.7445	0.6209	0.4666	0.3294	0.3686	0.5760	0.7806	0.8807	0.9187 (94)
Useful gains	772.5114	837.1257	881.6048	875.6775	773.9493	571.0853	385.1565	401.6927	576.0172	693.6912	721.7683	743.7335 (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	1557.5042	1520.1757	1393.0290	1185.7470	919.7125	617.3146	397.1849	418.6915	661.9480	991.4784	1293.9112	1544.0941 (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	584.0347	459.0096	380.4995	223.2500	108.4479	0.0000	0.0000	0.0000	0.0000	221.5536	411.9429	595.4683 (98)
Space heating												2984.2066 (98)
Space heating per m2										(98) / (4) =		24.2796 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3293.8263 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	584.0347	459.0096	380.4995	223.2500	108.4479	0.0000	0.0000	0.0000	0.0000	221.5536	411.9429	595.4683 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	644.6299	506.6331	419.9774	246.4129	119.6996	0.0000	0.0000	0.0000	0.0000	244.5404	454.6831	657.2498 (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	183.7865	140.3725	115.9383	63.5028	29.1379	12.7712	7.4444	38.9590	69.1669	120.9452	159.2198	182.9562 (64)
Efficiency of water heater (217)m	87.7861	87.8449	87.8524	87.9905	88.1014	79.9000	79.9000	79.9000	79.9000	86.5090	87.3395	79.9000 (216)
Fuel for water heating, kWh/month	209.3573	159.7958	131.9694	72.1700	33.0731	15.9839	9.3171	48.7597	86.5669	139.8064	182.2999	87.8354 (217)
Water heating fuel used												208.2945 (219)
Annual totals kWh/year												1297.3941 (219)
Space heating fuel - main system												3293.8263 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												87.7670 (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												212.7670 (231)
Electricity for lighting (calculated in Appendix L)												500.5042 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =									-675.5997			-675.5997 (233)
Total delivered energy for all uses												4628.8919 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3293.8263	3.4800	114.6252 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1297.3941	3.4800	45.1493 (247)
Mechanical ventilation fans	87.7670	13.1900	11.5765 (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	500.5042	13.1900	66.0165 (250)
Additional standing charges			120.0000 (251)

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Energy saving/generation technologies			
PV Unit	-675.5997	13.1900	-89.1116 (252)
Total energy cost			284.7433 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.7122 (257)
SAP value			90.0643
SAP rating (Section 12)			90 (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	3293.8263	0.2160	711.4665 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.3941	0.2160	280.2371 (264)
Space and water heating			991.7036 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1011.2551 (272)
CO2 emissions per m2			8.2300 (273)
EI value			91.9297
EI rating			92 (274)
EI band			A

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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	45.3000 (1b)	x 2.4100 (2b)	= 109.1730 (1b) - (3b)
First floor	45.3000 (1c)	x 2.6900 (2c)	= 121.8570 (1c) - (3c)
Second floor	32.3100 (1d)	x 2.5200 (2d)	= 81.4212 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.4512 (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) =								Air changes per hour					
Pressure test								0.0000 / (5) =	0.0000 (8)				
Measured/design AP50									Yes				
Infiltration rate									4.8700				
Number of sides sheltered									0.2435 (18)				
									2 (19)				
Shelter factor								(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =	0.2070 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	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													
	0.2277	0.2121	0.2121	0.2018	0.2018	0.1915	0.1915	0.1811	0.1811	0.1966	0.1915	0.2018 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross 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)			10.1300	1.3258	13.4299		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
Roof Window (Uw = 1.80)			1.5700	1.6791	2.6362		(27a)
150mm EPS B&B			45.3000	0.1500	6.7950	75.0000	3397.5000 (28a)
140mm Timber Frame	63.8200	13.0000	50.8200	0.1900	9.6558	9.0000	457.3800 (29a)
Wall to Void	21.6200		21.6200	0.1400	3.0268	9.0000	194.5800 (29a)
Dormer Cheek	6.1000	2.5800	3.5200	0.3200	1.1264	9.0000	31.6800 (29a)
400mm Mineral Wool	18.2900		18.2900	0.1100	2.0119	9.0000	164.6100 (30)
Sloping	11.9200	1.5700	10.3500	0.2000	2.0700	9.0000	93.1500 (30)
C2V	12.9900		12.9900	0.1400	1.8186	9.0000	116.9100 (30)
Dormer Roof	4.5600		4.5600	0.2800	1.2768	9.0000	41.0400 (30)
Total net area of external elements Aum(A, m ²)			184.6000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.0182		(32)
Timebr Frame			119.7200	0.0000	0.0000	20.0000	2394.4000 (32)
Timber GF			77.6000			9.0000	698.4000 (32c)
Timber FF			89.5100			9.0000	805.5900 (32c)
Timber 2F			49.0500			9.0000	441.4500 (32c)
Internal Floor			45.3000			18.0000	815.4000 (32d)
Internal Floor 2			32.3100			18.0000	581.5800 (32d)
Internal Ceiling			45.3000			18.0000	815.4000 (32e)
Internal Ceiling 2			32.3100			18.0000	581.5800 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =											11630.6500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												94.6274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												12.6934 (36)
Total fabric heat loss	(33) + (36) =											63.7116 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5544	Feb 51.5544	Mar 51.5544	Apr 51.5544	May 51.5544	Jun 51.5544	Jul 51.5544	Aug 51.5544	Sep 51.5544	Oct 51.5544	Nov 51.5544	Dec 51.5544 (38)
Heat transfer coeff	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660	115.2660 (39)
Average = Sum(39)m / 12 =												115.2660 (39)
HLP	Jan 0.9378	Feb 0.9378	Mar 0.9378	Apr 0.9378	May 0.9378	Jun 0.9378	Jul 0.9378	Aug 0.9378	Sep 0.9378	Oct 0.9378	Nov 0.9378	Dec 0.9378 (40)
HLP (average)												0.9378 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8739 (42)
Average daily hot water use (litres/day)													102.4549 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7004	108.6022	104.5040	100.4058	96.3076	92.2094	92.2094	96.3076	100.4058	104.5040	108.6022	112.7004	(44)
Energy content (annual)	167.1314	146.1742	150.8387	131.5048	126.1820	108.8855	100.8984	115.7824	117.1652	136.5448	149.0493	161.8579	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1612.0146 (45)
25.0697	21.9261	22.6258	19.7257	18.9273	16.3328	15.1348	17.3674	17.5748	20.4817	22.3574	24.2787	24.2787	(46)
Water storage loss:													250.0000 (47)
Store volume													1.7600 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.9504 (55)
Enter (49) or (54) in (55)													
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage													
20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	19.9584	20.6237	19.9584	20.6237	19.9584	20.6237	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	211.0175	185.8133	193.3290	167.2216	157.2738	138.7492	131.7575	147.5720	154.2327	179.0351	191.5197	205.7439	(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													1.2512 (H8)
Utilisation factor													0.5503 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													127.5000 (H13)
Daily hot water demand													102.4549 (H14)
Volume ratio Veff/V													1.2444 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-976.0069 (H17)
Solar input	-32.0402	-45.5591	-78.3051	-105.6517	-123.4799	-133.1336	-126.7328	-115.5087	-90.2586	-62.0716	-37.8951	-25.3705	(63)
Output from w/h	178.9774	140.2542	115.0239	61.5699	33.7938	5.6155	5.0248	32.0634	63.9741	116.9635	153.6246	180.3734	(64)
Heat gains from water heating, kWh/month	90.6801	80.3142	84.1461	72.2988	66.8289	60.0954	58.2360	63.9294	68.6114	79.3934	83.5352	88.9266	(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	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	172.4334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.8516	62.9297	51.1779	38.7450	28.9623	24.4512	26.4204	34.3422	46.0940	58.5270	68.3096	72.8207	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2757	435.7510	424.4734	400.4647	370.1581	341.6741	322.6451	318.1698	329.4474	353.4561	383.7627	412.2466	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	55.1172	(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)	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	-114.9556	(71)
Water heating gains (Table 5)	121.8818	119.5151	113.0996	100.4150	89.8238	83.4658	78.2742	85.9265	95.2937	106.7116	116.0211	119.5250	(72)
Total internal gains	739.6041	733.7908	704.3459	655.2197	604.5393	565.1862	542.9348	554.0336	586.4302	634.2897	683.6885	720.1874	(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	
East				2.8700	25.1925	0.7200	0.7000		0.7700		25.2533 (76)	
West				7.2600	25.1925	0.7200	0.7000		0.7700		63.8811 (80)	
East				3.3300	25.1925	0.7200	0.7000		0.7700		29.3008 (76)	
East				1.5700	34.2518	0.6300	0.7000		1.0000		21.3434 (82)	
Solar gains	139.7786	233.6688	389.5687	573.4248	666.0084	748.3161	686.9944	614.6881	475.6420	295.8809	173.9414	108.6658 (83)
Total gains	879.3827	967.4597	1093.9146	1228.6445	1270.5477	1313.5023	1229.9292	1168.7218	1062.0722	930.1705	857.6299	828.8532 (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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285	28.0285
alpha	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686	2.8686
util living area	0.9299	0.9081	0.8528	0.7531	0.6089	0.4218	0.3018	0.3166	0.5481	0.7805	0.8961	0.9376 (86)
MIT	19.4063	19.5988	20.0056	20.4429	20.7773	20.9449	20.9851	20.9831	20.8783	20.4937	19.8883	19.3589 (87)
Th 2	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355 (88)
util rest of house	0.9208	0.8964	0.8341	0.7225	0.5610	0.3577	0.2257	0.2371	0.4820	0.7445	0.8805	0.9292 (89)
MIT 2	18.0194	18.2935	18.8678	19.4676	19.9017	20.0918	20.1280	20.1270	20.0273	19.5516	18.7126	17.9527 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	18.1686	18.4339	18.9902	19.5725	19.9959	20.1836	20.2202	20.2190	20.1189	19.6529	18.8391	18.1039 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0186	18.2839	18.8402	19.4225	19.8459	20.0336	20.0702	20.0690	19.9689	19.5029	18.6891	17.9539 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8911	0.8643	0.8006	0.6942	0.5437	0.3499	0.2198	0.2309	0.4684	0.7139	0.8471	0.9007 (94)
Useful gains	783.6120	836.1486	875.7334	852.9279	690.8237	459.5690	270.3562	269.8274	497.4631	664.0742	726.5185	746.5478 (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	1454.4936	1427.4453	1295.6095	1086.0909	777.5673	476.4615	273.2031	273.0704	538.1627	864.8342	1185.9835	1435.5156 (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	499.1359	397.3514	312.3878	167.8774	64.5373	0.0000	0.0000	0.0000	0.0000	149.3654	330.8148	512.5920 (98)
Space heating												2434.0619 (98)
Space heating per m2										(98) / (4) =		19.8036 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2686.6025 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	499.1359	397.3514	312.3878	167.8774	64.5373	0.0000	0.0000	0.0000	0.0000	149.3654	330.8148	512.5920 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	550.9226	438.5777	344.7989	185.2951	71.2332	0.0000	0.0000	0.0000	0.0000	164.8625	365.1377	565.7748 (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	178.9774	140.2542	115.0239	61.5699	33.7938	5.6155	5.0248	32.0634	63.9741	116.9635	153.6246	180.3734 (64)
Efficiency of water heater	87.5070	87.5415	87.4484	87.4572	86.6137	79.9000	79.9000	79.9000	79.9000	85.5676	86.9092	79.9000 (216)
(217)m	87.5070	87.5415	87.4484	87.4572	86.6137	79.9000	79.9000	79.9000	79.9000	85.5676	86.9092	79.9000 (217)
Fuel for water heating, kWh/month	204.5291	160.2144	131.5335	70.4001	39.0167	7.0282	6.2888	40.1294	80.0677	136.6914	176.7646	206.0274 (219)
Water heating fuel used												1258.6913 (219)
Annual totals kWh/year												
Space heating fuel - main system												2686.6025 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												87.7670 (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												212.7670 (231)
Electricity for lighting (calculated in Appendix L)												500.5042 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =										-760.9470		-760.9470 (233)
Total delivered energy for all uses												3897.6180 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2686.6025	10.2300	274.8394 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1258.6913	10.2300	128.7641 (247)
Mechanical ventilation fans	87.7670	36.7200	32.2280 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	500.5042	36.7200	183.7852 (250)
Additional standing charges			103.0000 (251)

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Energy saving/generation technologies			
PV Unit	-760.9470	36.7200	-279.4197 (252)
Total energy cost			489.0970 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2686.6025	0.2160	580.3062 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1258.6913	0.2160	271.8773 (264)
Space and water heating			852.1835 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	500.5042	0.5190	259.7617 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	0.5190	-394.9315 (269)
Total kg/year			827.4397 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2686.6025	1.2200	3277.6551 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1258.6913	1.2200	1535.6034 (264)
Space and water heating			4813.2585 (265)
Pumps and fans	212.7670	3.0700	653.1946 (267)
Energy for lighting	500.5042	3.0700	1536.5480 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			4666.8938 (272)
Primary energy kWh/m2/year			37.9700 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	94.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	412.44 (P1)
Transmission heat loss coefficient	63.71 (37)
Summer heat loss coefficient	476.15 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
East	1.000	0.90	1.000
East	1.000	1.00	0.900 (P8)
West	1.000	0.90	1.000
			0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
East	2.8700	125.2818	0.7200	0.7000	0.9000	146.7863
West	7.2600	125.2818	0.7200	0.7000	0.9000	371.3130
East	3.3300	125.2818	0.7200	0.7000	0.9000	170.3130
East	1.5700	199.1355	0.6300	0.7000	1.0000	124.0879
total:						812.5001

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	875	813	712	
	586	563	574	
Total summer gains	1460	1376	1286	(P5)

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Summer gain/loss ratio	3.07	2.89	2.70	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 94.6)	1.34	1.34	1.34	
Threshold temperature	19.80	21.53	21.34	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight			
