

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-231.				Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	LTv1 Det As			
Property	14, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	85 B	DER	12.99	TER	16.08	
Environmental	88 B	% DER<TER	19.24			
CO ₂ Emissions (t/year)	1.50	DFEE	48.76	TFEE	56.69	
General Requirements Compliance	Pass	% DFEE<TFEE	13.98			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

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

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DWELLING AS BUILT

Detached House, total floor area 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) 16.08 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (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:	4.92 (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
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Boiler interlock	Yes	OK
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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
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Based on:

Overshading:	Average	
Windows facing North:	12.32 m ² , No overhang	
Windows facing South:	11.10 m ² , No overhang	
Windows facing West:	0.60 m ² , No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

10 Key features

External wall U-value	0.14 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Photovoltaic array	666.60 kWh/Year

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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	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												4.9200							
Infiltration rate												0.2460 (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) =				0.2460 (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																			
	0.3137	0.3075	0.3014	0.2706	0.2645	0.2337	0.2337	0.2276	0.2460	0.2645	0.2768	0.2891 (22b)							
Mechanical extract ventilation - decentralised																			
If mechanical ventilation:												0.5000 (23a)							
Effective ac	0.5637	0.5575	0.5514	0.5206	0.5145	0.5000	0.5000	0.5000	0.5000	0.5145	0.5268	0.5391 (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	66.3037	65.5803	64.8568	61.2396	60.5162	58.8164	58.8164	58.8164	58.8164	60.5162	61.9631	63.4100 (38)
Average = Sum(39)m / 12 =	176.6088	175.8854	175.1620	171.5448	170.8213	169.1215	169.1215	169.1215	169.1215	170.8213	172.2682	173.7151 (39)
												171.9427 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2411	1.2360	1.2309	1.2055	1.2004	1.1885	1.1885	1.1885	1.1885	1.2004	1.2106	1.2208 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9213 (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)
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
North					12.3200	10.6334	0.7200	0.7000			0.7700			45.7558 (74)
South					5.8800	46.7521	0.7200	0.7000			0.7700			96.0156 (78)
West					0.6000	19.6403	0.7200	0.7000			0.7700			4.1159 (80)
South					5.2200	46.7521	0.7200	0.7000			0.7700			85.2384 (78)
South					0.7500	45.6416	0.6300	0.7000			1.0000			13.5864 (82)
Solar gains	244.7120	416.8483	576.4013	734.1599	847.6622	854.5789	818.3359	730.4070	629.8616	461.7566	292.9652			209.5942 (83)
Total gains	780.8104	950.6007	1092.2925	1220.9189	1304.1695	1282.4870	1228.0217	1146.7709	1061.5073	922.7712	787.7406			730.3362 (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	19.5682	19.6487	19.7298	20.1459	20.2312	20.4345	20.4345	20.4345	20.4345	20.2312	20.0613	19.8942	
alpha	2.3045	2.3099	2.3153	2.3431	2.3487	2.3623	2.3623	2.3623	2.3623	2.3487	2.3374	2.3263	
util living area	0.9652	0.9451	0.9140	0.8570	0.7670	0.6411	0.5162	0.5587	0.7351	0.8839	0.9488	0.9698	(86)
MIT	18.1162	18.4562	18.9680	19.6304	20.2158	20.6516	20.8524	20.8162	20.4823	19.7191	18.8126	18.0758	(87)
Th 2	19.8873	19.8913	19.8953	19.9156	19.9197	19.9292	19.9292	19.9292	19.9292	19.9197	19.9115	19.9034	(88)
util rest of house	0.9601	0.9373	0.9011	0.8344	0.7268	0.5721	0.4161	0.4604	0.6762	0.8608	0.9402	0.9654	(89)
MIT 2	16.0343	16.5271	17.2657	18.2183	19.0290	19.6005	19.8270	19.7942	19.4036	18.3622	17.0593	15.9834	(90)
Living area fraction	16.2201	16.6993	17.4176	18.3443	19.1349	19.6943	19.9186	19.8854	19.4998	18.4834	17.2158	16.1702	(92)
MIT	16.2201	16.6993	17.4176	18.3443	19.1349	19.6943	19.9186	19.8854	19.4998	18.4834	17.2158	16.1702	(92)
Temperature adjustment	16.0701	16.5493	17.2676	18.1943	18.9849	19.5443	19.7686	19.7354	19.3498	18.3334	17.0658	16.0202	(93)
adjusted MIT	16.0701	16.5493	17.2676	18.1943	18.9849	19.5443	19.7686	19.7354	19.3498	18.3334	17.0658	16.0202	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9319	0.9013	0.8580	0.7877	0.6848	0.5437	0.3994	0.4404	0.6377	0.8144	0.9054	0.9399	(94)
Useful gains	727.6707	856.7618	937.1338	961.6624	893.0522	697.2631	490.4911	505.0212	676.9277	751.4807	713.1992	686.4383	(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	2078.7009	2048.9383	1886.0824	1594.3940	1244.4155	836.1864	535.8707	564.0874	887.8622	1321.0332	1716.7850	2053.3431	(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	1005.1664	801.1426	706.0178	455.5667	261.4143	0.0000	0.0000	0.0000	0.0000	423.7471	722.5818	1016.9771	(98)
Space heating												5392.6139	(98)
Space heating per m2											(98) / (4) =	37.8961	(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													5965.2808	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1005.1664	801.1426	706.0178	455.5667	261.4143	0.0000	0.0000	0.0000	0.0000	423.7471	722.5818	1016.9771	(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)	1111.9098	886.2197	780.9931	503.9455	289.1752	0.0000	0.0000	0.0000	0.0000	468.7468	799.3161	1124.9747	(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	88.3057	88.1322	87.8059	87.1124	85.7929	79.7000	79.7000	79.7000	79.7000	86.8595	87.8837	88.3668	(217)	
Fuel for water heating, kWh/month	244.2291	215.5412	226.8596	204.4983	203.1267	194.8245	186.5829	205.4634	205.3274	212.6940	222.8863	238.0266	(219)	
Water heating fuel used												2560.0598	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5965.2808	(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)														
Total delivered energy for all uses													9204.7183	(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	5965.2808	0.2160	1288.5007	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2560.0598	0.2160	552.9729	(264)
Space and water heating			1841.4736	(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	-666.6000	0.5190	-345.9654	(269)
Total CO2, kg/year			1848.1052	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9900	(273)

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

DER			12.9900	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			27.3121	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			27.3121	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	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 71.3607	Feb 70.8736	Mar 70.3962	Apr 68.1535	May 67.7339	Jun 65.7807	Jul 65.7807	Aug 65.4189	Sep 66.5330	Oct 67.7339	Nov 68.5828	Dec 69.4702 (38)
Heat transfer coeff	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)
Average = Sum(39)m / 12 =												167.0597 (39)
HLP	Jan 1.1965	Feb 1.1931	Mar 1.1898	Apr 1.1740	May 1.1711	Jun 1.1573	Jul 1.1573	Aug 1.1548	Sep 1.1626	Oct 1.1711	Nov 1.1770	Dec 1.1833 (40)
HLP (average)												1.1740 (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 113.9400	Feb 109.7967	Mar 105.6535	Apr 101.5102	May 97.3669	Jun 93.2236	Jul 93.2236	Aug 97.3669	Sep 101.5102	Oct 105.6535	Nov 109.7967	Dec 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 EMISSIONS 09 Jan 2014

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	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	(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												
(66)m	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	(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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					12.3200	10.6334	0.6300		0.7000	0.7700	40.0363 (74)	
South					11.1000	46.7521	0.6300		0.7000	0.7700	158.5972 (78)	
West					0.6000	19.6403	0.6300		0.7000	0.7700	3.6014 (80)	
South					0.7500	45.6416	0.6300		0.7000	1.0000	13.5864 (82)	
Solar gains	215.8213	367.8057	508.9044	648.4882	748.8435	754.9507	722.9376	645.2262	556.2277	407.5292	258.4120	184.8256 (83)
Total gains	754.6554	904.2940	1027.5314	1137.9830	1208.0865	1185.5946	1135.3591	1064.3258	990.6092	871.2796	755.9232	708.3033 (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	0.9988	0.9970	0.9917	0.9736	0.9169	0.7808	0.6120	0.6677	0.8859	0.9832	0.9974	0.9992 (86)
MIT	19.6324	19.8004	20.0592	20.3997	20.7094	20.9154	20.9804	20.9702	20.8262	20.4238	19.9661	19.6086 (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	0.9984	0.9959	0.9886	0.9627	0.8806	0.6915	0.4797	0.5364	0.8230	0.9744	0.9963	0.9989 (89)
MIT 2	18.0953	18.3425	18.7213	19.2200	19.6449	19.8945	19.9467	19.9433	19.8029	19.2614	18.5944	18.0678 (90)
Living area fraction												
MIT	18.2324	18.4726	18.8407	19.3253	19.7399	19.9856	20.0390	20.0350	19.8942	19.3652	18.7168	18.2053 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2324	18.4726	18.8407	19.3253	19.7399	19.9856	20.0390	20.0350	19.8942	19.3652	18.7168	18.2053 (93)

8. Space heating requirement

Utilisation	0.9974	0.9936	0.9840	0.9541	0.8720	0.6946	0.4910	0.5471	0.8189	0.9673	0.9942	0.9981 (94)
Useful gains	752.7056	898.5514	1011.0500	1085.7000	1053.4239	823.4797	557.4571	582.3448	811.1749	842.7664	751.5496	706.9565 (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	2372.2636	2304.3857	2089.3307	1741.6686	1339.7900	886.9557	566.3601	597.3274	958.6018	1460.6446	1945.7161	2358.1944 (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	1204.9511	944.7207	802.2409	472.2974	213.0564	0.0000	0.0000	0.0000	0.0000	459.7014	859.7998	1228.5210 (98)
Space heating												6185.2887 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 43.4665 (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													6615.2820 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1204.9511	944.7207	802.2409	472.2974	213.0564	0.0000	0.0000	0.0000	0.0000	459.7014	859.7998	1228.5210	(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)	1288.7178	1010.3964	858.0116	505.1309	227.8678	0.0000	0.0000	0.0000	0.0000	491.6593	919.5720	1313.9262	(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	88.6769	88.4936	88.1256	87.2634	85.3122	79.8000	79.8000	79.8000	79.8000	87.1185	88.2812	79.8000	(216)
Fuel for water heating, kWh/month	246.0759	217.2579	228.9237	206.9660	207.2537	197.6658	189.5374	208.3942	208.1555	214.9822	224.6718	239.8857	(219)
Water heating fuel used												2589.7697	(219)
Annual totals kWh/year													
Space heating fuel - main system												6615.2820	(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												9784.0531	(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	6615.2820	0.2160	1428.9009 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2589.7697	0.2160	559.3903 (264)
Space and water heating			1988.2912 (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			2288.7929 (272)
Emissions per m2 for space and water heating			13.9725 (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) = (13.9725 * 1.00) + 1.8382 + 0.2735, rounded to 2 d.p.			16.0800 (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		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							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								4.9200				
Infiltration rate								0.3582 (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) =	0.3582 (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	0.4567	0.4478	0.4388	0.3940	0.3851	0.3403	0.3403	0.3313	0.3582	0.3851	0.4030	0.4209 (22b)
Effective ac	0.6043	0.6002	0.5963	0.5776	0.5741	0.5579	0.5579	0.5549	0.5642	0.5741	0.5812	0.5886 (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 71.0852	Feb 70.6088	Mar 70.1418	Apr 67.9484	May 67.5381	Jun 65.6277	Jul 65.6277	Aug 65.2739	Sep 66.3635	Oct 67.5381	Nov 68.3682	Dec 69.2362	(38)
Heat transfer coeff	181.3903	180.9139	180.4470	178.2536	177.8432	175.9328	175.9328	175.5790	176.6687	177.8432	178.6734	179.5413	(39)
Average = Sum(39)m / 12 =												178.2516	(39)
HLP	Jan 1.2747	Feb 1.2714	Mar 1.2681	Apr 1.2527	May 1.2498	Jun 1.2364	Jul 1.2364	Aug 1.2339	Sep 1.2415	Oct 1.2498	Nov 1.2556	Dec 1.2617	(40)
HLP (average)												1.2526	(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
North					12.3200	10.6334	0.7200	0.7000		0.7700		45.7558 (74)
South					5.8800	46.7521	0.7200	0.7000		0.7700		96.0156 (78)
West					0.6000	19.6403	0.7200	0.7000		0.7700		4.1159 (80)
South					5.2200	46.7521	0.7200	0.7000		0.7700		85.2384 (78)
South					0.7500	45.6416	0.6300	0.7000		1.0000		13.5864 (82)
Solar gains	244.7120	416.8483	576.4013	734.1599	847.6622	854.5789	818.3359	730.4070	629.8616	461.7566	292.9652	209.5942 (83)
Total gains	700.3438	870.9978	1014.4828	1145.5470	1230.3804	1210.9265	1158.3554	1074.6776	988.5517	847.2923	709.4125	650.7296 (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	17.8712	17.9183	17.9647	18.1857	18.2277	18.4256	18.4256	18.4627	18.3488	18.2277	18.1430	18.0553
alpha	2.1914	2.1946	2.1976	2.2124	2.2152	2.2284	2.2284	2.2308	2.2233	2.2152	2.2095	2.2037
util living area	0.9687	0.9494	0.9198	0.8669	0.7833	0.6648	0.5442	0.5877	0.7584	0.8954	0.9544	0.9731 (86)
MIT	17.8433	18.1957	18.7340	19.4245	20.0646	20.5628	20.8042	20.7599	20.3620	19.5214	18.5569	17.7845 (87)
Th 2	19.8607	19.8633	19.8659	19.8781	19.8804	19.8910	19.8910	19.8930	19.8869	19.8804	19.8758	19.8709 (88)
util rest of house	0.9641	0.9421	0.9078	0.8455	0.7445	0.5958	0.4402	0.4869	0.7013	0.8741	0.9466	0.9692 (89)
MIT 2	16.9773	17.3270	17.8591	18.5401	19.1501	19.6058	19.7969	19.7702	19.4395	18.6473	17.6969	16.9256 (90)
Living area fraction	17.0546	17.4046	17.9372	18.6190	19.2317	19.6912	19.8868	19.8586	19.5218	18.7253	17.7737	17.0023 (91)
MIT	17.0546	17.4046	17.9372	18.6190	19.2317	19.6912	19.8868	19.8586	19.5218	18.7253	17.7737	17.0023 (93)
Temperature adjustment	0.0000											
adjusted MIT	17.0546	17.4046	17.9372	18.6190	19.2317	19.6912	19.8868	19.8586	19.5218	18.7253	17.7737	17.0023 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	663.9407	801.7704	893.7030	934.1703	883.0385	704.3272	509.3612	519.4480	671.0399	716.3365	657.1137	621.2980 (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	2313.5552	2262.2519	2063.8036	1732.4537	1339.4588	895.7173	578.2519	607.2525	957.8640	1445.0349	1907.1035	2298.5328 (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	1227.3131	981.4436	870.5549	574.7640	339.5767	0.0000	0.0000	0.0000	0.0000	542.1516	899.9927	1247.8627 (98)
Space heating	6683.6592 (98)											
Space heating per m2	(98) / (4) = 46.9688 (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	1653.7685	1301.9028	1334.4007	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6628	0.7299	0.6997	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1096.0959	950.3088	933.7456	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1529.0683	1465.1932	1370.9068	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	311.7401	383.0740	325.2480	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			1020.0621	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	77.9350	95.7685	81.3120	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												255.0155	(107)
Energy for space heating												1.7921	(108)
Energy for space cooling												46.9688	(99)
Total												1.7921	(108)
Dwelling Fabric Energy Efficiency (DFEE)												48.7609	(109)
												48.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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) =					Air changes per hour 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	
North					12.3200	10.6334	0.6300	0.7000	0.7700		40.0363 (74)	
South					11.1000	46.7521	0.6300	0.7000	0.7700		158.5972 (78)	
West					0.6000	19.6403	0.6300	0.7000	0.7700		3.6014 (80)	
South					0.7500	45.6416	0.6300	0.7000	1.0000		13.5864 (82)	
Solar gains	215.8213	367.8057	508.9044	648.4882	748.8435	754.9507	722.9376	645.2262	556.2277	407.5292	258.4120	184.8256 (83)
Total gains	671.4531	821.9552	946.9858	1059.8753	1131.5616	1111.2983	1062.9571	989.4967	914.9178	793.0649	674.8593	625.9610 (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	0.9993	0.9980	0.9942	0.9800	0.9328	0.8105	0.6462	0.7055	0.9102	0.9886	0.9984	0.9995	(86)
MIT	19.5782	19.7472	20.0083	20.3542	20.6751	20.8990	20.9751	20.9619	20.7967	20.3760	19.9135	19.5547	(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	0.9991	0.9973	0.9919	0.9714	0.9015	0.7248	0.5100	0.5726	0.8553	0.9823	0.9977	0.9994	(89)
MIT 2	18.6209	18.7918	19.0540	19.4054	19.7107	19.9040	19.9475	19.9446	19.8280	19.4318	18.9684	18.6059	(90)
Living area fraction	18.7064	18.8770	19.1392	19.4901	19.7968	19.9928	20.0392	20.0354	19.9145	19.5160	19.0528	18.6906	(92)
Temperature adjustment	18.7064	18.8770	19.1392	19.4901	19.7968	19.9928	20.0392	20.0354	19.9145	19.5160	19.0528	18.6906	(93)
adjusted MIT	18.7064	18.8770	19.1392	19.4901	19.7968	19.9928	20.0392	20.0354	19.9145	19.5160	19.0528	18.6906	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9963	0.9896	0.9666	0.8960	0.7284	0.5219	0.5837	0.8530	0.9787	0.9969	0.9991	(94)
Useful gains	670.5648	818.9081	937.1131	1024.4364	1013.9294	809.5054	554.7725	577.5293	780.4199	776.1661	672.7622	625.3783	(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	2452.9577	2373.0461	2139.8697	1769.1928	1349.2704	888.1307	566.4034	597.3870	961.9541	1485.7870	2001.9789	2439.9017	(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	1326.1003	1044.3807	894.8509	536.2246	249.4937	0.0000	0.0000	0.0000	0.0000	527.9580	957.0360	1350.0054	(98)
Space heating	6886.0495 (99)												
Space heating per m2	(98) / (4) = 48.3911 (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	0.7930	0.8739	0.8409	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1227.6345	1064.9892	1050.2179	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1412.6197	1353.6887	1271.3448	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	133.1893	214.7924	164.5184	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			512.5002 (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	33.2973	53.6981	41.1296	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												128.1250 (107)
Energy for space heating												0.9004 (108)
Energy for space cooling												48.3911 (99)
Total												0.9004 (108)
Target Fabric Energy Efficiency (TFEE)												49.2915 (109)
												56.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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											4.9200	
Infiltration rate											0.2460 (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) =	0.2460 (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	0.2706	0.2522	0.2522	0.2399	0.2399	0.2276	0.2276	0.2153	0.2153	0.2337	0.2276	0.2399 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5206	0.5022	0.5022	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	61.2396	59.0693	59.0693	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164 (38)
Heat transfer coeff	171.5448	169.3744	169.3744	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.3656 (39)
HLP	Jan 1.2055	Feb 1.1903	Mar 1.1903	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)												1.1902 (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)												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)
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
North				12.3200	13.4839		0.7200		0.7000		0.7700		58.0216 (74)
South				5.8800	56.7559		0.7200		0.7000		0.7700		116.5606 (78)
West				0.6000	25.1925		0.7200		0.7000		0.7700		5.2794 (80)
South				5.2200	56.7559		0.7200		0.7000		0.7700		103.4773 (78)
South				0.7500	57.0406		0.6300		0.7000		1.0000		16.9796 (82)
Solar gains	300.3185	435.9734	610.9361	790.3526	869.6472	964.2029	889.6463	823.6597	702.3274	515.2084	358.4412	243.4686	(83)
Total gains	1079.9585	1210.0760	1356.0585	1490.2758	1522.6089	1575.6900	1477.3202	1421.2033	1326.2719	1184.5886	1078.2921	1002.1614	(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	20.1459	20.4040	20.4040	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3431	2.3603	2.3603	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9253	0.9020	0.8549	0.7759	0.6555	0.4787	0.3533	0.3653	0.5848	0.7847	0.8900	0.9337 (86)
MIT	18.7689	19.0384	19.5145	20.0574	20.5474	20.8550	20.9515	20.9479	20.7478	20.2066	19.4319	18.7430 (87)
Th 2	19.9156	19.9278	19.9278	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9148	0.8886	0.8347	0.7433	0.6010	0.3964	0.2476	0.2567	0.5064	0.7448	0.8723	0.9242 (89)
MIT 2	16.9884	17.3790	18.0540	18.8084	19.4588	19.8179	19.9071	19.9053	19.7111	19.0297	17.9501	16.9601 (90)
Living area fraction	17.1473	17.5271	18.1844	18.9199	19.5559	19.9104	20.0003	19.9984	19.8036	19.1347	18.0823	17.1192 (92)
Temperature adjustment	16.9973	17.3771	18.0344	18.7699	19.4059	19.7604	19.8503	19.8484	19.6536	18.9847	17.9323	16.9692 (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	0.8745	0.8452	0.7887	0.7009	0.5708	0.3824	0.2393	0.2480	0.4838	0.7016	0.8273	0.8861	(94)
Useful gains	944.3965	1022.7625	1069.5259	1044.5410	869.0826	602.5775	353.5815	352.4388	641.6421	831.1040	892.0298	887.9771	(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													
	1989.4517	1943.9233	1767.3151	1483.1728	1066.4680	652.8848	363.6695	363.3336	736.2883	1181.2655	1612.1175	1939.6928	(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													
	777.5211	619.0201	519.1552	315.8149	146.8547	0.0000	0.0000	0.0000	0.0000	260.5201	518.4631	782.4764	(98)
Space heating												3939.8257	(98)
RHI space heating demand												3940	(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)				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =								0.0000 / (5) = 0.0000 (8)				
Pressure test								Yes				
Measured/design AP50								4.9200				
Infiltration rate								0.2460 (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) =							0.2460 (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												
	0.3137	0.3075	0.3014	0.2706	0.2645	0.2337	0.2337	0.2276	0.2460	0.2645	0.2768	0.2891 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5637	0.5575	0.5514	0.5206	0.5145	0.5000	0.5000	0.5000	0.5000	0.5145	0.5268	0.5391 (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/m²K 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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	66.3037	65.5803	64.8568	61.2396	60.5162	58.8164	58.8164	58.8164	58.8164	60.5162	61.9631	63.4100 (38)
Heat transfer coeff	176.6088	175.8854	175.1620	171.5448	170.8213	169.1215	169.1215	169.1215	169.1215	170.8213	172.2682	173.7151 (39)
Average = Sum(39)m / 12 =												171.9427 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2411	1.2360	1.2309	1.2055	1.2004	1.1885	1.1885	1.1885	1.1885	1.2004	1.2106	1.2208 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9213 (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
North				12.3200	10.6334		0.7200		0.7000		0.7700		45.7558 (74)
South				5.8800	46.7521		0.7200		0.7000		0.7700		96.0156 (78)
West				0.6000	19.6403		0.7200		0.7000		0.7700		4.1159 (80)
South				5.2200	46.7521		0.7200		0.7000		0.7700		85.2384 (78)
South				0.7500	45.6416		0.6300		0.7000		1.0000		13.5864 (82)
Solar gains	244.7120	416.8483	576.4013	734.1599	847.6622	854.5789	818.3359	730.4070	629.8616	461.7566	292.9652		209.5942 (83)
Total gains	1024.3521	1190.9508	1321.5237	1434.0831	1500.6239	1466.0660	1406.0098	1327.9506	1253.8060	1131.1369	1012.8160		968.2870 (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	19.5682	19.6487	19.7298	20.1459	20.2312	20.4345	20.4345	20.4345	20.4345	20.2312	20.0613	19.8942
alpha	2.3045	2.3099	2.3153	2.3431	2.3487	2.3623	2.3623	2.3623	2.3623	2.3487	2.3374	2.3263
util living area	0.9412	0.9169	0.8806	0.8168	0.7211	0.5907	0.4664	0.5036	0.6770	0.8386	0.9181	0.9473 (86)
MIT	18.3926	18.7109	19.1860	19.7968	20.3248	20.7104	20.8818	20.8538	20.5740	19.8963	19.0549	18.3523 (87)
Th 2	19.8873	19.8913	19.8953	19.9156	19.9197	19.9292	19.9292	19.9292	19.9292	19.9197	19.9115	19.9034 (88)
util rest of house	0.9331	0.9058	0.8641	0.7903	0.6777	0.5216	0.3715	0.4093	0.6145	0.8097	0.9054	0.9401 (89)
MIT 2	16.4308	16.8889	17.5701	18.4418	19.1640	19.6613	19.8493	19.8247	19.5069	18.5996	17.4022	16.3811 (90)
Living area fraction	16.6059	17.0515	17.7143	18.5627	19.2676	19.7549	19.9415	19.9165	19.6022	18.7153	17.5497	16.5571 (92)
Temperature adjustment	16.4559	16.9015	17.5643	18.4127	19.1176	19.6049	19.7915	19.7665	19.4522	18.5653	17.3997	16.4071 (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	0.8960	0.8633	0.8177	0.7447	0.6401	0.4982	0.3582	0.3936	0.5823	0.7631	0.8632	0.9053	(94)
Useful gains	917.7768	1028.0991	1080.5808	1067.9563	960.6220	730.4089	503.6623	522.6549	730.0335	863.1419	874.2670	876.5813	(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	2146.8410	2110.8948	1938.0477	1631.8537	1267.0774	846.4397	539.7483	569.3532	905.1697	1360.6472	1774.3165	2120.5513	(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	914.4237	727.6388	637.9554	406.0061	228.0028	0.0000	0.0000	0.0000	0.0000	370.1439	648.0357	925.5137	(98)
Space heating												4857.7200	(98)
Space heating per m2											(98) / (4) =	34.1372	(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													5373.5841	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	914.4237	727.6388	637.9554	406.0061	228.0028	0.0000	0.0000	0.0000	0.0000	370.1439	648.0357	925.5137	(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)	1011.5307	804.9101	705.7028	449.1218	252.2155	0.0000	0.0000	0.0000	0.0000	409.4513	716.8536	1023.7983	(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	88.1417	87.9554	87.6016	86.8444	85.4313	79.7000	79.7000	79.7000	79.7000	86.5322	87.6681	88.2071	(216)	
(217)m														
Fuel for water heating, kWh/month	244.6834	215.9743	227.3888	205.1292	203.9865	194.8245	186.5829	205.4634	205.3274	213.4987	223.4343	238.4577	(219)	
Water heating fuel used												2564.7511	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5373.5841	(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)														
Total delivered energy for all uses													8617.7129	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5373.5841	3.4800	187.0007	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2564.7511	3.4800	89.2533	(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	0.0000	13.1900	0.0000	(252)
Total energy cost			485.8640	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.0895	(257)
SAP value			84.8015	
SAP rating (Section 12)			85	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5373.5841	0.2160	1160.6942 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2564.7511	0.2160	553.9862 (264)
Space and water heating			1714.6804 (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	-666.6000	0.5190	-345.9654 (269)
Total kg/year			1721.3120 (272)
CO2 emissions per m2			12.1000 (273)
EI value			87.6852
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	$3.48 / 0.8477 = 4.105$, stars = 4
Water heating environmental impact	$0.216 / 0.8477 = 0.2548$, 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)			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =									Air changes per hour			
Pressure test								0.0000 / (5) =	0.0000	(8)		
Measured/design AP50								Yes	4.9200			
Infiltration rate									0.2460	(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) =	0.2460	(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												
	0.2706	0.2522	0.2522	0.2399	0.2399	0.2276	0.2276	0.2153	0.2153	0.2337	0.2276	0.2399 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5206	0.5022	0.5022	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	61.2396	59.0693	59.0693	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164 (38)
Average = Sum(39)m / 12 =	171.5448	169.3744	169.3744	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
												169.3656 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2055	1.1903	1.1903	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)

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	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)												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	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	
North				12.3200	13.4839	0.7200	0.7000		0.7700		58.0216 (74)	
South				5.8800	56.7559	0.7200	0.7000		0.7700		116.5606 (78)	
West				0.6000	25.1925	0.7200	0.7000		0.7700		5.2794 (80)	
South				5.2200	56.7559	0.7200	0.7000		0.7700		103.4773 (78)	
South				0.7500	57.0406	0.6300	0.7000		1.0000		16.9796 (82)	
Solar gains	300.3185	435.9734	610.9361	790.3526	869.6472	964.2029	889.6463	823.6597	702.3274	515.2084	358.4412	243.4686 (83)
Total gains	1079.9585	1210.0760	1356.0585	1490.2758	1522.6089	1575.6900	1477.3202	1421.2033	1326.2719	1184.5886	1078.2921	1002.1614 (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	20.1459	20.4040	20.4040	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3431	2.3603	2.3603	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9253	0.9020	0.8549	0.7759	0.6555	0.4787	0.3533	0.3653	0.5848	0.7847	0.8900	0.9337 (86)
MIT	18.7689	19.0384	19.5145	20.0574	20.5474	20.8550	20.9515	20.9479	20.7478	20.2066	19.4319	18.7430 (87)
Th 2	19.9156	19.9278	19.9278	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9148	0.8886	0.8347	0.7433	0.6010	0.3964	0.2476	0.2567	0.5064	0.7448	0.8723	0.9242 (89)
MIT 2	16.9884	17.3790	18.0540	18.8084	19.4588	19.8179	19.9071	19.9053	19.7111	19.0297	17.9501	16.9601 (90)
Living area fraction	17.1473	17.5271	18.1844	18.9199	19.5559	19.9104	20.0003	19.9984	19.8036	19.1347	18.0823	17.1192 (92)
MIT	17.1473	17.5271	18.1844	18.9199	19.5559	19.9104	20.0003	19.9984	19.8036	19.1347	18.0823	17.1192 (92)
Temperature adjustment	16.9973	17.3771	18.0344	18.7699	19.4059	19.7604	19.8503	19.8484	19.6536	18.9847	17.9323	16.9692 (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	0.8745	0.8452	0.7887	0.7009	0.5708	0.3824	0.2393	0.2480	0.4838	0.7016	0.8273	0.8861	(94)
Useful gains	944.3965	1022.7625	1069.5259	1044.5410	869.0826	602.5775	353.5815	352.4388	641.6421	831.1040	892.0298	887.9771	(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	1989.4517	1943.9233	1767.3151	1483.1728	1066.4680	652.8848	363.6695	363.3336	736.2883	1181.2655	1612.1175	1939.6928	(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	777.5211	619.0201	519.1552	315.8149	146.8547	0.0000	0.0000	0.0000	0.0000	260.5201	518.4631	782.4764	(98)
Space heating												3939.8257	(98)
Space heating per m2											(98) / (4) =	27.6868	(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													4358.2142	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	777.5211	619.0201	519.1552	315.8149	146.8547	0.0000	0.0000	0.0000	0.0000	260.5201	518.4631	782.4764	(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)	860.0897	684.7567	574.2867	349.3528	162.4499	0.0000	0.0000	0.0000	0.0000	288.1860	573.5212	865.5712	(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	87.8392	87.6373	87.1554	86.2252	84.2610	79.7000	79.7000	79.7000	79.7000	85.6301	87.1902	87.8999	(217)	
Fuel for water heating, kWh/month	245.5259	216.7585	228.5529	206.6024	206.8197	194.8245	186.5829	205.4634	205.3274	215.7477	224.6591	239.2911	(219)	
Water heating fuel used												2576.1554	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4358.2142	(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)														
Total delivered energy for all uses													7613.7473	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4358.2142	10.2300	445.8453	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2576.1554	10.2300	263.5407	(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	0.0000	36.7200	0.0000	(252)
Total energy cost			1061.8535	(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	4358.2142	0.2160	941.3743	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2576.1554	0.2160	556.4496	(264)
Space and water heating			1497.8238	(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	-666.6000	0.5190	-345.9654	(269)
Total kg/year			1504.4555	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	4358.2142	1.2200	5317.0214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.1554	1.2200	3142.9096 (264)
Space and water heating			8459.9310 (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	-666.6000	3.0700	-2046.4620 (269)
Primary energy kWh/year			8499.1584 (272)
Primary energy kWh/m2/year			59.7270 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
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	-270 kg (18.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£122 1.90 kg/m²	B 86	B 90
Total Savings	£122 1.90 kg/m²		
Potential energy efficiency rating:		B 86	
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	£812	£672	£140
Space heating	£613	£616	-£3
Water heating	£264	£139	£125
Lighting	£185	£185	£0
Total cost of fuels	£1061	£940	£122
Total cost of uses	£1062	£940	£122
Delivered energy	54 kWh/m²	44 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	49 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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					4.9200
Infiltration rate					0.2460 (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) =				0.2460 (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	0.3137	0.3075	0.3014	0.2706	0.2645	0.2337	0.2337	0.2276	0.2460	0.2645	0.2768	0.2891 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
Effective ac	0.5637	0.5575	0.5514	0.5206	0.5145	0.5000	0.5000	0.5000	0.5000	0.5145	0.5268	0.5391 (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	66.3037	65.5803	64.8568	61.2396	60.5162	58.8164	58.8164	58.8164	58.8164	60.5162	61.9631	63.4100 (38)
Average = Sum(39)m / 12 =	176.6088	175.8854	175.1620	171.5448	170.8213	169.1215	169.1215	169.1215	169.1215	170.8213	172.2682	173.7151 (39)
												171.9427 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2411	1.2360	1.2309	1.2055	1.2004	1.1885	1.1885	1.1885	1.1885	1.2004	1.2106	1.2208 (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		g	FF		Access		Gains			
						W/m2		Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W		
					North	12.3200	10.6334	0.7200	0.7000	0.7700	45.7558 (74)					
					South	5.8800	46.7521	0.7200	0.7000	0.7700	96.0156 (78)					
					West	0.6000	19.6403	0.7200	0.7000	0.7700	4.1159 (80)					
					South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384 (78)					
					South	0.7500	45.6416	0.6300	0.7000	1.0000	13.5864 (82)					
Solar gains					244.7120	416.8483	576.4013	734.1599	847.6622	854.5789	818.3359	730.4070	629.8616	461.7566	292.9652	209.5942 (83)
Total gains					1014.9645	1181.5633	1310.6353	1417.1915	1477.4790	1442.6710	1382.6148	1305.5561	1238.4152	1120.2485	1003.4285	958.8995 (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)	

FULL SAP CALCULATION PRINTOUT

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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	19.5682	19.6487	19.7298	20.1459	20.2312	20.4345	20.4345	20.4345	20.4345	20.2312	20.0613	Dec 19.8942
alpha	2.3045	2.3099	2.3153	2.3431	2.3487	2.3623	2.3623	2.3623	2.3623	2.3487	2.3374	2.3263
util living area	0.9422	0.9181	0.8823	0.8200	0.7264	0.5968	0.4725	0.5099	0.6814	0.8410	0.9195	0.9483 (86)
MIT	18.3824	18.7014	19.1762	19.7845	20.3129	20.7036	20.8784	20.8497	20.5675	19.8877	19.0453	18.3418 (87)
Th 2	19.8873	19.8913	19.8953	19.9156	19.9197	19.9292	19.9292	19.9292	19.9292	19.9197	19.9115	19.9034 (88)
util rest of house	0.9342	0.9071	0.8659	0.7938	0.6833	0.5276	0.3768	0.4151	0.6192	0.8124	0.9069	0.9412 (89)
MIT 2	16.4162	16.8755	17.5565	18.4253	19.1494	19.6544	19.8468	19.8215	19.4997	18.5882	17.3887	16.3661 (90)
Living area fraction	16.5917	17.0384	17.7010	18.5466	19.2533	19.7481	19.9389	19.9132	19.5950	18.7042	17.5366	16.5424 (92)
MIT	16.5917	17.0384	17.7010	18.5466	19.2533	19.7481	19.9389	19.9132	19.5950	18.7042	17.5366	16.5424 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4417	16.8884	17.5510	18.3966	19.1033	19.5981	19.7889	19.7632	19.4450	18.5542	17.3866	16.3924 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8974	0.8647	0.8196	0.7480	0.6452	0.5037	0.3632	0.3989	0.5864	0.7657	0.8650	0.9067 (94)
Useful gains	910.8050	1021.7531	1074.1494	1060.0688	953.2599	726.6116	502.1565	520.7665	726.2372	857.7473	867.9352	869.4324 (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	2144.3230	2108.5922	1935.7218	1629.0958	1264.6379	845.2797	539.3088	568.7954	903.9525	1358.7480	1772.0460	2118.0030 (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	917.7374	730.3559	641.0098	409.6994	231.6653	0.0000	0.0000	0.0000	0.0000	372.7445	650.9598	928.9365 (98)
Space heating												4883.1085 (98)
Space heating per m2										(98) / (4) =		34.3156 (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												5401.6687 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.7374	730.3559	641.0098	409.6994	231.6653	0.0000	0.0000	0.0000	0.0000	372.7445	650.9598	928.9365 (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)	1015.1962	807.9158	709.0817	453.2073	256.2669	0.0000	0.0000	0.0000	0.0000	412.3280	720.0883	1027.5846 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	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	88.4570	88.5304	88.6414	88.9082	89.2859	79.7000	79.7000	79.7000	79.7000	87.6060	88.1257	79.7000 (216)
(217)m	202.9479	153.9880	125.3970	65.8179	26.5857	9.2671	2.2480	42.1288	80.4902	132.5643	175.7859	201.9168 (219)
Fuel for water heating, kWh/month	202.9479	153.9880	125.3970	65.8179	26.5857	9.2671	2.2480	42.1288	80.4902	132.5643	175.7859	1219.1377 (219)
Water heating fuel used												
Annual totals kWh/year												
Space heating fuel - main system												5401.6687 (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)												
Total delivered energy for all uses												7350.1841 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5401.6687	3.4800	187.9781 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1219.1377	3.4800	42.4260 (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)

Energy saving/generation technologies

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			446.6090 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0015 (257)
SAP value		86.0295
SAP rating (Section 12)		86 (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	5401.6687	0.2160	1166.7604 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1219.1377	0.2160	263.3337 (264)
Space and water heating			1430.0942 (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	-666.6000	0.5190	-345.9654 (269)
Total kg/year			1462.6758 (272)
CO2 emissions per m2			10.2800 (273)
EI value			89.5356
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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											4.9200			
Infiltration rate											0.2460	(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) =	0.2460	(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														
	0.2706	0.2522	0.2522	0.2399	0.2399	0.2276	0.2276	0.2153	0.2153	0.2337	0.2276	0.2399	(22b)	
Mechanical extract ventilation - decentralised														
If mechanical ventilation:													0.5000	(23a)
Effective ac	0.5206	0.5022	0.5022	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	61.2396	59.0693	59.0693	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164 (38)
Heat transfer coeff	171.5448	169.3744	169.3744	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.3656 (39)
HLP	Jan 1.2055	Feb 1.1903	Mar 1.1903	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)												1.1902 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9213 (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)
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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)
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)
Total per year (kWh/year) = Sum(64)m =												1029.0181 (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)	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
North						12.3200	13.4839	0.7200	0.7000			0.7700			58.0216 (74)
South						5.8800	56.7559	0.7200	0.7000			0.7700			116.5606 (78)
West						0.6000	25.1925	0.7200	0.7000			0.7700			5.2794 (80)
South						5.2200	56.7559	0.7200	0.7000			0.7700			103.4773 (78)
South						0.7500	57.0406	0.6300	0.7000			1.0000			16.9796 (82)
Solar gains	300.3185	435.9734	610.9361	790.3526	869.6472	964.2029	889.6463	823.6597	702.3274	515.2084	358.4412			243.4686 (83)	
Total gains	1070.5710	1200.6884	1345.1701	1473.3842	1499.4640	1552.2949	1453.9252	1398.8088	1310.8811	1173.7003	1068.9045			992.7739 (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	20.1459	20.4040	20.4040	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3431	2.3603	2.3603	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9264	0.9033	0.8568	0.7794	0.6611	0.4841	0.3582	0.3703	0.5892	0.7874	0.8917	0.9348 (86)
MIT	18.7591	19.0292	19.5054	20.0467	20.5384	20.8513	20.9500	20.9463	20.7435	20.1995	19.4231	18.7329 (87)
Th 2	19.9156	19.9278	19.9278	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9161	0.8901	0.8367	0.7470	0.6068	0.4014	0.2513	0.2605	0.5108	0.7478	0.8741	0.9255 (89)
MIT 2	16.9744	17.3661	18.0416	18.7946	19.4485	19.8148	19.9064	19.9045	19.7070	19.0207	17.9378	16.9456 (90)
Living area fraction									fLA = Living area / (4) =			0.0892 (91)
MIT	17.1337	17.5145	18.1722	18.9063	19.5458	19.9073	19.9995	19.9975	19.7995	19.1259	18.0704	17.1051 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9837	17.3645	18.0222	18.7563	19.3958	19.7573	19.8495	19.8475	19.6495	18.9759	17.9204	16.9551 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8760	0.8468	0.7907	0.7044	0.5760	0.3870	0.2429	0.2516	0.4877	0.7044	0.8292	0.8876 (94)
Useful gains	937.8590	1016.7731	1063.6834	1037.8023	863.6625	600.7705	353.1200	351.9470	639.3443	826.7519	886.3532	881.2268 (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	1987.1185	1941.7983	1765.2596	1480.8850	1064.7516	652.3594	363.5340	363.1889	735.5879	1179.7812	1610.1048	1937.3099 (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	780.6491	621.6169	521.9727	319.0195	149.6103	0.0000	0.0000	0.0000	0.0000	262.6538	521.1011	785.7258 (98)
Space heating												3962.3492 (98)
Space heating per m2										(98) / (4) =		27.8450 (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												4383.1297 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	780.6491	621.6169	521.9727	319.0195	149.6103	0.0000	0.0000	0.0000	0.0000	262.6538	521.1011	785.7258 (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)	863.5498	687.6293	577.4035	352.8977	165.4982	0.0000	0.0000	0.0000	0.0000	290.5462	576.4393	869.1657 (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 (217)m	88.2341	88.2703	88.3327	88.6092	88.5054	79.7000	79.7000	79.7000	79.7000	86.9097	87.7761	79.7000 (216)
Fuel for water heating, kWh/month	197.9601	154.2884	124.7612	63.8010	32.0664	0.1679	0.0000	33.3660	73.8897	128.9883	170.0529	88.2317 (217)
Water heating fuel used												199.5362 (219)
Annual totals kWh/year												1178.8782 (219)
Space heating fuel - main system												4383.1297 (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)												
Total delivered energy for all uses												6291.3855 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4383.1297	10.2300	448.3942 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1178.8782	10.2300	120.5992 (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)

Energy saving/generation technologies

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PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			939.8209 (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	4383.1297	0.2160	946.7560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.8782	0.2160	254.6377 (264)
Space and water heating			1201.3937 (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	-666.6000	0.5190	-345.9654 (269)
Total kg/year			1233.9753 (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	4383.1297	1.2200	5347.4182 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.8782	1.2200	1438.2314 (264)
Space and water heating			6785.6496 (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	-666.6000	3.0700	-2046.4620 (269)
Primary energy kWh/year			6978.3770 (272)
Primary energy kWh/m2/year			49.0399 (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
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 (37)
Summer heat loss coefficient	580.84 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	12.3200	87.1704	0.7200	0.7000	0.9000	438.4252
South	5.8800	118.5567	0.7200	0.7000	0.9000	284.5895
West	0.6000	125.2818	0.7200	0.7000	0.9000	30.6870
South	5.2200	118.5567	0.7200	0.7000	0.9000	252.6458
South	0.7500	208.7653	0.6300	0.7000	1.0000	62.1442
total:						1068.4917

Solar gains	Jun 1145	Jul 1068	Aug 968	(P3)
Internal gains	608	585	595	

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Total summer gains	1753	1653	1563	(P5)
Summer gain/loss ratio	3.02	2.85	2.69	(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	19.81	21.53	21.38	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			