

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-233				Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	LTv1 Det As			
Property	62, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL					
SAP Rating	88 B	DER	12.52	TER	16.18	
Environmental	88 B	% DER<TER	22.61			
CO ₂ Emissions (t/year)	1.40	DFEE	49.23	TFEE	57.39	
General Requirements Compliance	Pass	% DFEE<TFEE	14.23			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Detached House, total floor area 142 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) 16.18 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.2 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	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.40 (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: 4.76 (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 H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.40 kWh/day
Permitted by DBSCG 2.10 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 South East: 11.10 m², No overhang
Windows facing South West: 0.60 m², No overhang
Windows facing North West: 12.32 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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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					4.7600
Infiltration rate					0.2380 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2380 (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	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (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)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				91.4500		(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		18.8551 (36)
Total fabric heat loss	(33) + (36) =	110.3051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.1039	Feb 64.4040	Mar 63.7040	Apr 60.2045	May 59.5045	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 59.5045	Nov 60.9044	Dec 62.3042 (38)
Heat transfer coeff	175.4090	174.7091	174.0092	170.5096	169.8097	169.1215	169.1215	169.1215	169.1215	169.8097	171.2095	172.6093 (39)
Average = Sum(39)m / 12 =												171.2134 (39)

HLP	Jan 1.2327	Feb 1.2278	Mar 1.2228	Apr 1.1982	May 1.1933	Jun 1.1885	Jul 1.1885	Aug 1.1885	Sep 1.1885	Oct 1.1933	Nov 1.2032	Dec 1.2130 (40)
HLP (average)												1.2032 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9213 (42)											
Average daily hot water use (litres/day)	103.5818 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content (annual)	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (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	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5386	25.3478	20.6142	15.6063	11.6659	9.8488	10.6420	13.8329	18.5664	23.5744	27.5148	29.3318 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.0122	315.2500	307.0910	289.7216	267.7959	247.1888	233.4220	230.1843	238.3432	255.7126	277.6383	298.2454 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	536.0983	533.7525	515.8912	486.7590	456.5073	427.9081	409.6858	416.3639	431.6458	461.0146	494.7754	520.7420 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.8800	36.7938		0.7200		0.7000		0.7700		75.5642 (77)
Southwest				0.6000	36.7938		0.7200		0.7000		0.7700		7.7106 (79)
Northwest				12.3200	11.2829		0.7200		0.7000		0.7700		48.5508 (81)
Southeast				5.2200	36.7938		0.7200		0.7000		0.7700		67.0825 (77)
Southeast				0.7500	39.2172		0.6300		0.7000		1.0000		11.6740 (82)
Solar gains	210.5822	376.6169	562.0012	773.1567	935.0504	958.3791	911.4782	786.2849	634.5280	428.9192	255.5136	178.0773	(83)
Total gains	746.6805	910.3694	1077.8924	1259.9157	1391.5577	1386.2871	1321.1640	1202.6488	1066.1738	889.9339	750.2890	698.8193	(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	19.7020	19.7810	19.8605	20.2682	20.3517	20.4345	20.4345	20.4345	20.4345	20.3517	20.1853	20.0216
alpha	2.3135	2.3187	2.3240	2.3512	2.3568	2.3623	2.3623	2.3623	2.3623	2.3568	2.3457	2.3348
util living area	0.9681	0.9494	0.9157	0.8490	0.7451	0.6119	0.4891	0.5407	0.7336	0.8904	0.9534	0.9724 (86)
MIT	18.0933	18.4284	18.9690	19.6746	20.2751	20.6865	20.8688	20.8290	20.4848	19.6987	18.7834	18.0539 (87)
Th 2	19.8940	19.8979	19.9018	19.9214	19.9253	19.9292	19.9292	19.9292	19.9292	19.9253	19.9175	19.9096 (88)
util rest of house	0.9634	0.9420	0.9031	0.8256	0.7034	0.5426	0.3916	0.4435	0.6746	0.8683	0.9454	0.9683 (89)
MIT 2	16.0044	16.4908	17.2710	18.2819	19.1073	19.6369	19.8396	19.8048	19.4064	18.3383	17.0208	15.9550 (90)
Living area fraction	16.1908	16.6637	17.4225	18.4062	19.2115	19.7306	19.9315	19.8962	19.5027	18.4597	17.1781	16.1423 (92)
MIT	16.1908	16.6637	17.4225	18.4062	19.2115	19.7306	19.9315	19.8962	19.5027	18.4597	17.1781	16.1423 (92)
Temperature adjustment	16.0408	16.5137	17.2725	18.2562	19.0615	19.5806	19.7815	19.7462	19.3527	18.3097	17.0281	15.9923 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9368	0.9076	0.8604	0.7792	0.6636	0.5172	0.3769	0.4250	0.6363	0.8225	0.9123	0.9443	(94)
Useful gains	699.5232	826.2210	927.3682	981.7040	923.4727	716.9741	497.8982	511.0760	678.3743	731.9503	684.4742	659.9012	(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	2059.4439	2029.0224	1874.5155	1595.3245	1250.0535	842.3186	538.0606	565.9098	888.3414	1309.1816	1699.7920	2035.4597	(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	1011.7810	808.2825	704.6776	441.8068	242.9762	0.0000	0.0000	0.0000	0.0000	429.4601	731.0288	1023.4155	(98)
Space heating												5393.4285	(98)
Space heating per m2												37.9018	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5966.1820	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1011.7810	808.2825	704.6776	441.8068	242.9762	0.0000	0.0000	0.0000	0.0000	429.4601	731.0288	1023.4155	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	1119.2267	894.1178	779.5106	488.7243	268.7789	0.0000	0.0000	0.0000	0.0000	475.0665	808.6602	1132.0968	(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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366	(64)	
Efficiency of water heater	88.3167	88.1480	87.8022	87.0421	85.6001	79.7000	79.7000	79.7000	79.7000	86.8912	87.9060	88.3772	(217)	
Fuel for water heating, kWh/month	244.1986	215.5025	226.8692	204.6633	203.5841	194.8245	186.5829	205.4634	205.3274	212.6165	222.8297	237.9987	(219)	
Water heating fuel used												2560.4609	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5966.1820	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													100.3763	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													175.3763	(231)
Electricity for lighting (calculated in Appendix L)													504.0013	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =													-795.1650	(233)
Total delivered energy for all uses													8410.8555	(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	5966.1820	0.2160	1288.6953	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2560.4609	0.2160	553.0595	(264)
Space and water heating			1841.7549	(265)
Pumps and fans	175.3763	0.5190	91.0203	(267)
Energy for lighting	504.0013	0.5190	261.5767	(268)
Energy saving/generation technologies				
PV Unit	-795.1650	0.5190	-412.6906	(269)
Total CO2, kg/year			1781.6612	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5200	(273)

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

DER			12.5200	ZC1
Total Floor Area		TFA	142.3000	
Assumed number of occupants		N	2.9213	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			12.9931	ZC2
CO2 emissions from cooking, equation (L16)			1.3290	ZC3
Total CO2 emissions			26.8421	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			26.8421	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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1122 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3622 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3622 (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	0.4618	0.4528	0.4437	0.3984	0.3894	0.3441	0.3441	0.3350	0.3622	0.3894	0.4075	0.4256 (22b)
Effective ac	0.6066	0.6025	0.5984	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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)			24.0200	1.3258	31.8447		(27)
TER Room Window (Uw = 1.70)			0.7500	1.5918	1.1938		(27a)
150mm EPS B&B			56.6000	0.1300	7.3580		(28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1800	26.0676		(29a)
W2V	31.8700		31.8700	0.1800	5.7366		(29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.1800	1.6956		(29a)
400mm Mineral Wool	6.4000		6.4000	0.1300	0.8320		(30)
Sloping	22.8900	0.7500	22.1400	0.1300	2.8782		(30)
Dormer Roof	5.1000		5.1000	0.1300	0.6630		(30)
C2V	27.5000		27.5000	0.1300	3.5750		(30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9645		(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)							14.9437 (36)
Total fabric heat loss						(33) + (36) =	98.9082 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	71.3607	70.8736	70.3962	68.1535	67.7339	65.7807	65.7807	65.4189	66.5330	67.7339	68.5828	69.4702 (38)
Average = Sum(39)m / 12 =	170.2690	169.7819	169.3044	167.0617	166.6421	164.6889	164.6889	164.3272	165.4412	166.6421	167.4910	168.3784 (39)
												167.0597 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1965	1.1931	1.1898	1.1740	1.1711	1.1573	1.1573	1.1548	1.1626	1.1711	1.1770	1.1833 (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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)

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Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	218.2124	192.2592	201.7405	180.6055	176.8126	157.7373	151.2509	166.2986	166.1081	187.2893	198.3429	212.8808 (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												
	218.2124	192.2592	201.7405	180.6055	176.8126	157.7373	151.2509	166.2986	166.1081	187.2893	198.3429	212.8808 (64)
Heat gains from water heating, kWh/month												
	95.5766	84.7193	90.0997	82.3297	81.8111	74.7260	73.3119	78.3152	77.5093	85.2946	88.2273	93.8038 (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	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	28.5386	25.3478	20.6142	15.6063	11.6659	9.8488	10.6420	13.8329	18.5664	23.5744	27.5148	29.3318 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	312.0122	315.2500	307.0910	289.7216	267.7959	247.1888	233.4220	230.1843	238.3432	255.7126	277.6383	298.2454 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067 (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)												
	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)												
	128.4631	126.0704	121.1017	114.3467	109.9612	103.7861	98.5375	105.2624	107.6518	114.6433	122.5380	126.0804 (72)
Total internal gains												
	538.8341	536.4882	518.6270	489.4947	459.2431	430.6438	412.4215	419.0996	434.3815	463.7504	497.5112	523.4778 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
Southeast				11.1000	36.7938		0.6300		0.7000		0.7700		124.8159 (77)
Southwest				0.6000	36.7938		0.6300		0.7000		0.7700		6.7468 (79)
Northwest				12.3200	11.2829		0.6300		0.7000		0.7700		42.4820 (81)
Southeast				0.7500	39.2172		0.6300		0.7000		1.0000		11.6740 (82)

Solar gains	185.7186	332.2493	495.9411	682.3303	825.1254	845.6457	804.2908	693.8967	559.9781	378.4399	225.3657	157.0368 (83)	
Total gains	724.5527	868.7375	1014.5681	1171.8250	1284.3685	1276.2895	1216.7123	1112.9963	994.3596	842.1903	722.8769	680.5146 (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	58.0373	58.2038	58.3679	59.1515	59.3004	60.0037	60.0037	60.1358	59.7308	59.3004	58.9999	58.6889
alpha	4.8692	4.8803	4.8912	4.9434	4.9534	5.0002	5.0002	5.0091	4.9821	4.9534	4.9333	4.9126
util living area	0.9990	0.9975	0.9922	0.9705	0.8997	0.7449	0.5767	0.6444	0.8847	0.9854	0.9978	0.9993 (86)
MIT	19.6128	19.7774	20.0510	20.4190	20.7408	20.9319	20.9849	20.9745	20.8276	20.4062	19.9447	19.5904 (87)
Th 2	19.9228	19.9255	19.9282	19.9408	19.9432	19.9543	19.9543	19.9563	19.9500	19.9432	19.9384	19.9334 (88)
util rest of house	0.9987	0.9966	0.9892	0.9585	0.8587	0.6532	0.4492	0.5150	0.8214	0.9775	0.9969	0.9991 (89)
MIT 2	18.0666	18.3091	18.7095	19.2466	19.6825	19.9078	19.9486	19.9455	19.8043	19.2367	18.5632	18.0413 (90)
Living area fraction												
	fLA = Living area / (4) =											0.0892 (91)
MIT	18.2046	18.4401	18.8293	19.3512	19.7769	19.9992	20.0411	20.0373	19.8956	19.3411	18.6865	18.1795 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2046	18.4401	18.8293	19.3512	19.7769	19.9992	20.0411	20.0373	19.8956	19.3411	18.6865	18.1795 (93)

8. Space heating requirement

Utilisation	0.9978	0.9946	0.9847	0.9495	0.8509	0.6575	0.4603	0.5257	0.8173	0.9709	0.9952	0.9984 (94)
Useful gains	722.9752	864.0424	999.0472	1112.6181	1092.8628	839.2104	560.0069	585.1176	812.7174	817.7047	719.3925	679.4248 (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	2367.5263	2298.8713	2087.3985	1746.0014	1345.9569	889.1901	566.7108	597.7087	958.8357	1456.6323	1940.6362	2353.8506 (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	1223.5461	964.2050	809.7333	456.0360	188.3020	0.0000	0.0000	0.0000	0.0000	475.3622	879.2954	1245.7727 (98)
Space heating												6242.2527 (98)

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Space heating per m2

(98) / (4) = 43.8668 (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													6676.2061 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1223.5461	964.2050	809.7333	456.0360	188.3020	0.0000	0.0000	0.0000	0.0000	475.3622	879.2954	1245.7727	(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)	1308.6054	1031.2353	866.0249	487.7390	201.3925	0.0000	0.0000	0.0000	0.0000	508.4087	940.4229	1332.3773	(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	218.2124	192.2592	201.7405	180.6055	176.8126	157.7373	151.2509	166.2986	166.1081	187.2893	198.3429	212.8808	(64)
Efficiency of water heater (217)m	88.6999	88.5266	88.1427	87.1837	84.9819	79.8000	79.8000	79.8000	79.8000	87.1955	88.3204	79.8000	(216)
Fuel for water heating, kWh/month	246.0119	217.1768	228.8792	207.1550	208.0591	197.6658	189.5374	208.3942	208.1555	214.7923	224.5721	239.8306	(219)
Water heating fuel used												2590.2301	(219)
Annual totals kWh/year													
Space heating fuel - main system												6676.2061	(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)												504.0013	(232)
Total delivered energy for all uses												9845.4376	(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	6676.2061	0.2160	1442.0605 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2590.2301	0.2160	559.4897 (264)
Space and water heating			2001.5502 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Total CO2, kg/m2/year			2302.0519 (272)
Emissions per m2 for space and water heating			14.0657 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8382 (272b)
Emissions per m2 for pumps and fans			0.2735 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0657 * 1.00) + 1.8382 + 0.2735, rounded to 2 d.p.			16.1800 (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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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											4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.1122 (8)	
Pressure test										Yes		
Measured/design AP50											4.7600	
Infiltration rate											0.3502 (18)	
Number of sides sheltered											0 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
Effective ac	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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)			18.8000	1.3258	24.9242			(27)					
French Door (Uw = 1.40)			5.2200	1.3258	6.9205			(27)					
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593			(27a)					
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000	(28a)					
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800	(29a)					
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600	(29a)					
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600	(29a)					
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000	(30)					
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600	(30)					
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000	(30)					
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000	(30)					
Total net area of external elements Aum(A, m2)			330.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.4500			(33)					
Timber GF			105.9000			9.0000	953.1000	(32c)					
Timber FF			146.5800			9.0000	1319.2200	(32c)					
Timber 2F			26.8800			9.0000	241.9200	(32c)					
Internal Floor			56.6000			18.0000	1018.8000	(32d)					
Internal Floor 2			29.1000			18.0000	523.8000	(32d)					
Internal Ceiling			56.6000			9.0000	509.4000	(32e)					
Internal Ceiling 2			29.1000			9.0000	261.9000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11670.0000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							82.0098	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8551	(36)					
Total fabric heat loss						(33) + (36) =	110.3051	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 70.5433	Feb 70.0880	Mar 69.6416	Apr 67.5451	May 67.1528	Jun 65.3269	Jul 65.3269	Aug 64.9887	Sep 66.0302	Oct 67.1528	Nov 67.9464	Dec 68.7760	(38)
Heat transfer coeff	180.8485	180.3931	179.9467	177.8502	177.4580	175.6320	175.6320	175.2938	176.3353	177.4580	178.2515	179.0811	(39)
Average = Sum(39)m / 12 =												177.8483	(39)
HLP	Jan 1.2709	Feb 1.2677	Mar 1.2646	Apr 1.2498	May 1.2471	Jun 1.2342	Jul 1.2342	Aug 1.2319	Sep 1.2392	Oct 1.2471	Nov 1.2526	Dec 1.2585	(40)
HLP (average)												1.2498	(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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content (annual)	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (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	35.9061	31.4037	32.4058	28.2521	27.1086	23.3927	21.6767	24.8744	25.1715	29.3349	32.0213	34.7731 (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	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5386	25.3478	20.6142	15.6063	11.6659	9.8488	10.6420	13.8329	18.5664	23.5744	27.5148	29.3318 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.0122	315.2500	307.0910	289.7216	267.7959	247.1888	233.4220	230.1843	238.3432	255.7126	277.6383	298.2454 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	48.2608	46.7317	43.5562	39.2391	36.4363	32.4898	29.1354	33.4333	34.9604	39.4286	44.4741	46.7380 (72)
Total internal gains	455.6318	454.1495	438.0815	411.3871	382.7182	356.3475	340.0195	344.2706	358.6901	385.5357	416.4473	441.1354 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	5.8800	36.7938	0.7200	0.7000	0.7700	75.5642 (77)
Southwest	0.6000	36.7938	0.7200	0.7000	0.7700	7.7106 (79)
Northwest	12.3200	11.2829	0.7200	0.7000	0.7700	48.5508 (81)
Southeast	5.2200	36.7938	0.7200	0.7000	0.7700	67.0825 (77)
Southeast	0.7500	39.2172	0.6300	0.7000	1.0000	11.6740 (82)

Solar gains	210.5822	376.6169	562.0012	773.1567	935.0504	958.3791	911.4782	786.2849	634.5280	428.9192	255.5136	178.0773 (83)
Total gains	666.2140	830.7664	1000.0826	1184.5438	1317.7686	1314.7266	1251.4977	1130.5555	993.2182	814.4549	671.9608	619.2127 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	17.9248	17.9700	18.0146	18.2269	18.2672	18.4572	18.4572	18.4928	18.3835	18.2672	18.1859	18.1017
alpha	2.1950	2.1980	2.2010	2.2151	2.2178	2.2305	2.2305	2.2329	2.2256	2.2178	2.2124	2.2068
util living area	0.9715	0.9536	0.9216	0.8596	0.7626	0.6349	0.5154	0.5685	0.7566	0.9019	0.9587	0.9756 (86)
MIT	17.8092	18.1564	18.7255	19.4635	20.1243	20.6055	20.8258	20.7768	20.3669	19.4927	18.5178	17.7518 (87)
Th 2	19.8637	19.8662	19.8687	19.8803	19.8825	19.8927	19.8927	19.8946	19.8888	19.8825	19.8781	19.8735 (88)
util rest of house	0.9674	0.9469	0.9099	0.8374	0.7220	0.5651	0.4137	0.4685	0.6994	0.8817	0.9517	0.9720 (89)
MIT 2	16.9455	17.2905	17.8528	18.5781	19.2033	19.6384	19.8101	19.7815	19.4450	18.6220	17.6602	16.8948 (90)
Living area fraction	17.0226	17.3678	17.9307	18.6571	19.2855	19.7247	19.9007	19.8703	19.5273	18.6997	17.7367	16.9713 (91)
MIT	17.0226	17.3678	17.9307	18.6571	19.2855	19.7247	19.9007	19.8703	19.5273	18.6997	17.7367	16.9713 (92)
Temperature adjustment	17.0226	17.3678	17.9307	18.6571	19.2855	19.7247	19.9007	19.8703	19.5273	18.6997	17.7367	16.9713 (93)
adjusted MIT	17.0226	17.3678	17.9307	18.6571	19.2855	19.7247	19.9007	19.8703	19.5273	18.6997	17.7367	16.9713 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9523	0.9263	0.8833	0.8073	0.6965	0.5532	0.4145	0.4661	0.6771	0.8535	0.9325	0.9586 (94)
Useful gains	634.4452	769.5458	883.3994	956.3039	917.8636	727.3622	518.7206	526.9273	672.4835	695.1370	626.6275	593.5605 (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	2300.8546	2249.1076	2056.9098	1735.2993	1346.1007	900.0607	579.7163	608.3302	957.0201	1437.3555	1896.0146	2287.0984 (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	1239.8086	994.2655	873.0917	560.8767	318.6084	0.0000	0.0000	0.0000	0.0000	552.2106	913.9587	1259.9922 (98)
Space heating												6712.8124 (98)
Space heating per m ²												47.1737 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1650.9406	1299.6767	1332.2331	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6904	0.7536	0.7163	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1139.7606	979.4302	954.2419	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1650.5688	1574.2585	1436.5193	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	367.7819	442.5523	358.8144	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													1169.1486 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	91.9455	110.6381	89.7036	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													292.2871 (107)
Space cooling per m2													2.0540 (108)
Energy for space heating													47.1737 (99)
Energy for space cooling													2.0540 (108)
Total													49.2277 (109)
Dwelling Fabric Energy Efficiency (DFEE)													49.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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) = 0.1122 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3622 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3622 (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	0.4618	0.4528	0.4437	0.3984	0.3894	0.3441	0.3441	0.3350	0.3622	0.3894	0.4075	0.4256 (22b)
Effective ac	0.6066	0.6025	0.5984	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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)			24.0200	1.3258	31.8447		(27)
TER Room Window (Uw = 1.70)			0.7500	1.5918	1.1938		(27a)
150mm EPS B&B			56.6000	0.1300	7.3580		(28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1800	26.0676		(29a)
W2V	31.8700		31.8700	0.1800	5.7366		(29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.1800	1.6956		(29a)
400mm Mineral Wool	6.4000		6.4000	0.1300	0.8320		(30)
Sloping	22.8900	0.7500	22.1400	0.1300	2.8782		(30)
Dormer Roof	5.1000		5.1000	0.1300	0.6630		(30)
C2V	27.5000		27.5000	0.1300	3.5750		(30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.9645		(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)							14.9437 (36)
Total fabric heat loss						(33) + (36) =	98.9082 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	71.3607	70.8736	70.3962	68.1535	67.7339	65.7807	65.7807	65.4189	66.5330	67.7339	68.5828	69.4702 (38)
Average = Sum(39)m / 12 =	170.2690	169.7819	169.3044	167.0617	166.6421	164.6889	164.6889	164.3272	165.4412	166.6421	167.4910	168.3784 (39)
												167.0597 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1965	1.1931	1.1898	1.1740	1.1711	1.1573	1.1573	1.1548	1.1626	1.1711	1.1770	1.1833 (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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy conte	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (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 = 1629.7453 (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	35.9061	31.4037	32.4058	28.2521	27.1086	23.3927	21.6767	24.8744	25.1715	29.3349	32.0213	34.7731 (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	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5386	25.3478	20.6142	15.6063	11.6659	9.8488	10.6420	13.8329	18.5664	23.5744	27.5148	29.3318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.0122	315.2500	307.0910	289.7216	267.7959	247.1888	233.4220	230.1843	238.3432	255.7126	277.6383	298.2454	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	(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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	(71)
Water heating gains (Table 5)	48.2608	46.7317	43.5562	39.2391	36.4363	32.4898	29.1354	33.4333	34.9604	39.4286	44.4741	46.7380	(72)
Total internal gains	455.6318	454.1495	438.0815	411.3871	382.7182	356.3475	340.0195	344.2706	358.6901	385.5357	416.4473	441.1354	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Southeast					11.1000	36.7938	0.6300	0.7000	0.7700		124.8159 (77)	
Southwest					0.6000	36.7938	0.6300	0.7000	0.7700		6.7468 (79)	
Northwest					12.3200	11.2829	0.6300	0.7000	0.7700		42.4820 (81)	
Southeast					0.7500	39.2172	0.6300	0.7000	1.0000		11.6740 (82)	
Solar gains	185.7186	332.2493	495.9411	682.3303	825.1254	845.6457	804.2908	693.8967	559.9781	378.4399	225.3657	157.0368 (83)
Total gains	641.3505	786.3988	934.0225	1093.7174	1207.8436	1201.9932	1144.3103	1038.1672	918.6682	763.9756	641.8130	598.1722 (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	58.0373	58.2038	58.3679	59.1515	59.3004	60.0037	60.0037	60.1358	59.7308	59.3004	58.9999	58.6889	
alpha	4.8692	4.8803	4.8912	4.9434	4.9534	5.0002	5.0002	5.0091	4.9821	4.9534	4.9333	4.9126	
util living area	0.9995	0.9984	0.9945	0.9774	0.9170	0.7743	0.6080	0.6807	0.9090	0.9903	0.9987	0.9996	(86)
MIT	19.5586	19.7241	20.0001	20.3741	20.7093	20.9187	20.9809	20.9675	20.7982	20.3580	19.8920	19.5366	(87)
Th 2	19.9228	19.9255	19.9282	19.9408	19.9432	19.9543	19.9543	19.9563	19.9500	19.9432	19.9384	19.9334	(88)
util rest of house	0.9993	0.9978	0.9924	0.9678	0.8807	0.6844	0.4761	0.5486	0.8538	0.9848	0.9982	0.9995	(89)
MIT 2	18.6013	18.7688	19.0459	19.4244	19.7395	19.9153	19.9493	19.9466	19.8292	19.4142	18.9469	18.5877	(90)
Living area fraction	18.6868	18.8540	19.1310	19.5091	19.8260	20.0049	20.0414	20.0377	19.9157	19.4984	19.0313	18.6724	(91)
MIT	18.6868	18.8540	19.1310	19.5091	19.8260	20.0049	20.0414	20.0377	19.9157	19.4984	19.0313	18.6724	(92)
Temperature adjustment	18.6868	18.8540	19.1310	19.5091	19.8260	20.0049	20.0414	20.0377	19.9157	19.4984	19.0313	18.6724	(93)
adjusted MIT	18.6868	18.8540	19.1310	19.5091	19.8260	20.0049	20.0414	20.0377	19.9157	19.4984	19.0313	18.6724	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	640.6561	783.9792	924.8021	1052.8878	1057.8193	828.5334	558.1019	581.1991	782.2316	749.8362	640.2052	597.7173	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2449.6184	2369.1443	2138.4892	1772.3809	1354.1377	890.1210	566.7531	597.7686	962.1517	1482.8562	1998.3831	2436.8419	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1345.8679	1065.2309	902.9832	518.0351	220.4609	0.0000	0.0000	0.0000	0.0000	545.3669	977.8881	1368.3087	(98)
Space heating												6944.1417	(98)
Space heating per m2												48.7993	(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	1548.0754	1218.6977	1248.8864	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8253	0.8965	0.8582	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1277.6048	1092.5135	1071.8566	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1518.8026	1448.9745	1328.5331	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	173.6624	265.2070	190.9673	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			629.8367 (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	43.4156	66.3017	47.7418	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												157.4592 (107)
Energy for space heating												1.1065 (108)
Energy for space cooling												48.7993 (99)
Total												1.1065 (108)
Target Fabric Energy Efficiency (TFEE)												49.9058 (109)
												57.4 (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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2380 (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												
	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	91.4500	(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8551 (36)
Total fabric heat loss					(33) + (36) =		110.3051 (37)

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

(38)m	Jan 60.2045	Feb 58.8164	Mar 58.8164	Apr 58.8164	May 58.8164	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 58.8164	Nov 58.8164	Dec 58.8164 (38)
Heat transfer coeff	170.5096	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.2372 (39)
HLP	Jan 1.1982	Feb 1.1885	Mar 1.1885	Apr 1.1885	May 1.1885	Jun 1.1885	Jul 1.1885	Aug 1.1885	Sep 1.1885	Oct 1.1885	Nov 1.1885	Dec 1.1885 (40)
HLP (average)												1.1893 (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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												180.0000 (47)
Store volume												1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7560 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Total per year (kWh/year) = Sum(64)m =												2179.5813 (64)
RHI water heating demand												2180 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (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	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	779.6400	774.1025	745.1224	699.9232	652.9616	611.4871	587.6739	597.5436	623.9444	669.3803	719.8509	758.6928 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.8800	45.1778		0.7200		0.7000		0.7700		92.7826 (77)
Southwest				0.6000	45.1778		0.7200		0.7000		0.7700		9.4676 (79)
Northwest				12.3200	14.6176		0.7200		0.7000		0.7700		62.9002 (81)
Southeast				5.2200	45.1778		0.7200		0.7000		0.7700		82.3682 (77)
Southeast				0.7500	49.4580		0.6300		0.7000		1.0000		14.7224 (82)
Solar gains	262.2410	400.5511	606.2053	844.3955	968.9959	1089.9219	999.7150	897.9182	719.4710	486.9821	317.4472	209.7514	(83)
Total gains	1041.8810	1174.6537	1351.3277	1544.3187	1621.9576	1701.4090	1587.3889	1495.4618	1343.4154	1156.3624	1037.2980	968.4442	(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	20.2682	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3512	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9298	0.9069	0.8556	0.7648	0.6320	0.4510	0.3317	0.3495	0.5800	0.7918	0.8972	0.9378 (86)
MIT	18.7438	19.0072	19.5138	20.0906	20.5836	20.8726	20.9577	20.9526	20.7525	20.1880	19.3929	18.7063 (87)
Th 2	19.9214	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9199	0.8941	0.8354	0.7314	0.5770	0.3715	0.2314	0.2448	0.5017	0.7527	0.8803	0.9289 (89)
MIT 2	16.9561	17.3361	18.0540	18.8512	19.4997	19.8325	19.9102	19.9077	19.7156	19.0063	17.8962	16.9078 (90)
Living area fraction												fLA = Living area / (4) = 0.0892 (91)
MIT	17.1157	17.4852	18.1843	18.9618	19.5965	19.9253	20.0037	20.0009	19.8081	19.1117	18.0298	17.0683 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9657	17.3352	18.0343	18.8118	19.4465	19.7753	19.8537	19.8509	19.6581	18.9617	17.8798	16.9183 (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	0.8807	0.8513	0.7895	0.6900	0.5493	0.3593	0.2240	0.2367	0.4795	0.7089	0.8358	0.8917	(94)
Useful gains	917.6006	999.9546	1066.8552	1065.5373	890.9097	611.3015	355.5021	353.9256	644.1416	819.7296	866.9916	863.5880	(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													
	1972.0594	1933.9397	1764.6686	1490.2734	1073.3214	655.4048	364.2326	363.7706	737.0483	1177.3816	1603.2369	1931.0877	(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													
	784.5173	627.6379	519.1732	305.8100	135.7143	0.0000	0.0000	0.0000	0.0000	266.0931	530.0966	794.2198	(98)
Space heating												3963.2621	(98)
RHI space heating demand												3963	(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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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							4.7600					
Infiltration rate							0.2380	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2380 (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	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (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)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				91.4500		(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8551 (36)
Total fabric heat loss	(33) + (36) =						110.3051 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	65.1039	64.4040	63.7040	60.2045	59.5045	58.8164	58.8164	58.8164	58.8164	59.5045	60.9044	62.3042 (38)
Average = Sum(39)m / 12 =	175.4090	174.7091	174.0092	170.5096	169.8097	169.1215	169.1215	169.1215	169.1215	169.8097	171.2095	172.6093 (39)
												171.2134 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2327	1.2278	1.2228	1.1982	1.1933	1.1885	1.1885	1.1885	1.1885	1.1933	1.2032	1.2130 (40)
Days in month												1.2032 (40)
	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	2.9213 (42)											
Average daily hot water use (litres/day)	103.5818 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content (annual)	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1629.7453 (45)											
	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (65)
	Total per year (kWh/year) = Sum(64)m = 2179.5813 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	779.6400	774.1025	745.1224	699.9232	652.9616	611.4871	587.6739	597.5436	623.9444	669.3803	719.8509	758.6928 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			5.8800		36.7938		0.7200		0.7000		0.7700		75.5642 (77)
Southwest			0.6000		36.7938		0.7200		0.7000		0.7700		7.7106 (79)
Northwest			12.3200		11.2829		0.7200		0.7000		0.7700		48.5508 (81)
Southeast			5.2200		36.7938		0.7200		0.7000		0.7700		67.0825 (77)
Southeast			0.7500		39.2172		0.6300		0.7000		1.0000		11.6740 (82)
Solar gains	210.5822	376.6169	562.0012	773.1567	935.0504	958.3791	911.4782	786.2849	634.5280	428.9192	255.5136	178.0773	(83)
Total gains	990.2222	1150.7195	1307.1235	1473.0799	1588.0121	1569.8661	1499.1521	1383.8285	1258.4725	1098.2995	975.3644	936.7701	(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	19.7020	19.7810	19.8605	20.2682	20.3517	20.4345	20.4345	20.4345	20.4345	20.3517	20.1853	20.0216
alpha	2.3135	2.3187	2.3240	2.3512	2.3568	2.3623	2.3623	2.3623	2.3623	2.3568	2.3457	2.3348
util living area	0.9446	0.9216	0.8823	0.8086	0.7001	0.5648	0.4436	0.4884	0.6756	0.8451	0.9233	0.9505 (86)
MIT	18.3733	18.6874	19.1888	19.8366	20.3753	20.7380	20.8940	20.8633	20.5760	19.8802	19.0301	18.3337 (87)
Th 2	19.8940	19.8979	19.9018	19.9214	19.9253	19.9292	19.9292	19.9292	19.9292	19.9253	19.9175	19.9096 (88)
util rest of house	0.9370	0.9110	0.8660	0.7814	0.6559	0.4961	0.3515	0.3956	0.6131	0.8171	0.9112	0.9436 (89)
MIT 2	16.4066	16.8594	17.5779	18.4987	19.2301	19.6892	19.8584	19.8322	19.5091	18.5822	17.3708	16.3578 (90)
Living area fraction	16.5821	17.0225	17.7217	18.6181	19.3323	19.7828	19.9508	19.9242	19.6043	18.6981	17.5189	16.5341 (92)
Temperature adjustment	16.4321	16.8725	17.5717	18.4681	19.1823	19.6328	19.8008	19.7742	19.4543	18.5481	17.3689	16.3841 (93)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9011	0.8695	0.8199	0.7365	0.6207	0.4752	0.3396	0.3809	0.5810	0.7705	0.8701	0.9100	(94)
Useful gains	892.2657	1000.5544	1071.6593	1084.9654	985.6309	745.9547	509.0997	527.0644	731.1703	846.2590	848.6973	852.4616	(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	2128.0859	2091.7119	1926.5763	1631.4535	1270.5639	851.1478	541.3270	570.6499	905.5336	1349.6594	1758.1255	2103.0953	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	919.4503	733.2578	636.0582	393.4715	211.9902	0.0000	0.0000	0.0000	0.0000	374.5299	654.7884	930.4714	(98)
Space heating												4854.0176	(98)
Space heating per m2												(98) / (4) =	34.1112 (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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5369.4885 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	919.4503	733.2578	636.0582	393.4715	211.9902	0.0000	0.0000	0.0000	0.0000	374.5299	654.7884	930.4714	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1017.0910	811.1259	703.6042	435.2560	234.5024	0.0000	0.0000	0.0000	0.0000	414.3030	724.3234	1029.2825	(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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366	(64)
Efficiency of water heater	88.1515	87.9699	87.5954	86.7696	85.2371	79.7000	79.7000	79.7000	79.7000	86.5612	87.6892	88.2164	(217)
Fuel for water heating, kWh/month	244.6563	215.9388	227.4048	205.3062	204.4513	194.8245	186.5829	205.4634	205.3274	213.4271	223.3807	238.4325	(219)
Water heating fuel used												2565.1959	(219)
Annual totals kWh/year													
Space heating fuel - main system												5369.4885	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													100.3763 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													175.3763 (231)
Electricity for lighting (calculated in Appendix L)													504.0013 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =										-795.1650		-795.1650	(233)
Total delivered energy for all uses												7818.8970	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5369.4885	3.4800	186.8582	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2565.1959	3.4800	89.2688	(247)
Mechanical ventilation fans	100.3763	13.1900	13.2396	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	504.0013	13.1900	66.4778	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-795.1650	13.1900	-104.8823	(252)
Total energy cost			380.8547	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8540 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.0863
SAP rating (Section 12)		88 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5369.4885	0.2160	1159.8095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2565.1959	0.2160	554.0823 (264)
Space and water heating			1713.8918 (265)
Pumps and fans	175.3763	0.5190	91.0203 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1653.7982 (272)
CO2 emissions per m2			11.6200 (273)
EI value			88.1682
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8475 = 4.106$, stars = 4
Water heating environmental impact	$0.216 / 0.8475 = 0.2549$, 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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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							4.7600					
Infiltration rate							0.2380	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2380 (21)				
Wind speed	Jan 4.4000	Feb 4.1000	Mar 4.1000	Apr 3.9000	May 3.9000	Jun 3.7000	Jul 3.7000	Aug 3.5000	Sep 3.5000	Oct 3.8000	Nov 3.7000	Dec 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	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	91.4500	(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8551 (36)
Total fabric heat loss					(33) + (36) =		110.3051 (37)

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

(38)m	Jan 60.2045	Feb 58.8164	Mar 58.8164	Apr 58.8164	May 58.8164	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 58.8164	Nov 58.8164	Dec 58.8164 (38)
Heat transfer coeff	170.5096	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.2372 (39)
HLP	Jan 1.1982	Feb 1.1885	Mar 1.1885	Apr 1.1885	May 1.1885	Jun 1.1885	Jul 1.1885	Aug 1.1885	Sep 1.1885	Oct 1.1885	Nov 1.1885	Dec 1.1885 (40)
HLP (average)												1.1893 (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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content (annual)	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1629.7453 (45)
	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												180.0000 (47)
Store volume												1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7560 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (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	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	779.6400	774.1025	745.1224	699.9232	652.9616	611.4871	587.6739	597.5436	623.9444	669.3803	719.8509	758.6928 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
Southeast				5.8800	45.1778		0.7200		0.7000		0.7700		92.7826 (77)
Southwest				0.6000	45.1778		0.7200		0.7000		0.7700		9.4676 (79)
Northwest				12.3200	14.6176		0.7200		0.7000		0.7700		62.9002 (81)
Southeast				5.2200	45.1778		0.7200		0.7000		0.7700		82.3682 (77)
Southeast				0.7500	49.4580		0.6300		0.7000		1.0000		14.7224 (82)
Solar gains	262.2410	400.5511	606.2053	844.3955	968.9959	1089.9219	999.7150	897.9182	719.4710	486.9821	317.4472	209.7514	(83)
Total gains	1041.8810	1174.6537	1351.3277	1544.3187	1621.9576	1701.4090	1587.3889	1495.4618	1343.4154	1156.3624	1037.2980	968.4442	(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	20.2682	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3512	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9298	0.9069	0.8556	0.7648	0.6320	0.4510	0.3317	0.3495	0.5800	0.7918	0.8972	0.9378 (86)
MIT	18.7438	19.0072	19.5138	20.0906	20.5836	20.8726	20.9577	20.9526	20.7525	20.1880	19.3929	18.7063 (87)
Th 2	19.9214	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9199	0.8941	0.8354	0.7314	0.5770	0.3715	0.2314	0.2448	0.5017	0.7527	0.8803	0.9289 (89)
MIT 2	16.9561	17.3361	18.0540	18.8512	19.4997	19.8325	19.9102	19.9077	19.7156	19.0063	17.8962	16.9078 (90)
Living area fraction	17.1157	17.4852	18.1843	18.9618	19.5965	19.9253	20.0037	20.0009	19.8081	19.1117	18.0298	17.0683 (92)
MIT	17.1157	17.4852	18.1843	18.9618	19.5965	19.9253	20.0037	20.0009	19.8081	19.1117	18.0298	17.0683 (92)
Temperature adjustment	16.9657	17.3352	18.0343	18.8118	19.4465	19.7753	19.8537	19.8509	19.6581	18.9617	17.8798	16.9183 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8807	0.8513	0.7895	0.6900	0.5493	0.3593	0.2240	0.2367	0.4795	0.7089	0.8358	0.8917	(94)
Useful gains	917.6006	999.9546	1066.8552	1065.5373	890.9097	611.3015	355.5021	353.9256	644.1416	819.7296	866.9916	863.5880	(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	1972.0594	1933.9397	1764.6686	1490.2734	1073.3214	655.4048	364.2326	363.7706	737.0483	1177.3816	1603.2369	1931.0877	(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	784.5173	627.6379	519.1732	305.8100	135.7143	0.0000	0.0000	0.0000	0.0000	266.0931	530.0966	794.2198	(98)
Space heating												3963.2621	(98)
Space heating per m2												27.8515	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4384.1395	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	784.5173	627.6379	519.1732	305.8100	135.7143	0.0000	0.0000	0.0000	0.0000	266.0931	530.0966	794.2198	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	867.8289	694.2898	574.3066	338.2854	150.1264	0.0000	0.0000	0.0000	0.0000	294.3507	586.3901	878.5617	(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	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366	(64)	
Efficiency of water heater	87.8567	87.6655	87.1555	86.1429	84.0558	79.7000	79.7000	79.7000	79.7000	85.6860	87.2398	87.9283	(217)	
Fuel for water heating, kWh/month	245.4773	216.6887	228.5527	206.7996	207.3245	194.8245	186.5829	205.4634	205.3274	215.6070	224.5312	239.2137	(219)	
Water heating fuel used												2576.3929	(219)	
Annual totals kWh/year												4384.1395	(211)	
Space heating fuel - main system												0.0000	(215)	
Space heating fuel - secondary														
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													100.3763	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													175.3763	(231)
Electricity for lighting (calculated in Appendix L)													504.0013	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =													-882.9989	(233)
Total delivered energy for all uses													6756.9112	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4384.1395	10.2300	448.4975	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2576.3929	10.2300	263.5650	(247)
Mechanical ventilation fans	100.3763	36.7200	36.8582	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	504.0013	36.7200	185.0693	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-882.9989	36.7200	-324.2372	(252)
Total energy cost			740.2928	(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	4384.1395	0.2160	946.9741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2576.3929	0.2160	556.5009	(264)
Space and water heating			1503.4750	(265)
Pumps and fans	175.3763	0.5190	91.0203	(267)
Energy for lighting	504.0013	0.5190	261.5767	(268)
Energy saving/generation technologies				
PV Unit	-882.9989	0.5190	-458.2764	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total kg/year 1397.7956 (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	4384.1395	1.2200	5348.6502 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.3929	1.2200	3143.1993 (264)
Space and water heating			8491.8495 (265)
Pumps and fans	175.3763	3.0700	538.4054 (267)
Energy for lighting	504.0013	3.0700	1547.2841 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			7866.7324 (272)
Primary energy kWh/m2/year			55.2827 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 122	-271 kg (19.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£122 1.90 kg/m²	B 89	B 90
Total Savings	£122 1.90 kg/m²		

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

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	£249	£268	-£18
Mains gas	£815	£675	£140
Space heating	£616	£618	-£3
Water heating	£264	£139	£125
Lighting	£185	£185	£0
Generated (PV)	-£324	-£324	£0
Total cost of fuels	£740	£619	£122
Total cost of uses	£741	£618	£122
Delivered energy	47 kWh/m²	38 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	55 kWh/m ²	45 kWh/m ²	11 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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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					4.7600
Infiltration rate					0.2380 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2380 (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	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (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)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	91.4500	(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		18.8551 (36)
Total fabric heat loss	(33) + (36) =	110.3051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	65.1039	64.4040	63.7040	60.2045	59.5045	58.8164	58.8164	58.8164	58.8164	59.5045	60.9044	62.3042 (38)
Average = Sum(39)m / 12 =	175.4090	174.7091	174.0092	170.5096	169.8097	169.1215	169.1215	169.1215	169.1215	169.8097	171.2095	172.6093 (39)
												171.2134 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2327	1.2278	1.2228	1.1982	1.1933	1.1885	1.1885	1.1885	1.1885	1.1933	1.2032	1.2130 (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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												190.0000 (47)
Store volume												1.4514 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7837 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (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	206.9377	182.0756	189.0700	162.9409	152.7436	134.2196	126.9492	142.9274	149.7942	174.6188	187.4319	201.6061 (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												1.1128 (H8)
Utilisation factor												0.5929 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.5818 (H14)
Volume ratio Veff/V												1.0571 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-945.4432 (H17)
Solar input	-27.4160	-45.7494	-77.9164	-104.4234	-129.0063	-126.8337	-125.1575	-109.3508	-85.6436	-58.4845	-32.5193	-22.9425 (63)
Solar input (sum of months) = Sum(63)m =												-945.4432 (63)
Output from w/h	179.5217	136.3263	111.1536	58.5175	23.7373	7.3859	1.7917	33.5766	64.1507	116.1344	154.9126	178.6636 (64)
Total per year (kWh/year) = Sum(64)m =												1065.8719 (64)
Heat gains from water heating, kWh/month	86.5568	76.5724	79.9633	68.1980	62.5559	55.9118	53.8705	59.6183	64.4582	75.1583	79.4985	84.7841 (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	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	116.3398	113.9471	107.4775	94.7194	84.0805	77.6553	72.4066	80.1321	89.5252	101.0192	110.4146	113.9571 (72)
Total internal gains	770.2525	764.7150	734.2340	683.0316	629.8167	588.0920	564.2789	575.1491	608.5537	658.4919	710.4633	749.3052 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Southeast					5.8800	36.7938		0.7200	0.7000	0.7700		75.5642 (77)	
Southwest					0.6000	36.7938		0.7200	0.7000	0.7700		7.7106 (79)	
Northwest					12.3200	11.2829		0.7200	0.7000	0.7700		48.5508 (81)	
Southeast					5.2200	36.7938		0.7200	0.7000	0.7700		67.0825 (77)	
Southeast					0.7500	39.2172		0.6300	0.7000	1.0000		11.6740 (82)	
Solar gains	210.5822	376.6169	562.0012	773.1567	935.0504	958.3791	911.4782	786.2849	634.5280	428.9192	255.5136	178.0773	(83)
Total gains	980.8346	1141.3319	1296.2352	1456.1883	1564.8672	1546.4711	1475.7571	1361.4340	1243.0817	1087.4111	965.9769	927.3825	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.7020	19.7810	19.8605	20.2682	20.3517	20.4345	20.4345	20.4345	20.4345	20.3517	20.1853	20.0216
alpha	2.3135	2.3187	2.3240	2.3512	2.3568	2.3623	2.3623	2.3623	2.3623	2.3568	2.3457	2.3348
util living area	0.9456	0.9227	0.8839	0.8118	0.7053	0.5705	0.4491	0.4944	0.6801	0.8475	0.9246	0.9514 (86)
MIT	18.3629	18.6777	19.1789	19.8246	20.3645	20.7321	20.8911	20.8596	20.5695	19.8714	19.0203	18.3230 (87)
Th 2	19.8940	19.8979	19.9018	19.9214	19.9253	19.9292	19.9292	19.9292	19.9292	19.9253	19.9175	19.9096 (88)
util rest of house	0.9381	0.9123	0.8678	0.7849	0.6613	0.5017	0.3563	0.4010	0.6178	0.8198	0.9127	0.9447 (89)
MIT 2	16.3917	16.8457	17.5642	18.4828	19.2169	19.6832	19.8563	19.8293	19.5019	18.5705	17.3569	16.3425 (90)
Living area fraction									fLA = Living area / (4) =			0.0892 (91)
MIT	16.5677	17.0092	17.7083	18.6025	19.3193	19.7768	19.9486	19.9212	19.5972	18.6866	17.5054	16.5193 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4177	16.8592	17.5583	18.4525	19.1693	19.6268	19.7986	19.7712	19.4472	18.5366	17.3554	16.3693 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9025	0.8710	0.8218	0.7398	0.6255	0.4802	0.3441	0.3859	0.5852	0.7732	0.8719	0.9114 (94)
Useful gains	885.1961	994.0977	1065.1922	1077.3069	978.8601	742.6271	507.8125	525.3471	727.3959	840.7387	842.2410	845.2201 (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	2125.5474	2089.3803	1924.2464	1628.7964	1268.3565	850.1455	540.9544	570.1458	904.3244	1347.7184	1755.8210	2100.5287 (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	922.8213	736.0299	639.1364	397.0724	215.3853	0.0000	0.0000	0.0000	0.0000	377.1928	657.7776	933.9496 (98)
Space heating												4879.3654 (98)
Space heating per m2										(98) / (4) =		34.2893 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5397.5281 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.8213	736.0299	639.1364	397.0724	215.3853	0.0000	0.0000	0.0000	0.0000	377.1928	657.7776	933.9496 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	1020.8201	814.1924	707.0092	439.2394	238.2581	0.0000	0.0000	0.0000	0.0000	417.2487	727.6301	1033.1301 (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	179.5217	136.3263	111.1536	58.5175	23.7373	7.3859	1.7917	33.5766	64.1507	116.1344	154.9126	178.6636 (64)
Efficiency of water heater	88.4658	88.5424	88.6371	88.8676	89.2111	79.7000	79.7000	79.7000	79.7000	87.6305	88.1443	79.7000 (216)
(217)m	202.9278	153.9673	125.4031	65.8480	26.6080	9.2671	2.2480	42.1288	80.4902	132.5274	175.7488	88.4922 (217)
Fuel for water heating, kWh/month												201.8975 (219)
Water heating fuel used												1219.0620 (219)
Annual totals kWh/year												
Space heating fuel - main system												5397.5281 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												100.3763 (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												225.3763 (231)
Electricity for lighting (calculated in Appendix L)												504.0013 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =										-795.1650		-795.1650 (233)
Total delivered energy for all uses												6550.8028 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5397.5281	3.4800	187.8340 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1219.0620	3.4800	42.4234 (247)
Mechanical ventilation fans	100.3763	13.1900	13.2396 (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	504.0013	13.1900	66.4778 (250)
Additional standing charges			120.0000 (251)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-795.1650	13.1900	-104.8823 (252)
Total energy cost			341.5800 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.7660 (257)
SAP value			89.3149
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	5397.5281	0.2160	1165.8661 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1219.0620	0.2160	263.3174 (264)
Space and water heating			1429.1835 (265)
Pumps and fans	225.3763	0.5190	116.9703 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1395.0398 (272)
CO2 emissions per m2			9.8000 (273)
EI value			90.0195
EI rating			90 (274)
EI band			B

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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	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (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								4.7600				
Infiltration rate								0.2380 (18)				
Number of sides sheltered								0 (19)				
Shelter factor	(20) = 1 - [0.075 x (19)] =							1.0000 (20)				
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =							0.2380 (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)
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												
	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			18.8000	1.3258	24.9242		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
Roof Window (Uw = 1.80)			0.7500	1.6791	1.2593		(27a)
150mm EPS B&B			56.6000	0.1800	10.1880	75.0000	4245.0000 (28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1900	27.5158	9.0000	1303.3800 (29a)
W2V	31.8700		31.8700	0.1400	4.4618	18.0000	573.6600 (29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.3200	3.0144	18.0000	169.5600 (29a)
400mm Mineral Wool	6.4000		6.4000	0.1100	0.7040	9.0000	57.6000 (30)
Sloping	22.8900	0.7500	22.1400	0.2000	4.4280	9.0000	199.2600 (30)
Dormer Roof	5.1000		5.1000	0.2800	1.4280	9.0000	45.9000 (30)
C2V	27.5000		27.5000	0.1400	3.8500	9.0000	247.5000 (30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				91.4500		(33)
Timber GF			105.9000			9.0000	953.1000 (32c)
Timber FF			146.5800			9.0000	1319.2200 (32c)
Timber 2F			26.8800			9.0000	241.9200 (32c)
Internal Floor			56.6000			18.0000	1018.8000 (32d)
Internal Floor 2			29.1000			18.0000	523.8000 (32d)
Internal Ceiling			56.6000			18.0000	1018.8000 (32e)
Internal Ceiling 2			29.1000			18.0000	523.8000 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						12441.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							87.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.8551 (36)
Total fabric heat loss	(33) + (36) =						110.3051 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.2045	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164 (38)
Average = Sum(39)m / 12 =	170.5096	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
												169.2372 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1982	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885	1.1885 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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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												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												190.0000 (47)
Store volume												1.4514 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7837 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (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	206.9377	182.0756	189.0700	162.9409	152.7436	134.2196	126.9492	142.9274	149.7942	174.6188	187.4319	201.6061 (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												1.2376 (H8)
Utilisation factor												0.5543 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.5818 (H14)
Volume ratio Veff/V												1.0571 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-982.9869 (H17)
Solar input	-32.2693	-45.8849	-78.8651	-106.4073	-124.3630	-134.0858	-127.6391	-116.3347	-90.9041	-62.5155	-38.1661	-25.5520 (63)
Solar input (sum of months) = Sum(63)m =												-982.9869 (63)
Output from w/h	174.6684	136.1908	110.2049	56.5336	28.3805	0.1338	0.0000	26.5927	58.8901	112.1033	149.2658	176.0541 (64)
Total per year (kWh/year) = Sum(64)m =												1029.0181 (64)
Heat gains from water heating, kWh/month	86.5568	76.5724	79.9633	68.1980	62.5559	55.9118	53.8705	59.6183	64.4582	75.1583	79.4985	84.7841 (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	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (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)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	116.3398	113.9471	107.4775	94.7194	84.0805	77.6553	72.4066	80.1321	89.5252	101.0192	110.4146	113.9571 (72)
Total internal gains	770.2525	764.7150	734.2340	683.0316	629.8167	588.0920	564.2789	575.1491	608.5537	658.4919	710.4633	749.3052 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W				
Southeast						5.8800	45.1778		0.7200	0.7000		0.7700	92.7826 (77)				
Southwest						0.6000	45.1778		0.7200	0.7000		0.7700	9.4676 (79)				
Northwest						12.3200	14.6176		0.7200	0.7000		0.7700	62.9002 (81)				
Southeast						5.2200	45.1778		0.7200	0.7000		0.7700	82.3682 (77)				
Southeast						0.7500	49.4580		0.6300	0.7000		1.0000	14.7224 (82)				
Solar gains						262.2410	400.5511	606.2053	844.3955	968.9959	1089.9219	999.7150	897.9182	719.4710	486.9821	317.4472	209.7514 (83)
Total gains						1032.4935	1165.2661	1340.4393	1527.4271	1598.8127	1678.0139	1563.9939	1473.0673	1328.0246	1145.4740	1027.9105	959.0566 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2682	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3512	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9310	0.9082	0.8575	0.7683	0.6374	0.4560	0.3361	0.3542	0.5843	0.7946	0.8988	0.9390 (86)
MIT	18.7338	18.9979	19.5047	20.0804	20.5755	20.8696	20.9565	20.9513	20.7483	20.1807	19.3839	18.6960 (87)
Th 2	19.9214	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9212	0.8956	0.8374	0.7351	0.5825	0.3759	0.2347	0.2482	0.5059	0.7557	0.8821	0.9301 (89)
MIT 2	16.9419	17.3229	18.0416	18.8381	19.4906	19.8300	19.9096	19.9070	19.7115	18.9971	17.8837	16.8931 (90)
Living area fraction									fLA = Living area / (4) =			0.0892 (91)
MIT	17.1018	17.4724	18.1722	18.9489	19.5874	19.9228	20.0030	20.0002	19.8041	19.1027	18.0176	17.0540 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9518	17.3224	18.0222	18.7989	19.4374	19.7728	19.8530	19.8502	19.6541	18.9527	17.8676	16.9040 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8823	0.8529	0.7915	0.6934	0.5542	0.3634	0.2271	0.2400	0.4833	0.7117	0.8378	0.8933 (94)
Useful gains	910.9483	993.8574	1060.9999	1059.0657	886.0253	609.7949	355.1257	353.4992	641.9005	815.2608	861.1661	856.7264 (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	1969.6967	1931.7783	1762.6102	1488.0894	1071.7959	654.9716	364.1224	363.6454	736.3670	1175.8517	1601.1698	1928.6691 (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	787.7088	630.2828	521.9980	308.8971	138.2134	0.0000	0.0000	0.0000	0.0000	268.2796	532.8026	797.5254 (98)
Space heating												3985.7077 (98)
Space heating per m2										(98) / (4) =		28.0092 (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 %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4408.9687 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	787.7088	630.2828	521.9980	308.8971	138.2134	0.0000	0.0000	0.0000	0.0000	268.2796	532.8026	797.5254 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	871.3593	697.2155	577.4315	341.7003	152.8909	0.0000	0.0000	0.0000	0.0000	296.7694	589.3834	882.2183 (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	174.6684	136.1908	110.2049	56.5336	28.3805	0.1338	0.0000	26.5927	58.8901	112.1033	149.2658	176.0541 (64)
Efficiency of water heater	88.2497	88.2938	88.3328	88.5606	88.3787	79.7000	79.7000	79.7000	79.7000	86.9594	87.8198	79.7000 (216)
(217)m	197.9253	154.2473	124.7611	63.8360	32.1124	0.1679	0.0000	33.3660	73.8897	128.9146	169.9682	199.4782 (219)
Fuel for water heating, kWh/month												1178.6668 (219)
Water heating fuel used												
Annual totals kWh/year												
Space heating fuel - main system												4408.9687 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												100.3763 (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												225.3763 (231)
Electricity for lighting (calculated in Appendix L)												504.0013 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =										-882.9989		-882.9989 (233)
Total delivered energy for all uses												5434.0143 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4408.9687	10.2300	451.0375 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1178.6668	10.2300	120.5776 (247)
Mechanical ventilation fans	100.3763	36.7200	36.8582 (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	504.0013	36.7200	185.0693 (250)
Additional standing charges			103.0000 (251)

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Energy saving/generation technologies			
PV Unit	-882.9989	36.7200	-324.2372 (252)
Total energy cost			618.2054 (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	4408.9687	0.2160	952.3372 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.6668	0.2160	254.5920 (264)
Space and water heating			1206.9293 (265)
Pumps and fans	225.3763	0.5190	116.9703 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			1127.1999 (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	4408.9687	1.2200	5378.9418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.6668	1.2200	1437.9735 (264)
Space and water heating			6816.9153 (265)
Pumps and fans	225.3763	3.0700	691.9054 (267)
Energy for lighting	504.0013	3.0700	1547.2841 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			6345.2982 (272)
Primary energy kWh/m2/year			44.5910 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	87.4 (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	470.53 (P1)
Transmission heat loss coefficient	110.31 (P7)
Summer heat loss coefficient	580.84 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	1.00	1.000	1.000 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	5.8800	127.3119	0.7200	0.7000	0.9000	305.6059
South West	0.6000	127.3119	0.7200	0.7000	0.9000	31.1843
North West	12.3200	106.0502	0.7200	0.7000	0.9000	533.3814
South East	5.2200	127.3119	0.7200	0.7000	0.9000	271.3032
South East	0.7500	205.2157	0.6300	0.7000	1.0000	61.0876
total:						1202.5623

Solar gains	Jun 1296	Jul 1203	Aug 1057	(P3)
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Internal gains	608	585	595	
Total summer gains	1904	1787	1652	(P5)
Summer gain/loss ratio	3.28	3.08	2.84	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 87.4)	1.39	1.39	1.39	
Threshold temperature	20.07	21.76	21.53	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			