

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-220				Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	K End As			
Property	56, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL					
SAP Rating		88 B	DER	12.53	TER	16.20
Environmental		89 B	% DER<TER	22.67		
CO ₂ Emissions (t/year)		1.23	DFEE	44.78	TFEE	52.71
General Requirements Compliance		Pass	% DFEE<TFEE	15.03		
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

End-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) 16.20 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.53 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (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: 4.49 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC 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 North: 1.80 m², No overhang
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)
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50												4.4900	
Infiltration rate												0.2245 (18)	
Number of sides sheltered												1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2077 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													
	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5148	0.5096	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)					
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		65.3534		(33)					
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =		10956.5300	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						89.1427	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						14.6347	(36)					
Total fabric heat loss						(33) + (36) =	79.9881 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.0773	Feb 52.5420	Mar 52.0067	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	133.0654	132.5301	131.9948	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	(39)
Average = Sum(39)m / 12 =												131.7894 (39)
HLP	Jan 1.0826	Feb 1.0783	Mar 1.0739	Apr 1.0702	May 1.0702	Jun 1.0702	Jul 1.0702	Aug 1.0702	Sep 1.0702	Oct 1.0702	Nov 1.0702	Dec 1.0702 (40)
HLP (average)												1.0722 (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	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	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	27.6559	24.5637	19.9765	15.1235	11.3050	9.5442	10.3128	13.4050	17.9921	22.8451	26.6637	28.4245 (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	517.1047	514.6443	497.5865	469.9662	441.5045	414.5515	397.3791	404.1246	418.6311	446.4854	478.4181	502.7671 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8000	10.6334		0.7200		0.7000		0.7700		6.6851 (74)
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	115.5082	226.6140	376.2873	555.8535	688.9195	708.9748	673.4127	573.0460	439.7385	269.5771	144.1075	94.9551	(83)
Total gains	632.6129	741.2583	873.8738	1025.8198	1130.4240	1123.5263	1070.7918	977.1706	858.3697	716.0626	622.5256	597.7222	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.8721	22.9644	23.0576	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5248	2.5310	2.5372	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area	0.9697	0.9540	0.9207	0.8525	0.7454	0.6085	0.4819	0.5339	0.7374	0.8978	0.9564	0.9735 (86)
MIT	18.4341	18.7209	19.2247	19.8508	20.3900	20.7464	20.8994	20.8664	20.5599	19.8379	19.0240	18.3910 (87)
Th 2	20.0150	20.0186	20.0222	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house	0.9654	0.9476	0.9094	0.8308	0.7062	0.5438	0.3925	0.4442	0.6823	0.8779	0.9493	0.9698 (89)
MIT 2	16.5567	16.9737	17.7014	18.5906	19.3286	19.7842	19.9541	19.9248	19.5705	18.5907	17.4216	16.4998 (90)
Living area fraction	16.7587	17.1616	17.8653	18.7261	19.4428	19.8877	20.0558	20.0261	19.6769	18.7249	17.5940	16.7032 (92)
Temperature adjustment	-0.1500											
adjusted MIT	16.6087	17.0116	17.7153	18.5761	19.2928	19.7377	19.9058	19.8761	19.5269	18.5749	17.4440	16.5532 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9424	0.9185	0.8727	0.7901	0.6720	0.5227	0.3807	0.4292	0.6489	0.8379	0.9207	0.9488	(94)
Useful gains	596.1792	680.8631	762.6414	810.5513	759.6610	587.2285	407.6078	419.4013	557.0219	599.9598	573.1812	567.1185	(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	1637.8574	1605.1576	1480.3562	1272.8212	998.7762	675.8233	434.8497	457.2552	713.8644	1049.0331	1360.6760	1624.9691	(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	775.0086	621.1259	533.9798	332.8343	177.9017	0.0000	0.0000	0.0000	0.0000	334.1105	566.9963	787.0408	(98)
Space heating												4128.9980	(98)
Space heating per m2												(98) / (4) =	33.5937 (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													4557.3929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	775.0086	621.1259	533.9798	332.8343	177.9017	0.0000	0.0000	0.0000	0.0000	334.1105	566.9963	787.0408	(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)	855.4178	685.5694	589.3817	367.3668	196.3595	0.0000	0.0000	0.0000	0.0000	368.7754	625.8237	868.6985	(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	87.9958	87.8037	87.3707	86.4974	84.8992	79.9000	79.9000	79.9000	79.9000	86.4151	87.5422	88.0732	(217)
Fuel for water heating, kWh/month	249.8485	220.7157	232.9884	211.0223	210.7284	200.1370	192.2693	210.8976	210.4996	219.0238	228.5449	243.6413	(219)
Water heating fuel used												2630.3170	(219)
Annual totals kWh/year													
Space heating fuel - main system												4557.3929	(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)													488.4111 (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												7163.2883	(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	4557.3929	0.2160	984.3969	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2630.3170	0.2160	568.1485	(264)
Space and water heating			1552.5453	(265)
Pumps and fans	162.7670	0.5190	84.4761	(267)
Energy for lighting	488.4111	0.5190	253.4854	(268)
Energy saving/generation technologies				
PV Unit	-675.5997	0.5190	-350.6362	(269)
Total CO2, kg/year			1539.8705	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5300	(273)

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

DER			12.5300	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			27.9906	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			27.9906	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					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3497 (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	0.4458	0.4371	0.4283	0.3846	0.3759	0.3322	0.3322	0.3234	0.3497	0.3759	0.3934	0.4109 (22b)
Effective ac	0.5994	0.5955	0.5917	0.5740	0.5706	0.5552	0.5552	0.5523	0.5611	0.5706	0.5774	0.5844 (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)			15.2600	1.3258	20.2311		(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	123.7400	14.8000	108.9400	0.1800	19.6092		(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)			244.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.8782		(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)							12.0065 (36)
Total fabric heat loss						(33) + (36) =	72.8847 (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	61.8015	61.4036	61.0136	59.1816	58.8389	57.2433	57.2433	56.9478	57.8579	58.8389	59.5323	60.2572 (38)
Heat transfer coeff	134.6862	134.2883	133.8983	132.0664	131.7236	130.1280	130.1280	129.8326	130.7426	131.7236	132.4170	133.1419 (39)
Average = Sum(39)m / 12 =												132.0647 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0958	1.0926	1.0894	1.0745	1.0717	1.0587	1.0587	1.0563	1.0637	1.0717	1.0773	1.0832 (40)
HLP (average)												1.0745 (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 EMISSIONS 09 Jan 2014

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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2

(98) / (4) = 39.6034 (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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5206.0525 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	957.6187	761.3055	634.5355	345.9519	134.3001	0.0000	0.0000	0.0000	0.0000	371.9655	688.5949	973.3867	(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)	1024.1912	814.2305	678.6476	370.0021	143.6365	0.0000	0.0000	0.0000	0.0000	397.8241	736.4652	1041.0553	(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	88.2722	88.0841	87.6232	86.4655	84.0306	79.8000	79.8000	79.8000	79.8000	86.5563	87.8271	79.8000	(216)
Fuel for water heating, kWh/month	251.5381	222.2505	234.8070	213.5423	215.5034	203.0339	195.2446	213.8962	213.4095	221.1874	230.2079	245.3683	(219)
Water heating fuel used												2659.9893	(219)
Annual totals kWh/year													
Space heating fuel - main system												5206.0525	(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)												488.4111	(232)
Total delivered energy for all uses												8429.4529	(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	5206.0525	0.2160	1124.5073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2659.9893	0.2160	574.5577	(264)
Space and water heating			1699.0650	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	488.4111	0.5190	253.4854	(268)
Total CO2, kg/m2/year			1991.4754	(272)
Emissions per m2 for space and water heating			13.8237	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0624	(272b)
Emissions per m2 for pumps and fans			0.3167	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8237 * 1.00) + 2.0624 + 0.3167, rounded to 2 d.p.			16.2000	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.4900
Infiltration rate					0.3525 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3261 (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	0.4158	0.4076	0.3994	0.3587	0.3505	0.3098	0.3098	0.3016	0.3261	0.3505	0.3668	0.3831 (22b)
Effective ac	0.5864	0.5831	0.5798	0.5643	0.5614	0.5480	0.5480	0.5455	0.5532	0.5614	0.5673	0.5734 (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)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.3534		(33)
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =	10258.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.4598 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6347 (36)
Total fabric heat loss						(33) + (36) =	79.9881 (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	60.4657	60.1196	59.7805	58.1873	57.8893	56.5017	56.5017	56.2447	57.0362	57.8893	58.4923	59.1227 (38)
Heat transfer coeff	140.4538	140.1077	139.7686	138.1754	137.8774	136.4898	136.4898	136.2328	137.0243	137.8774	138.4803	139.1107 (39)
Average = Sum(39)m / 12 =												138.1740 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1427	1.1399	1.1372	1.1242	1.1218	1.1105	1.1105	1.1084	1.1148	1.1218	1.1267	1.1318 (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 content	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	27.6559	24.5637	19.9765	15.1235	11.3050	9.5442	10.3128	13.4050	17.9921	22.8451	26.6637	28.4245 (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	430.4547	428.8484	413.5643	388.3554	361.4592	336.7105	321.4118	325.7567	339.4103	364.7688	393.8833	416.9677 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8000	10.6334	0.7200	0.7000	0.7700	6.6851 (74)			
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	115.5082	226.6140	376.2873	555.8535	688.9195	708.9748	673.4127	573.0460	439.7385	269.5771	144.1075	94.9551 (83)
Total gains	545.9629	655.4625	789.8517	944.2090	1050.3787	1045.6853	994.8245	898.8027	779.1488	634.3459	537.9907	511.9227 (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	20.2875	20.3376	20.3870	20.6220	20.6666	20.8767	20.8767	20.9161	20.7953	20.6666	20.5766	20.4834
alpha	2.3525	2.3558	2.3591	2.3748	2.3778	2.3918	2.3918	2.3944	2.3864	2.3778	2.3718	2.3656
util living area	0.9749	0.9608	0.9310	0.8689	0.7704	0.6395	0.5164	0.5711	0.7694	0.9144	0.9645	0.9784 (86)
MIT	18.0648	18.3652	18.9053	19.6117	20.2281	20.6643	20.8576	20.8141	20.4338	19.6065	18.7099	18.0152 (87)
Th 2	19.9661	19.9684	19.9706	19.9811	19.9831	19.9923	19.9923	19.9940	19.9887	19.9831	19.9791	19.9749 (88)
util rest of house	0.9714	0.9553	0.9209	0.8488	0.7328	0.5746	0.4223	0.4784	0.7169	0.8971	0.9586	0.9753 (89)
MIT 2	17.2629	17.5619	18.0964	18.7915	19.3755	19.7707	19.9219	19.8961	19.5824	18.8006	17.9141	17.2193 (90)
Living area fraction	17.3491	17.6483	18.1834	18.8797	19.4672	19.8668	20.0225	19.9949	19.6740	18.8873	17.9997	17.3049 (92)
MIT	17.3491	17.6483	18.1834	18.8797	19.4672	19.8668	20.0225	19.9949	19.6740	18.8873	17.9997	17.3049 (93)
Temperature adjustment	17.3491	17.6483	18.1834	18.8797	19.4672	19.8668	20.0225	19.9949	19.6740	18.8873	17.9997	17.3049 (93)
adjusted MIT	17.3491	17.6483	18.1834	18.8797	19.4672	19.8668	20.0225	19.9949	19.6740	18.8873	17.9997	17.3049 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9586	0.9382	0.8981	0.8222	0.7107	0.5656	0.4253	0.4785	0.6976	0.8728	0.9425	0.9638 (94)
Useful gains	523.3775	614.9486	709.3281	776.3518	746.5380	591.4379	423.1210	430.0596	543.5673	553.6582	507.0621	493.4166 (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	1832.7985	1786.1388	1632.9729	1378.9482	1070.9180	718.8695	467.1417	489.7407	763.7733	1142.6256	1509.3989	1823.0386 (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	974.2092	787.0399	687.1917	433.8694	241.3387	0.0000	0.0000	0.0000	0.0000	438.1918	721.6825	989.2388 (98)
Space heating	974.2092	787.0399	687.1917	433.8694	241.3387	0.0000	0.0000	0.0000	0.0000	438.1918	721.6825	5272.7619 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 42.8994 (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	1283.0041	1010.0245	1035.3696	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7150	0.7781	0.7420	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	917.3793	785.9229	768.2224	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1319.6187	1258.6609	1151.8265	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	289.6124	351.7171	285.4015	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													926.7309 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	72.4031	87.9293	71.3504	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													231.6827 (107)
Space cooling per m2													1.8850 (108)
Energy for space heating													42.8994 (99)
Energy for space cooling													1.8850 (108)
Total													44.7844 (109)
Dwelling Fabric Energy Efficiency (DFEE)													44.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3497 (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	0.4458	0.4371	0.4283	0.3846	0.3759	0.3322	0.3322	0.3234	0.3497	0.3759	0.3934	0.4109 (22b)
Effective ac	0.5994	0.5955	0.5917	0.5740	0.5706	0.5552	0.5552	0.5523	0.5611	0.5706	0.5774	0.5844 (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)			15.2600	1.3258	20.2311		(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	123.7400	14.8000	108.9400	0.1800	19.6092		(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)			244.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8782		(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)							12.0065 (36)
Total fabric heat loss						(33) + (36) =	72.8847 (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	61.8015	61.4036	61.0136	59.1816	58.8389	57.2433	57.2433	56.9478	57.8579	58.8389	59.5323	60.2572 (38)
Heat transfer coeff	134.6862	134.2883	133.8983	132.0664	131.7236	130.1280	130.1280	129.8326	130.7426	131.7236	132.4170	133.1419 (39)
Average = Sum(39)m / 12 =												132.0647 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0958	1.0926	1.0894	1.0745	1.0717	1.0587	1.0587	1.0563	1.0637	1.0717	1.0773	1.0832 (40)
HLP (average)												1.0745 (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	27.6559	24.5637	19.9765	15.1235	11.3050	9.5442	10.3128	13.4050	17.9921	22.8451	26.6637	28.4245	(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	430.4547	428.8484	413.5643	388.3554	361.4592	336.7105	321.4118	325.7567	339.4103	364.7688	393.8833	416.9677	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.8000	10.6334	0.6300	0.7000		0.7700	5.8495 (74)		
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	103.1309	202.4392	336.3913	497.2664	616.5889	634.6565	602.7743	512.7538	393.2312	240.8857	128.6856	84.7672 (83)
Total gains	533.5856	631.2877	749.9556	885.6218	978.0481	971.3670	924.1862	838.5105	732.6414	605.6544	522.5688	501.7348 (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	63.3726	63.5604	63.7455	64.6298	64.7979	65.5924	65.5924	65.7417	65.2841	64.7979	64.4586	64.1077	
alpha	5.2248	5.2374	5.2497	5.3087	5.3199	5.3728	5.3728	5.3828	5.3523	5.3199	5.2972	5.2738	
util living area	0.9996	0.9989	0.9958	0.9801	0.9198	0.7718	0.6006	0.6750	0.9159	0.9927	0.9991	0.9997	(86)
MIT	19.6758	19.8174	20.0769	20.4344	20.7478	20.9354	20.9864	20.9757	20.8206	20.4041	19.9790	19.6578	(87)
Th 2	20.0043	20.0069	20.0095	20.0217	20.0240	20.0347	20.0347	20.0367	20.0306	20.0240	20.0194	20.0145	(88)
util rest of house	0.9994	0.9985	0.9942	0.9718	0.8857	0.6866	0.4785	0.5516	0.8654	0.9886	0.9987	0.9996	(89)
MIT 2	18.7835	18.9271	19.1880	19.5505	19.8455	20.0034	20.0310	20.0292	19.9209	19.5259	19.0988	18.7738	(90)
Living area fraction	18.8795	19.0229	19.2836	19.6456	19.9426	20.1036	20.1338	20.1310	20.0176	19.6204	19.1935	18.8689	(92)
Temperature adjustment	18.8795	19.0229	19.2836	19.6456	19.9426	20.1036	20.1338	20.1310	20.0176	19.6204	19.1935	18.8689	(93)
adjusted MIT	18.8795	19.0229	19.2836	19.6456	19.9426	20.1036	20.1338	20.1310	20.0176	19.6204	19.1935	18.8689	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9992	0.9979	0.9926	0.9676	0.8823	0.6933	0.4916	0.5646	0.8646	0.9862	0.9982	0.9994	(94)
Ext temp.	533.1560	629.9608	744.3873	856.9102	862.8835	673.4651	454.3493	473.4040	633.4456	597.2998	521.6342	501.4472	(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	1963.6547	1896.5380	1711.7012	1419.1312	1085.7432	716.1766	459.8452	484.4042	773.6874	1188.1935	1601.3796	1953.0427	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	1064.2911	851.1399	719.6816	404.7991	165.8076	0.0000	0.0000	0.0000	0.0000	439.6248	777.4167	1079.9870	(98)
												5502.7478	(98)
												44.7705	(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													

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	1223.2036	962.9475	986.7275	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8463	0.9141	0.8792	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1035.2503	880.2090	867.5664	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1232.7532	1176.0966	1081.3551	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	142.2021	220.1404	159.0588	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			521.4013 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	35.5505	55.0351	39.7647	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												130.3503 (107)
Energy for space heating												1.0605 (108)
Energy for space cooling												44.7705 (99)
Total												1.0605 (108)
Target Fabric Energy Efficiency (TFEE)												45.8311 (109)
												52.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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											4.4900		
Number of sides sheltered											0.2245 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2077 (21)
	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													
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)					
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		65.3534		(33)					
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =		10956.5300		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					89.1427		(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					14.6347		(36)					
Total fabric heat loss			(33) + (36) =		79.9881		(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	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425 (39)
Average = Sum(39)m / 12 =												131.5425 (39)
HLP	Jan 1.0702	Feb 1.0702	Mar 1.0702	Apr 1.0702	May 1.0702	Jun 1.0702	Jul 1.0702	Aug 1.0702	Sep 1.0702	Oct 1.0702	Nov 1.0702	Dec 1.0702 (40)
HLP (average)												1.0702 (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	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)
RHI water heating demand	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)
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	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	69.1396	61.4092	49.9413	37.8088	28.2625	23.8604	25.7820	33.5124	44.9803	57.1129	66.6591	71.0612 (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	747.3962	741.7743	714.1142	671.2916	627.1008	588.1069	565.8079	575.7148	600.8237	643.8803	691.5420	727.9319 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.8000	13.4839	0.7200	0.7000	0.7700	8.4772 (74)		
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	148.2558	247.6178	413.7762	612.7401	715.9695	806.8077	739.7437	658.5046	506.2529	313.6674	184.4004	115.3335 (83)
Total gains	895.6520	989.3921	1127.8904	1284.0317	1343.0703	1394.9145	1305.5516	1234.2194	1107.0766	957.5478	875.9424	843.2655 (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	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area	0.9277	0.9068	0.8543	0.7591	0.6210	0.4390	0.3187	0.3353	0.5689	0.7890	0.8960	0.9350 (86)
MIT	19.0431	19.2547	19.7194	20.2433	20.6712	20.9062	20.9712	20.9676	20.8076	20.3136	19.6016	18.9961 (87)
Th 2	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house	0.9180	0.8945	0.8350	0.7272	0.5694	0.3667	0.2298	0.2424	0.4963	0.7518	0.8797	0.9261 (89)
MIT 2	17.4396	17.7414	18.3994	19.1216	19.6821	19.9521	20.0114	20.0095	19.8558	19.2370	18.2446	17.3736 (90)
Living area fraction	17.6121	17.9041	18.5414	19.2423	19.7885	20.0547	20.1146	20.1126	19.9582	19.3528	18.3905	17.5481 (92)
MIT	17.4621	17.7541	18.3914	19.0923	19.6385	19.9047	19.9646	19.9626	19.8082	19.2028	18.2405	17.3981 (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	0.8828	0.8564	0.7945	0.6918	0.5470	0.3572	0.2240	0.2362	0.4785	0.7139	0.8401	0.8922	(94)
Useful gains	790.6600	847.2797	896.1455	888.2836	734.6111	498.3138	292.4965	291.5151	529.7784	683.5997	735.9134	752.3758	(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	1586.6762	1559.3220	1419.5233	1196.0212	860.0906	526.7881	297.8957	297.6262	593.0218	947.4796	1294.4466	1565.1081	(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	592.2360	478.4924	389.3931	221.5711	93.3568	0.0000	0.0000	0.0000	0.0000	196.3266	402.1439	604.6728	(98)
Space heating												2978.1927	(98)
RHI space heating demand												2978	(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)
												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													4.4900
Infiltration rate													0.2245 (18)
Number of sides sheltered													1 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2077 (21)
	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													
	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5148	0.5096	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)					
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		65.3534		(33)					
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =		10956.5300		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					89.1427		(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					14.6347		(36)					
Total fabric heat loss			(33) + (36) =		79.9881		(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 53.0773	Feb 52.5420	Mar 52.0067	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	133.0654	132.5301	131.9948	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	(39)
Average = Sum(39)m / 12 =												131.7894 (39)
HLP	Jan 1.0826	Feb 1.0783	Mar 1.0739	Apr 1.0702	May 1.0702	Jun 1.0702	Jul 1.0702	Aug 1.0702	Sep 1.0702	Oct 1.0702	Nov 1.0702	Dec 1.0702 (40)
HLP (average)												1.0722 (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	69.1396	61.4092	49.9413	37.8088	28.2625	23.8604	25.7820	33.5124	44.9803	57.1129	66.6591	71.0612 (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	747.3962	741.7743	714.1142	671.2916	627.1008	588.1069	565.8079	575.7148	600.8237	643.8803	691.5420	727.9319 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8000	10.6334	0.7200	0.7000	0.7700	6.6851 (74)			
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	115.5082	226.6140	376.2873	555.8535	688.9195	708.9748	673.4127	573.0460	439.7385	269.5771	144.1075	94.9551 (83)
Total gains	862.9043	968.3884	1090.4015	1227.1451	1316.0203	1297.0817	1239.2205	1148.7608	1040.5622	913.4575	835.6495	822.8870 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.8721	22.9644	23.0576	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5248	2.5310	2.5372	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area	0.9418	0.9212	0.8804	0.8036	0.6910	0.5522	0.4285	0.4723	0.6671	0.8436	0.9209	0.9475 (86)
MIT	18.7519	19.0163	19.4735	20.0297	20.4969	20.7987	20.9235	20.8997	20.6580	20.0426	19.3031	18.7080 (87)
Th 2	20.0150	20.0186	20.0222	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house	0.9342	0.9111	0.8649	0.7777	0.6492	0.4886	0.3454	0.3879	0.6083	0.8169	0.9091	0.9407 (89)
MIT 2	17.0133	17.3948	18.0493	18.8302	19.4600	19.8377	19.9724	19.9519	19.6815	18.8666	17.8177	16.9561 (90)
Living area fraction	17.2003	17.5692	18.2025	18.9592	19.5715	19.9411	20.0747	20.0539	19.7865	18.9931	17.9775	17.1445 (91)
MIT	17.2003	17.5692	18.2025	18.9592	19.5715	19.9411	20.0747	20.0539	19.7865	18.9931	17.9775	17.1445 (92)
Temperature adjustment	17.0503	17.4192	18.0525	18.8092	19.4215	19.7911	19.9247	19.9039	19.6365	18.8431	17.8275	16.9945 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9018	0.8747	0.8248	0.7390	0.6200	0.4721	0.3363	0.3767	0.5817	0.7762	0.8724	0.9100	(94)
Useful gains	778.1624	847.0706	899.4036	906.8787	815.9333	612.3004	416.7884	432.7296	605.3287	709.0042	729.0426	748.8202	(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	1696.6227	1659.1697	1524.8674	1303.4850	1015.7095	682.8448	437.3342	460.9099	728.2911	1084.3165	1411.1169	1683.0224	(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	683.3344	545.7305	465.3450	285.5566	148.6334	0.0000	0.0000	0.0000	0.0000	279.2324	491.0935	695.0464	(98)
Space heating												3593.9722	(98)
Space heating per m2												(98) / (4) =	29.2407 (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													3966.8568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	683.3344	545.7305	465.3450	285.5566	148.6334	0.0000	0.0000	0.0000	0.0000	279.2324	491.0935	695.0464	(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)	754.2322	602.3516	513.6259	315.1839	164.0546	0.0000	0.0000	0.0000	0.0000	308.2035	542.0458	767.1594	(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	87.7398	87.5283	87.0523	86.1036	84.4246	79.9000	79.9000	79.9000	79.9000	85.9500	87.2189	87.8255	(216)
(217)m	250.5775	221.4102	233.8405	211.9874	211.9132	200.1370	192.2693	210.8976	210.4996	220.2089	229.3920	244.3285	(219)
Fuel for water heating, kWh/month	250.5775	221.4102	233.8405	211.9874	211.9132	200.1370	192.2693	210.8976	210.4996	220.2089	229.3920	2637.4619	(219)
Water heating fuel used												2637.4619	(219)
Annual totals kWh/year													
Space heating fuel - main system												3966.8568	(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)													488.4111 (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												6579.8971	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3966.8568	3.4800	138.0466	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2637.4619	3.4800	91.7837	(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	488.4111	13.1900	64.4214	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-675.5997	13.1900	-89.1116	(252)
Total energy cost			346.6091	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8670 (257)
SAP value			87.9055
SAP rating (Section 12)			88 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3966.8568	0.2160	856.8411 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2637.4619	0.2160	569.6918 (264)
Space and water heating			1426.5328 (265)
Pumps and fans	162.7670	0.5190	84.4761 (267)
Energy for lighting	488.4111	0.5190	253.4854 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1413.8580 (272)
CO2 emissions per m2			11.5000 (273)
EI value			88.7168
EI rating			B9 (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	$3.48 / 0.8445 = 4.121$, stars = 4
Water heating environmental impact	$0.216 / 0.8445 = 0.2558$, 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	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											4.4900		
Infiltration rate											0.2245 (18)		
Number of sides sheltered											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2077 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.1200	1.3000	2.7560			(26)					
Window (Uw = 1.40)			11.9300	1.3258	15.8163			(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	0.1700	7.7010	75.0000	3397.5000	(28a)					
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600	(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)			244.5200					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	65.3534			(33)					
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000	(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) =	10956.5300			(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.1427	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6347	(36)					
Total fabric heat loss						(33) + (36) =	79.9881	(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	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	(39)
Average = Sum(39)m / 12 =													(39)
HLP	Jan 1.0702	Feb 1.0702	Mar 1.0702	Apr 1.0702	May 1.0702	Jun 1.0702	Jul 1.0702	Aug 1.0702	Sep 1.0702	Oct 1.0702	Nov 1.0702	Dec 1.0702	(40)
HLP (average)													(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											
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)											
Heat gains from water heating, kWh/month	1.7600 (48)											
	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 =											
	0.0000 (63)											
	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)
	Total per year (kWh/year) = Sum (64)m =											
	2232.8066 (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	69.1396	61.4092	49.9413	37.8088	28.2625	23.8604	25.7820	33.5124	44.9803	57.1129	66.6591	71.0612 (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	747.3962	741.7743	714.1142	671.2916	627.1008	588.1069	565.8079	575.7148	600.8237	643.8803	691.5420	727.9319 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8000	13.4839		0.7200		0.7000		0.7700		8.4772 (74)
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	148.2558	247.6178	413.7762	612.7401	715.9695	806.8077	739.7437	658.5046	506.2529	313.6674	184.4004	115.3335	(83)
Total gains	895.6520	989.3921	1127.8904	1284.0317	1343.0703	1394.9145	1305.5516	1234.2194	1107.0766	957.5478	875.9424	843.2655	(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	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area	0.9277	0.9068	0.8543	0.7591	0.6210	0.4390	0.3187	0.3353	0.5689	0.7890	0.8960	0.9350 (86)
MIT	19.0431	19.2547	19.7194	20.2433	20.6712	20.9062	20.9712	20.9676	20.8076	20.3136	19.6016	18.9961 (87)
Th 2	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house	0.9180	0.8945	0.8350	0.7272	0.5694	0.3667	0.2298	0.2424	0.4963	0.7518	0.8797	0.9261 (89)
MIT 2	17.4396	17.7414	18.3994	19.1216	19.6821	19.9521	20.0114	20.0095	19.8558	19.2370	18.2446	17.3736 (90)
Living area fraction	17.6121	17.9041	18.5414	19.2423	19.7885	20.0547	20.1146	20.1126	19.9582	19.3528	18.3905	17.5481 (92)
Temperature adjustment	17.4621	17.7541	18.3914	19.0923	19.6385	19.9047	19.9646	19.9626	19.8082	19.2028	18.2405	17.3981 (93)
adjusted MIT	17.4621	17.7541	18.3914	19.0923	19.6385	19.9047	19.9646	19.9626	19.8082	19.2028	18.2405	17.3981 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8828	0.8564	0.7945	0.6918	0.5470	0.3572	0.2240	0.2362	0.4785	0.7139	0.8401	0.8922 (94)
Useful gains	790.6600	847.2797	896.1455	888.2836	734.6111	498.3138	292.4965	291.5151	529.7784	683.5997	735.9134	752.3758 (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	1586.6762	1559.3220	1419.5233	1196.0212	860.0906	526.7881	297.8957	297.6262	593.0218	947.4796	1294.4466	1565.1081 (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	592.2360	478.4924	389.3931	221.5711	93.3568	0.0000	0.0000	0.0000	0.0000	196.3266	402.1439	604.6728 (98)
Space heating												2978.1927 (98)
Space heating per m2												(98) / (4) = 24.2307 (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	3287.1884	(211)

[illegible][illegible]

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)

mechanical ventilation fans (SFP = 0.2302)

central heating pump

main heating flue fan

Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

Energy saving/generation technologies (Appendices M ,N and O)

PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =

Total delivered energy for all uses

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3287.1884	10.2300	336.2794 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2649.3913	10.2300	271.0327 (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	488.4111	36.7200	179.3446 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-760.9470	36.7200	-279.4197 (252)
Total energy cost			670.0049 (253)

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	3287.3894	0.2160	710.0327 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2649.3913	0.2160	572.2685 (264)
Space and water heating			1282.3012 (265)
Pumps and fans	162.7670	0.5190	84.4761 (267)
Energy for lighting	488.4111	0.5190	253.4854 (268)

Energy saving/generation technologies

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-760.9470	0.5190	-394.9315 (269)
Total kg/year			1225.3311 (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	3287.1884	1.2200	4010.3698 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2649.3913	1.2200	3232.2573 (264)
Space and water heating			7242.6271 (265)
Pumps and fans	162.7670	3.0700	499.6946 (267)
Energy for lighting	488.4111	3.0700	1499.4221 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			6905.6365 (272)
Primary energy kWh/m2/year			56.1845 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 122	-270 kg (22.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£122 2.20 kg/m²	B 89	B 91
Total Savings	£122 2.20 kg/m²		

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

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	£239	£257	-£18
Mains gas	£710	£570	£140
Space heating	£499	£502	-£3
Water heating	£271	£146	£125
Lighting	£179	£179	£0
Generated (PV)	-£279	-£279	£0
Total cost of fuels	£670	£548	£122
Total cost of uses	£670	£548	£122
Delivered energy	47 kWh/m²	37 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.3 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	56 kWh/m ²	44 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					4.4900
Infiltration rate					0.2245 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2077 (21)

	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	0.2648	0.2596	0.2544	0.2284	0.2232	0.1973	0.1973	0.1921	0.2077	0.2232	0.2336	0.2440 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5148	0.5096	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.3534		(32)
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =	10956.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		89.1427 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.6347 (36)
Total fabric heat loss	(33) + (36) =	79.9881 (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	53.0773	52.5420	52.0067	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544	51.5544 (38)
Heat transfer coeff	133.0654	132.5301	131.9948	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425 (39)
Average = Sum(39)m / 12 =												131.7894 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0826	1.0783	1.0739	1.0702	1.0702	1.0702	1.0702	1.0702	1.0702	1.0702	1.0702	1.0702 (40)
HLP (average)												1.0722 (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												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:												
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	20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	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												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1251 (H8)
Utilisation factor												0.5889 (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												-939.0647 (H17)
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)
												Solar input (sum of months) = Sum(63)m = -939.0647 (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)
												Total per year (kWh/year) = Sum(64)m = 1124.2006 (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	69.1396	61.4092	49.9413	37.8088	28.2625	23.8604	25.7820	33.5124	44.9803	57.1129	66.6591	71.0612 (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	737.8922	732.2703	703.1094	654.2836	603.8395	564.5954	542.2964	553.2039	585.3165	632.8755	682.0380	718.4279 (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		
North				1.8000	10.6334		0.7200		0.7000	0.7700	6.6851 (74)	
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	115.5082	226.6140	376.2873	555.8535	688.9195	708.9748	673.4127	573.0460	439.7385	269.5771	144.1075	94.9551 (83)
Total gains	853.4003	958.8844	1079.3967	1210.1371	1292.7590	1273.5702	1215.7091	1126.2499	1025.0550	902.4527	826.1455	813.3830 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	22.8721	22.9644	23.0576	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5248	2.5310	2.5372	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area	0.9431	0.9227	0.8826	0.8078	0.6976	0.5594	0.4354	0.4797	0.6728	0.8467	0.9226	0.9487 (86)
MIT	18.7393	19.0046	19.4617	20.0158	20.4848	20.7925	20.9206	20.8960	20.6507	20.0322	19.2914	18.6952 (87)
Th 2	20.0150	20.0186	20.0222	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house	0.9357	0.9128	0.8673	0.7821	0.6560	0.4955	0.3513	0.3946	0.6142	0.8203	0.9110	0.9421 (89)
MIT 2	16.9954	17.3782	18.0329	18.8118	19.4453	19.8314	19.9702	19.9490	19.6735	18.8528	17.8012	16.9377 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	17.1830	17.5531	18.1866	18.9413	19.5571	19.9348	20.0724	20.0509	19.7786	18.9796	17.9615	17.1268 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0330	17.4031	18.0366	18.7913	19.4071	19.7848	19.9224	19.9009	19.6286	18.8296	17.8115	16.9768 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9035	0.8766	0.8273	0.7432	0.6262	0.4784	0.3419	0.3829	0.5871	0.7795	0.8746	0.9117 (94)
Useful gains	771.0861	840.5501	892.9375	899.3892	809.5469	609.3223	415.7048	431.2630	601.7650	703.4905	722.5703	741.5766 (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	1694.3193	1657.0423	1522.7684	1301.1254	1013.8142	682.0211	437.0431	460.5118	727.2465	1082.5479	1409.0131	1680.6876 (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	686.8856	548.6827	468.5942	289.2501	151.9749	0.0000	0.0000	0.0000	0.0000	282.0187	494.2388	698.6986 (98)
Space heating												3620.3436 (98)
Space heating per m2										(98) / (4) =		29.4552 (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												3995.9643 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	686.8856	548.6827	468.5942	289.2501	151.9749	0.0000	0.0000	0.0000	0.0000	282.0187	494.2388	698.6986 (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)	758.1518	605.6101	517.2122	319.2606	167.7427	0.0000	0.0000	0.0000	0.0000	311.2789	545.5174	771.1905 (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	88.1093	88.1940	88.2558	88.4672	88.6892	79.9000	79.9000	79.9000	79.9000	87.0992	87.7371	79.9000 (216)
Fuel for water heating, kWh/month	208.5892	159.1634	131.3662	71.7811	32.8539	15.9839	9.3171	48.7597	86.5669	138.8592	181.4736	207.5503 (219)
Water heating fuel used												1292.2646 (219)
Annual totals kWh/year												
Space heating fuel - main system												3995.9643 (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)												488.4111 (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												5313.8073 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3995.9643	3.4800	139.0596 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.2646	3.4800	44.9708 (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	488.4111	13.1900	64.4214 (250)
Additional standing charges			120.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-675.5997	13.1900	-89.1116 (252)
Total energy cost			307.4042 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7689 (257)
SAP value		89.2735
SAP rating (Section 12)		89 (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	3995.9643	0.2160	863.1283 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.2646	0.2160	279.1292 (264)
Space and water heating			1142.2574 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	488.4111	0.5190	253.4854 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1155.5326 (272)
CO2 emissions per m2			9.4000 (273)
EI value			90.7783
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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							4.4900					
Infiltration rate							0.2245	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2077 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2284	0.2129	0.2129	0.2025	0.2025	0.1921	0.1921	0.1817	0.1817	0.1973	0.1921	0.2025 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			11.9300	1.3258	15.8163		(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	0.1700	7.7010	75.0000	3397.5000 (28a)					
140mm Timber Frame	123.7400	14.8000	108.9400	0.1900	20.6986	9.0000	980.4600 (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)			244.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.3534		(33)					
Timebr Frame			59.8600	0.0000	0.0000	20.0000	1197.2000 (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) =		10956.5300 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							89.1427 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6347 (36)					
Total fabric heat loss						(33) + (36) =	79.9881 (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	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425	131.5425 (39)
Average = Sum(39)m / 12 =												131.5425 (39)
HLP	Jan 1.0702	Feb 1.0702	Mar 1.0702	Apr 1.0702	May 1.0702	Jun 1.0702	Jul 1.0702	Aug 1.0702	Sep 1.0702	Oct 1.0702	Nov 1.0702	Dec 1.0702 (40)
HLP (average)												1.0702 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8739 (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													
Primary loss	20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	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)
Solar input (sum of months) = Sum(63)m =													-976.0069 (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)
Total per year (kWh/year) = Sum(64)m =													1087.2585 (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	69.1396	61.4092	49.9413	37.8088	28.2625	23.8604	25.7820	33.5124	44.9803	57.1129	66.6591	71.0612	(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	737.8922	732.2703	703.1094	654.2836	603.8395	564.5954	542.2964	553.2039	585.3165	632.8755	682.0380	718.4279	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8000	13.4839		0.7200		0.7000		0.7700		8.4772 (74)
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	148.2558	247.6178	413.7762	612.7401	715.9695	806.8077	739.7437	658.5046	506.2529	313.6674	184.4004	115.3335	(83)
Total gains	886.1480	979.8881	1116.8856	1267.0237	1319.8090	1371.4031	1282.0401	1211.7085	1091.5694	946.5430	866.4384	833.7615	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369	23.1369
alpha	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425	2.5425
util living area												
	0.9292	0.9085	0.8567	0.7636	0.6278	0.4451	0.3240	0.3409	0.5744	0.7926	0.8980	0.9365 (86)
MIT	19.0311	19.2435	19.7086	20.2316	20.6624	20.9031	20.9700	20.9663	20.8032	20.3051	19.5908	18.9839 (87)
Th 2	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252	20.0252 (88)
util rest of house												
	0.9197	0.8964	0.8376	0.7319	0.5763	0.3722	0.2338	0.2467	0.5016	0.7557	0.8820	0.9277 (89)
MIT 2	17.4226	17.7257	18.3846	19.1066	19.6722	19.9495	20.0108	20.0089	19.8515	19.2263	18.2296	17.3561 (90)
Living area fraction									fLA = Living area / (4) =			0.1076 (91)
MIT	17.5956	17.8889	18.5270	19.2276	19.7787	20.0521	20.1140	20.1119	19.9539	19.3423	18.3760	17.5312 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4456	17.7389	18.3770	19.0776	19.6287	19.9021	19.9640	19.9619	19.8039	19.1923	18.2260	17.3812 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8847	0.8584	0.7971	0.6961	0.5532	0.3624	0.2279	0.2403	0.4835	0.7175	0.8426	0.8941 (94)
Useful gains	783.9836	841.1211	890.2897	882.0086	730.1156	497.0192	292.1912	291.1686	527.7398	679.1834	730.0544	745.5062 (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												
	1584.5099	1557.3208	1417.6401	1194.0884	858.8066	526.4431	297.8119	297.5310	592.4520	946.0974	1292.5421	1562.8826 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	595.5916	481.2862	392.3487	224.6975	95.7461	0.0000	0.0000	0.0000	0.0000	198.5840	404.9911	608.1280 (98)
Space heating												3001.3731 (98)
Space heating per m2										(98) / (4) =		24.4193 (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												3312.7738 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	595.5916	481.2862	392.3487	224.6975	95.7461	0.0000	0.0000	0.0000	0.0000	198.5840	404.9911	608.1280 (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)	657.3858	531.2210	433.0559	248.0105	105.6800	0.0000	0.0000	0.0000	0.0000	219.1876	447.0101	671.2229 (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												79.9000 (216)
(217)m	87.8806	87.9424	87.9305	88.0635	87.5417	79.9000	79.9000	79.9000	79.9000	86.3154	87.3819	87.9070 (217)
Fuel for water heating, kWh/month	203.6596	159.4841	130.8124	69.9154	38.6031	7.0282	6.2888	40.1294	80.0677	135.5071	175.8084	205.1865 (219)
Water heating fuel used												1252.4907 (219)
Annual totals kWh/year												
Space heating fuel - main system												3312.7738 (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)												488.4111 (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												4505.4956 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3312.7738	10.2300	338.8968 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1252.4907	10.2300	128.1298 (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	488.4111	36.7200	179.3446 (250)
Additional standing charges			103.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-760.9470	36.7200	-279.4197 (252)
Total energy cost			548.0794 (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	3312.7738	0.2160	715.5591 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1252.4907	0.2160	270.5380 (264)
Space and water heating			986.0971 (265)
Pumps and fans	212.7670	0.5190	110.4261 (267)
Energy for lighting	488.4111	0.5190	253.4854 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	0.5190	-394.9315 (269)
Total kg/year			955.0771 (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	3312.7738	1.2200	4041.5841 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1252.4907	1.2200	1528.0386 (264)
Space and water heating			5569.6227 (265)
Pumps and fans	212.7670	3.0700	653.1946 (267)
Energy for lighting	488.4111	3.0700	1499.4221 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			5386.1321 (272)
Primary energy kWh/m2/year			43.8218 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace 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	89.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	412.44 (P1)
Transmission heat loss coefficient	79.99 (37)
Summer heat loss coefficient	492.42 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	1.00	1.000	1.000 (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
North	1.8000	87.1704	0.7200	0.7000	0.9000	64.0556
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:						876.5557

Jun Jul Aug

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Solar gains	945	877	764	(P3)
Internal gains	585	563	573	
Total summer gains	1530	1439	1337	(P5)
Summer gain/loss ratio	3.11	2.92	2.71	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 89.1)	1.38	1.38	1.38	
Threshold temperature	19.88	21.60	21.39	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			