

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-236				Issued on Date	12/12/2023
Assessment Reference	As Built	Prop Type Ref	LTv2 Det As			
Property	65, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL					
SAP Rating	88 B	DER	12.63	TER	16.22	
Environmental	88 B	% DER<TER	22.13			
CO ₂ Emissions (t/year)	1.40	DFEE	49.54	TFEE	57.61	
General Requirements Compliance	Pass	% DFEE<TFEE	14.00			
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) 16.22 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 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: 4.96 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.40 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North East: 12.32 m², No overhang
Windows facing South West: 11.10 m², No overhang
Windows facing North West: 0.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	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							4.9600					
Infiltration rate							0.2480	(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) =	0.2480 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.3162	0.3100	0.3038	0.2728	0.2666	0.2356	0.2356	0.2294	0.2480	0.2666	0.2790	0.2914 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5662	0.5600	0.5538	0.5228	0.5166	0.5000	0.5000	0.5000	0.5000	0.5166	0.5290	0.5414 (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	66.6037	65.8744	65.1450	61.4984	60.7691	58.8164	58.8164	58.8164	58.8164	60.7691	62.2277	63.6864 (38)
Average = Sum(39)m / 12 =	176.9088	176.1795	175.4502	171.8035	171.0742	169.1215	169.1215	169.1215	169.1215	171.0742	172.5329	173.9915 (39)
												172.1251 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2432	1.2381	1.2330	1.2073	1.2022	1.1885	1.1885	1.1885	1.1885	1.2022	1.2125	1.2227 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9213 (42)											
Average daily hot water use (litres/day)	103.5818 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content (annual)	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												
Store volume	180.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4000 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7560 (55)											
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670	146.0670 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5386	25.3478	20.6142	15.6063	11.6659	9.8488	10.6420	13.8329	18.5664	23.5744	27.5148	29.3318 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.0122	315.2500	307.0910	289.7216	267.7959	247.1888	233.4220	230.1843	238.3432	255.7126	277.6383	298.2454 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067	37.6067 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	536.0983	533.7525	515.8912	486.7590	456.5073	427.9081	409.6858	416.3639	431.6458	461.0146	494.7754	520.7420 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					12.3200	11.2829	0.7200	0.7000			0.7700	48.5508 (75)
Southwest					5.8800	36.7938	0.7200	0.7000			0.7700	75.5642 (79)
Northwest					0.6000	11.2829	0.7200	0.7000			0.7700	2.3645 (81)
Southwest					5.2200	36.7938	0.7200	0.7000			0.7700	67.0825 (79)
Southwest					0.7500	39.2172	0.6300	0.7000			1.0000	11.6740 (82)
Solar gains	205.2360	368.2958	552.7020	765.1313	929.2529	954.0273	906.6985	779.6284	625.6360	420.2851	249.2531	173.4095 (83)
Total gains	741.3344	902.0483	1068.5933	1251.8903	1385.7602	1381.9354	1316.3843	1195.9923	1057.2818	881.2998	744.0285	694.1515 (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	19.5350	19.6159	19.6974	20.1155	20.2013	20.4345	20.4345	20.4345	20.4345	20.2013	20.0305	19.8626
alpha	2.3023	2.3077	2.3132	2.3410	2.3468	2.3623	2.3623	2.3623	2.3623	2.3468	2.3354	2.3242
util living area	0.9686	0.9504	0.9173	0.8513	0.7480	0.6131	0.4904	0.5428	0.7364	0.8927	0.9542	0.9728 (86)
MIT	18.0652	18.3978	18.9402	19.6530	20.2613	20.6852	20.8681	20.8276	20.4801	19.6780	18.7595	18.0281 (87)
Th 2	19.8856	19.8897	19.8937	19.9141	19.9182	19.9292	19.9292	19.9292	19.9292	19.9182	19.9100	19.9019 (88)
util rest of house	0.9640	0.9432	0.9049	0.8281	0.7063	0.5438	0.3928	0.4455	0.6776	0.8710	0.9464	0.9688 (89)
MIT 2	15.9599	16.4427	17.2257	18.2480	19.0847	19.6355	19.8391	19.8036	19.4010	18.3056	16.9827	15.9137 (90)
Living area fraction	16.1478	16.6172	17.3788	18.3734	19.1897	19.7291	19.9309	19.8949	19.4973	18.4281	17.1413	16.1024 (92)
Temperature adjustment	15.9978	16.4672	17.2288	18.2234	19.0397	19.5791	19.7809	19.7449	19.3473	18.2781	16.9913	15.9524 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9375	0.9089	0.8622	0.7814	0.6659	0.5183	0.3780	0.4267	0.6390	0.8250	0.9134	0.9449	(94)
Useful gains	695.0093	819.8458	921.3429	978.1803	922.8220	716.2005	497.5473	510.3863	675.6105	727.0574	679.6057	655.8703	(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	2069.4367	2037.9053	1882.3620	1601.7910	1255.6297	842.0798	537.9575	565.7030	887.4255	1313.5226	1706.5733	2044.8136	(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	1022.5739	818.5360	714.9982	448.9997	247.6089	0.0000	0.0000	0.0000	0.0000	436.3301	739.4166	1033.3738	(98)
Space heating												5461.8372	(98)
Space heating per m2											(98) / (4) =	38.3826	(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													6041.8554	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1022.5739	818.5360	714.9982	448.9997	247.6089	0.0000	0.0000	0.0000	0.0000	436.3301	739.4166	1033.3738	(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)	1131.1659	905.4602	790.9272	496.6811	273.9037	0.0000	0.0000	0.0000	0.0000	482.6661	817.9387	1143.1126	(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	88.3344	88.1703	87.8307	87.0792	85.6501	79.7000	79.7000	79.7000	79.7000	86.9285	87.9277	88.3930	(217)	
Fuel for water heating, kWh/month	244.1495	215.4480	226.7956	204.5761	203.4654	194.8245	186.5829	205.4634	205.3274	212.5252	222.7746	237.9560	(219)	
Water heating fuel used												2559.8887	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6041.8554	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													100.3763	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													175.3763	(231)
Electricity for lighting (calculated in Appendix L)													504.0013	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =													-795.1650	(233)
Total delivered energy for all uses													8485.9567	(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	6041.8554	0.2160	1305.0408	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2559.8887	0.2160	552.9360	(264)
Space and water heating			1857.9767	(265)
Pumps and fans	175.3763	0.5190	91.0203	(267)
Energy for lighting	504.0013	0.5190	261.5767	(268)
Energy saving/generation technologies				
PV Unit	-795.1650	0.5190	-412.6906	(269)
Total CO2, kg/year			1797.8831	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6300	(273)

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

DER			12.6300	ZC1
Total Floor Area		TFA	142.3000	
Assumed number of occupants		N	2.9213	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			12.9931	ZC2
CO2 emissions from cooking, equation (L16)			1.3290	ZC3
Total CO2 emissions			26.9521	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			26.9521	ZC8

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1122 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3622 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3622 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4618	0.4528	0.4437	0.3984	0.3894	0.3441	0.3441	0.3350	0.3622	0.3894	0.4075	0.4256 (22b)
Effective ac	0.6066	0.6025	0.5984	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
TER Room Window (Uw = 1.70)			0.7500	1.5918	1.1938		(27a)
150mm EPS B&B			56.6000	0.1300	7.3580		(28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1800	26.0676		(29a)
W2V	31.8700		31.8700	0.1800	5.7366		(29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.1800	1.6956		(29a)
400mm Mineral Wool	6.4000		6.4000	0.1300	0.8320		(30)
Sloping	22.8900	0.7500	22.1400	0.1300	2.8782		(30)
Dormer Roof	5.1000		5.1000	0.1300	0.6630		(30)
C2V	27.5000		27.5000	0.1300	3.5750		(30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9645		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.9437 (36)
Total fabric heat loss						(33) + (36) =	98.9082 (37)

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

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Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457	(46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	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	
Northeast				12.3200	11.2829	0.6300	0.7000	0.7700			42.4820 (75)	
Southwest				11.1000	36.7938	0.6300	0.7000	0.7700			124.8159 (79)	
Northwest				0.6000	11.2829	0.6300	0.7000	0.7700			2.0689 (81)	
Southwest				0.7500	39.2172	0.6300	0.7000	1.0000			11.6740 (82)	
Solar gains	181.0408	324.9684	487.8043	675.3081	820.0526	841.8380	800.1085	688.0723	552.1976	370.8851	219.8878	152.9526 (83)
Total gains	719.8749	861.4566	1006.4313	1164.8028	1279.2957	1272.4818	1212.5301	1107.1719	986.5791	834.6355	717.3990	676.4303 (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	0.9991	0.9976	0.9924	0.9711	0.9009	0.7464	0.5784	0.6471	0.8873	0.9859	0.9979	0.9993 (86)
MIT	19.6098	19.7727	20.0459	20.4150	20.7388	20.9313	20.9847	20.9740	20.8247	20.4016	19.9412	19.5877 (87)
Th 2	19.9228	19.9255	19.9282	19.9408	19.9432	19.9543	19.9543	19.9563	19.9500	19.9432	19.9384	19.9334 (88)
util rest of house	0.9987	0.9967	0.9896	0.9594	0.8602	0.6547	0.4507	0.5175	0.8247	0.9783	0.9970	0.9991 (89)
MIT 2	18.0622	18.3022	18.7022	19.2411	19.6801	19.9073	19.9485	19.9452	19.8013	19.2302	18.5580	18.0374 (90)
Living area fraction												
MIT	18.2003	18.4335	18.8221	19.3459	19.7746	19.9987	20.0410	20.0371	19.8927	19.3348	18.6815	18.1757 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2003	18.4335	18.8221	19.3459	19.7746	19.9987	20.0410	20.0371	19.8927	19.3348	18.6815	18.1757 (93)

8. Space heating requirement

Utilisation	0.9979	0.9948	0.9852	0.9504	0.8523	0.6590	0.4618	0.5282	0.8205	0.9718	0.9953	0.9984 (94)
Useful gains	718.3498	856.9566	991.4922	1107.0795	1090.3685	838.6275	559.8951	584.8138	809.5032	811.1272	714.0475	675.3748 (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	2366.7896	2297.7398	2086.1828	1745.1098	1345.5686	889.1078	566.6954	597.6670	958.3480	1455.5801	1939.7925	2353.2118 (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	1226.4392	968.2063	814.4498	459.3818	189.8689	0.0000	0.0000	0.0000	0.0000	479.4730	882.5364	1248.3107 (98)
Space heating												6268.6661 (98)

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Space heating per m2

(98) / (4) = 44.0525 (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													6704.4557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1226.4392	968.2063	814.4498	459.3818	189.8689	0.0000	0.0000	0.0000	0.0000	479.4730	882.5364	1248.3107	(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)	1311.6997	1035.5148	871.0693	491.3175	203.0683	0.0000	0.0000	0.0000	0.0000	512.8053	943.8892	1335.0916	(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	88.7035	88.5333	88.1534	87.2004	85.0040	79.8000	79.8000	79.8000	79.8000	87.2152	88.3267	79.8000	(216)
Fuel for water heating, kWh/month	246.0021	217.1604	228.8516	207.1154	208.0049	197.6658	189.5374	208.3942	208.1555	214.7440	224.5559	239.8226	(219)
Water heating fuel used												2590.0099	(219)
Annual totals kWh/year													
Space heating fuel - main system												6704.4557	(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												9873.4669	(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	6704.4557	0.2160	1448.1624	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2590.0099	0.2160	559.4421	(264)
Space and water heating			2007.6046	(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			2308.1062	(272)
Emissions per m2 for space and water heating			14.1083	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8382	(272b)
Emissions per m2 for pumps and fans			0.2735	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1083 * 1.00) + 1.8382 + 0.2735, rounded to 2 d.p.			16.2200	(273)

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1122 (8)	
Pressure test										Yes		
Measured/design AP50											4.9600	
Infiltration rate											0.3602 (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) =	0.3602 (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	0.4593	0.4503	0.4413	0.3962	0.3872	0.3422	0.3422	0.3332	0.3602	0.3872	0.4052	0.4233 (22b)
Effective ac	0.6055	0.6014	0.5974	0.5785	0.5750	0.5586	0.5586	0.5555	0.5649	0.5750	0.5821	0.5896 (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 71.2226	Feb 70.7409	Mar 70.2686	Apr 68.0507	May 67.6357	Jun 65.7040	Jul 65.7040	Aug 65.3462	Sep 66.4480	Oct 67.6357	Nov 68.4752	Dec 69.3528	(38)
Heat transfer coeff	181.5277	181.0460	180.5738	178.3558	177.9408	176.0091	176.0091	175.6514	176.7532	177.9408	178.7803	179.6580	(39)
Average = Sum(39)m / 12 =												178.3538	(39)
HLP	Jan 1.2757	Feb 1.2723	Mar 1.2690	Apr 1.2534	May 1.2505	Jun 1.2369	Jul 1.2369	Aug 1.2344	Sep 1.2421	Oct 1.2505	Nov 1.2564	Dec 1.2625	(40)
HLP (average)												1.2534	(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			
Northeast				12.3200	11.2829	0.7200	0.7000	0.7700	48.5508 (75)			
Southwest				5.8800	36.7938	0.7200	0.7000	0.7700	75.5642 (79)			
Northwest				0.6000	11.2829	0.7200	0.7000	0.7700	2.3645 (81)			
Southwest				5.2200	36.7938	0.7200	0.7000	0.7700	67.0825 (79)			
Southwest				0.7500	39.2172	0.6300	0.7000	1.0000	11.6740 (82)			
Solar gains	205.2360	368.2958	552.7020	765.1313	929.2529	954.0273	906.6985	779.6284	625.6360	420.2851	249.2531	173.4095 (83)
Total gains	660.8678	822.4453	990.7835	1176.5184	1311.9711	1310.3749	1246.7180	1123.8990	984.3261	805.8208	665.7004	614.5449 (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	17.8577	17.9052	17.9520	18.1753	18.2177	18.4176	18.4176	18.4551	18.3401	18.2177	18.1321	18.0435
alpha	2.1905	2.1937	2.1968	2.2117	2.2145	2.2278	2.2278	2.2303	2.2227	2.2145	2.2088	2.2029
util living area	0.9720	0.9545	0.9230	0.8614	0.7644	0.6366	0.5174	0.5713	0.7598	0.9038	0.9595	0.9759 (86)
MIT	17.7930	18.1375	18.7073	19.4507	20.1166	20.6020	20.8238	20.7738	20.3589	19.4793	18.5038	17.7378 (87)
Th 2	19.8599	19.8626	19.8652	19.8775	19.8798	19.8906	19.8906	19.8926	19.8865	19.8798	19.8752	19.8703 (88)
util rest of house	0.9679	0.9479	0.9115	0.8393	0.7239	0.5668	0.4153	0.4710	0.7028	0.8839	0.9526	0.9724 (89)
MIT 2	16.9271	17.2696	17.8328	18.5641	19.1944	19.6340	19.8070	19.7779	19.4366	18.6075	17.6446	16.8789 (90)
Living area fraction	17.0044	17.3470	17.9109	18.6432	19.2767	19.7204	19.8978	19.8668	19.5189	18.6853	17.7213	16.9556 (92)
MIT	17.0044	17.3470	17.9109	18.6432	19.2767	19.7204	19.8978	19.8668	19.5189	18.6853	17.7213	16.9556 (93)
Temperature adjustment												0.0000
adjusted MIT	17.0044	17.3470	17.9109	18.6432	19.2767	19.7204	19.8978	19.8668	19.5189	18.6853	17.7213	16.9556 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	629.7772	762.8311	876.8482	951.9939	916.0751	726.9377	518.7144	526.4287	669.5670	689.5819	621.4807	589.4109 (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	2306.1982	2253.4872	2060.5067	1737.7550	1348.2110	901.2283	580.4378	608.9530	957.8059	1438.7110	1898.8824	2291.6382 (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	1247.2572	1001.7209	880.6419	565.7480	321.5091	0.0000	0.0000	0.0000	0.0000	557.3520	919.7292	1266.4571 (98)
Space heating												6760.4156 (98)
Space heating per m2												(98) / (4) = 47.5082 (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	1654.4854	1302.4672	1334.9503	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6883	0.7515	0.7135	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1138.7993	978.8637	952.5255	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1645.4824	1568.6718	1428.7390	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	364.8118	438.8173	354.3028	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													1157.9319 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	91.2030	109.7043	88.5757	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													289.4830 (107)
Space cooling per m2													2.0343 (108)
Energy for space heating													47.5082 (99)
Energy for space cooling													2.0343 (108)
Total													49.5425 (109)
Dwelling Fabric Energy Efficiency (DFEE)													49.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1122 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3622 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3622 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4618	0.4528	0.4437	0.3984	0.3894	0.3441	0.3441	0.3350	0.3622	0.3894	0.4075	0.4256 (22b)
Effective ac	0.6066	0.6025	0.5984	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			24.0200	1.3258	31.8447		(27)
TER Room Window (Uw = 1.70)			0.7500	1.5918	1.1938		(27a)
150mm EPS B&B			56.6000	0.1300	7.3580		(28a)
140mm Timber Frame	168.5800	23.7600	144.8200	0.1800	26.0676		(29a)
W2V	31.8700		31.8700	0.1800	5.7366		(29a)
Dormer Cheek	11.8000	2.3800	9.4200	0.1800	1.6956		(29a)
400mm Mineral Wool	6.4000		6.4000	0.1300	0.8320		(30)
Sloping	22.8900	0.7500	22.1400	0.1300	2.8782		(30)
Dormer Roof	5.1000		5.1000	0.1300	0.6630		(30)
C2V	27.5000		27.5000	0.1300	3.5750		(30)
Total net area of external elements Aum(A, m ²)			330.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.9645		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.9437 (36)
Total fabric heat loss						(33) + (36) =	98.9082 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	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)
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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	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)
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)

	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)

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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	
Northeast					12.3200	11.2829	0.6300	0.7000	0.7700		42.4820 (75)	
Southwest					11.1000	36.7938	0.6300	0.7000	0.7700		124.8159 (79)	
Northwest					0.6000	11.2829	0.6300	0.7000	0.7700		2.0689 (81)	
Southwest					0.7500	39.2172	0.6300	0.7000	1.0000		11.6740 (82)	
Solar gains	181.0408	324.9684	487.8043	675.3081	820.0526	841.8380	800.1085	688.0723	552.1976	370.8851	219.8878	152.9526 (83)
Total gains	636.6726	779.1178	925.8858	1086.6951	1202.7708	1198.1855	1140.1280	1032.3428	910.8877	756.4208	636.3351	594.0880 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.0373	58.2038	58.3679	59.1515	59.3004	60.0037	60.0037	60.1358	59.7308	59.3004	58.9999	58.6889	
alpha	4.8692	4.8803	4.8912	4.9434	4.9534	5.0002	5.0002	5.0091	4.9821	4.9534	4.9333	4.9126	
util living area	0.9995	0.9984	0.9947	0.9779	0.9181	0.7758	0.6099	0.6836	0.9114	0.9907	0.9988	0.9996	(86)
MIT	19.5556	19.7194	19.9949	20.3700	20.7071	20.9180	20.9807	20.9669	20.7950	20.3532	19.8884	19.5339	(87)
Th 2	19.9228	19.9255	19.9282	19.9408	19.9432	19.9543	19.9543	19.9563	19.9500	19.9432	19.9384	19.9334	(88)
util rest of house	0.9993	0.9979	0.9926	0.9686	0.8821	0.6861	0.4778	0.5514	0.8570	0.9854	0.9983	0.9995	(89)
MIT 2	18.5983	18.7641	19.0407	19.4205	19.7377	19.9149	19.9492	19.9463	19.8268	19.4096	18.9434	18.5851	(90)
Living area fraction	18.6837	18.8493	19.1259	19.5052	19.8242	20.0044	20.0413	20.0374	19.9132	19.4938	19.0277	18.6697	(92)
Temperature adjustment	18.6837	18.8493	19.1259	19.5052	19.8242	20.0044	20.0413	20.0374	19.9132	19.4938	19.0277	18.6697	(93)
adjusted MIT	18.6837	18.8493	19.1259	19.5052	19.8242	20.0044	20.0413	20.0374	19.9132	19.4938	19.0277	18.6697	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	636.0051	776.8133	917.0579	1047.0276	1055.0373	827.8285	557.9567	580.7981	778.4572	742.9407	634.7989	593.6498	(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	2449.0992	2368.3442	2137.6211	1771.7241	1353.8299	890.0476	566.7378	597.7269	961.7400	1482.0892	1997.7863	2436.3920	(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	1348.9420	1069.5087	908.0990	521.7815	222.3017	0.0000	0.0000	0.0000	0.0000	549.9265	981.3509	1371.0002	(98)
Space heating												6972.9105	(98)
Space heating per m2												49.0015	(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	0.8240	0.8954	0.8563	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1275.6610	1091.2315	1069.4046	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1514.3520	1444.0861	1321.7253	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	171.8575	262.5238	187.7266	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			622.1079 (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	42.9644	65.6310	46.9316	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												155.5270 (107)
Energy for space heating												1.0930 (108)
Energy for space cooling												49.0015 (99)
Total												1.0930 (108)
Target Fabric Energy Efficiency (TFEE)												50.0944 (109)
												57.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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		
Infiltration rate													4.9600
Number of sides sheltered													0.2480 (18)
													0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2480 (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													
	0.2728	0.2542	0.2542	0.2418	0.2418	0.2294	0.2294	0.2170	0.2170	0.2356	0.2294	0.2418 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5228	0.5042	0.5042	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 61.4984	Feb 59.3105	Mar 59.3105	Apr 58.8164	May 58.8164	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 58.8164	Nov 58.8164	Dec 58.8164 (38)
Heat transfer coeff	171.8035	169.6156	169.6156	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.4274 (39)

HLP	Jan 1.2073	Feb 1.1920	Mar 1.1920	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)												1.1906 (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	
Northeast				12.3200	14.6176	0.7200	0.7000		0.7700		62.9002 (75)	
Southwest				5.8800	45.1778	0.7200	0.7000		0.7700		92.7826 (79)	
Northwest				0.6000	14.6176	0.7200	0.7000		0.7700		3.0633 (81)	
Southwest				5.2200	45.1778	0.7200	0.7000		0.7700		82.3682 (79)	
Southwest				0.7500	49.4580	0.6300	0.7000		1.0000		14.7224 (82)	
Solar gains	255.8367	392.1738	596.9904	836.6803	963.9516	1085.9004	995.3875	891.3475	710.3528	477.7958	309.9969	204.4420 (83)
Total gains	1035.4768	1166.2763	1342.1127	1536.6034	1616.9132	1697.3874	1583.0614	1488.8911	1334.2972	1147.1761	1029.8478	963.1348 (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	20.1155	20.3750	20.3750	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3410	2.3583	2.3583	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9309	0.9083	0.8575	0.7664	0.6332	0.4519	0.3325	0.3509	0.5825	0.7942	0.8985	0.9385 (86)
MIT	18.7181	18.9917	19.4997	20.0859	20.5819	20.8721	20.9575	20.9522	20.7500	20.1819	19.3858	18.7004 (87)
Th 2	19.9141	19.9264	19.9264	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9211	0.8956	0.8374	0.7331	0.5782	0.3723	0.2320	0.2458	0.5042	0.7552	0.8817	0.9296 (89)
MIT 2	16.9155	17.3126	18.0329	18.8452	19.4977	19.8321	19.9101	19.9075	19.7132	18.9985	17.8863	16.8995 (90)
Living area fraction	17.0764	17.4625	18.1638	18.9560	19.5945	19.9249	20.0036	20.0007	19.8057	19.1041	18.0201	17.0603 (91)
MIT	17.0764	17.4625	18.1638	18.9560	19.5945	19.9249	20.0036	20.0007	19.8057	19.1041	18.0201	17.0603 (92)
Temperature adjustment	16.9264	17.3125	18.0138	18.8060	19.4445	19.7749	19.8536	19.8507	19.6557	18.9541	17.8701	16.9103 (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	0.8819	0.8528	0.7914	0.6915	0.5503	0.3600	0.2245	0.2376	0.4818	0.7113	0.8374	0.8926	(94)
Useful gains	913.1785	994.6202	1062.1629	1062.5915	889.8552	611.0461	355.4337	353.8024	642.8199	815.9624	862.3712	859.7110	(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													
	1980.2684	1935.7379	1766.3491	1489.2798	1072.9924	655.3314	364.2126	363.7344	736.6467	1176.0920	1601.5974	1929.7210	(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													
	793.9149	632.4311	523.9145	307.2155	136.2541	0.0000	0.0000	0.0000	0.0000	267.9364	532.2429	796.0874	(98)
Space heating												3989.9969	(98)
RHI space heating demand												3990	(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	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					4.9600
Infiltration rate					0.2480 (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) =				0.2480 (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	0.3162	0.3100	0.3038	0.2728	0.2666	0.2356	0.2356	0.2294	0.2480	0.2666	0.2790	0.2914 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5662	0.5600	0.5538	0.5228	0.5166	0.5000	0.5000	0.5000	0.5000	0.5166	0.5290	0.5414 (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 66.6037	Feb 65.8744	Mar 65.1450	Apr 61.4984	May 60.7691	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 60.7691	Nov 62.2277	Dec 63.6864 (38)
Heat transfer coeff	176.9088	176.1795	175.4502	171.8035	171.0742	169.1215	169.1215	169.1215	169.1215	171.0742	172.5329	173.9915 (39)
Average = Sum(39)m / 12 =												172.1251 (39)

HLP	Jan 1.2432	Feb 1.2381	Mar 1.2330	Apr 1.2073	May 1.2022	Jun 1.1885	Jul 1.1885	Aug 1.1885	Sep 1.1885	Oct 1.2022	Nov 1.2125	Dec 1.2227 (40)
HLP (average)												1.2096 (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:												180.0000 (47)
Store volume												1.4000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7560 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	215.6681	189.9612	199.1962	178.1433	174.2683	155.2751	148.7066	163.7543	163.6459	184.7450	195.8807	210.3366 (64)
Heat gains from water heating, kWh/month	93.5412	82.8809	88.0642	80.3599	79.7757	72.7562	71.2764	76.2798	75.5395	83.2592	86.2576	91.7684 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	125.7274	123.3346	118.3659	111.6110	107.2254	101.0503	95.8017	102.5266	104.9160	111.9076	119.8022	123.3446 (72)
Total internal gains	779.6400	774.1025	745.1224	699.9232	652.9616	611.4871	587.6739	597.5436	623.9444	669.3803	719.8509	758.6928 (73)

6. Solar gains

[Jan]					Area 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	
Northeast					12.3200	11.2829	0.7200	0.7000				0.7700			48.5508 (75)	
Southwest					5.8800	36.7938	0.7200	0.7000				0.7700			75.5642 (79)	
Northwest					0.6000	11.2829	0.7200	0.7000				0.7700			2.3645 (81)	
Southwest					5.2200	36.7938	0.7200	0.7000				0.7700			67.0825 (79)	
Southwest					0.7500	39.2172	0.6300	0.7000				1.0000			11.6740 (82)	
Solar gains					205.2360	368.2958	552.7020	765.1313	929.2529	954.0273	906.6985	779.6284	625.6360	420.2851	249.2531	173.4095 (83)
Total gains					984.8761	1142.3984	1297.8244	1465.0545	1582.2146	1565.5144	1494.3724	1377.1720	1249.5805	1089.6654	969.1040	932.1023 (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	19.5350	19.6159	19.6974	20.1155	20.2013	20.4345	20.4345	20.4345	20.4345	20.2013	20.0305	19.8626
alpha	2.3023	2.3077	2.3132	2.3410	2.3468	2.3623	2.3623	2.3623	2.3623	2.3468	2.3354	2.3242
util living area	0.9454	0.9230	0.8843	0.8112	0.7031	0.5659	0.4447	0.4902	0.6782	0.8479	0.9245	0.9511 (86)
MIT	18.3448	18.6569	19.1607	19.8161	20.3626	20.7369	20.8934	20.8622	20.5723	19.8607	19.0063	18.3074 (87)
Th 2	19.8856	19.8897	19.8937	19.9141	19.9182	19.9292	19.9292	19.9292	19.9292	19.9182	19.9100	19.9019 (88)
util rest of house	0.9378	0.9125	0.8682	0.7842	0.6588	0.4972	0.3525	0.3971	0.6158	0.8200	0.9125	0.9443 (89)
MIT 2	16.3616	16.8117	17.5339	18.4664	19.2089	19.6881	19.8580	19.8313	19.5050	18.5514	17.3330	16.3159 (90)
Living area fraction	16.5386	16.9764	17.6791	18.5869	19.3119	19.7817	19.9504	19.9233	19.6002	18.6683	17.4823	16.4936 (92)
Temperature adjustment	16.3886	16.8264	17.5291	18.4369	19.1619	19.6317	19.8004	19.7733	19.4502	18.5183	17.3323	16.3436 (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	0.9019	0.8710	0.8219	0.7388	0.6230	0.4761	0.3405	0.3823	0.5834	0.7731	0.8715	0.9107	(94)
Useful gains	888.2763	995.0173	1066.6330	1082.4023	985.7674	745.3431	508.8408	526.5607	728.9984	842.4596	844.5312	848.8686	(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	2138.5755	2101.1864	1935.0574	1638.4725	1276.5335	850.9638	541.2521	570.5022	904.8382	1354.6110	1765.4079	2112.8919	(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	930.2226	743.3457	646.1077	400.3706	216.3300	0.0000	0.0000	0.0000	0.0000	381.0406	663.0312	940.4333	(98)
Space heating												4920.8817	(98)
Space heating per m2											(98) / (4) =	34.5810	(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													5443.4532	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	930.2226	743.3457	646.1077	400.3706	216.3300	0.0000	0.0000	0.0000	0.0000	381.0406	663.0312	940.4333	(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)	1029.0073	822.2850	714.7209	442.8878	239.3031	0.0000	0.0000	0.0000	0.0000	421.5051	733.4416	1040.3024	(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	88.1721	87.9955	87.6277	86.8111	85.2912	79.7000	79.7000	79.7000	79.7000	86.6035	87.7144	88.2348	(217)	
Fuel for water heating, kWh/month	244.5991	215.8761	227.3209	205.2078	204.3215	194.8245	186.5829	205.4634	205.3274	213.3228	223.3164	238.3827	(219)	
Water heating fuel used												2564.5455	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5443.4532	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													100.3763	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													175.3763	(231)
Electricity for lighting (calculated in Appendix L)													504.0013	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =										-795.1650		-795.1650	(233)	
Total delivered energy for all uses												7892.2114	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5443.4532	3.4800	189.4322	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2564.5455	3.4800	89.2462	(247)
Mechanical ventilation fans	100.3763	13.1900	13.2396	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	504.0013	13.1900	66.4778	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-795.1650	13.1900	-104.8823	(252)
Total energy cost			383.4060	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8597	(257)
SAP value		88.0065	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5443.4532	0.2160	1175.7859 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2564.5455	0.2160	553.9418 (264)
Space and water heating			1729.7277 (265)
Pumps and fans	175.3763	0.5190	91.0203 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1669.6341 (272)
CO2 emissions per m2			11.7300 (273)
EI value			88.0549
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	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					4.9600
Infiltration rate					0.2480 (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) =				0.2480 (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	0.2728	0.2542	0.2542	0.2418	0.2418	0.2294	0.2294	0.2170	0.2170	0.2356	0.2294	0.2418 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5228	0.5042	0.5042	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	61.4984	59.3105	59.3105	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164	58.8164 (38)
Average = Sum(39)m / 12 =	171.8035	169.6156	169.6156	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2073	1.1920	1.1920	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	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:													
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)
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	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			
Northeast				12.3200	14.6176	0.7200	0.7000	0.7700	62.9002 (75)			
Southwest				5.8800	45.1778	0.7200	0.7000	0.7700	92.7826 (79)			
Northwest				0.6000	14.6176	0.7200	0.7000	0.7700	3.0633 (81)			
Southwest				5.2200	45.1778	0.7200	0.7000	0.7700	82.3682 (79)			
Southwest				0.7500	49.4580	0.6300	0.7000	1.0000	14.7224 (82)			
Solar gains	255.8367	392.1738	596.9904	836.6803	963.9516	1085.9004	995.3875	891.3475	710.3528	477.7958	309.9969	204.4420 (83)
Total gains	1035.4768	1166.2763	1342.1127	1536.6034	1616.9132	1697.3874	1583.0614	1488.8911	1334.2972	1147.1761	1029.8478	963.1348 (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	20.1155	20.3750	20.3750	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	
alpha	2.3410	2.3583	2.3583	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	
util living area	0.9309	0.9083	0.8575	0.7664	0.6332	0.4519	0.3325	0.3509	0.5825	0.7942	0.8985	0.9385	(86)
MIT	18.7181	18.9917	19.4997	20.0859	20.5819	20.8721	20.9575	20.9522	20.7500	20.1819	19.3858	18.7004	(87)
Th 2	19.9141	19.9264	19.9264	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	(88)
util rest of house	0.9211	0.8956	0.8374	0.7331	0.5782	0.3723	0.2320	0.2458	0.5042	0.7552	0.8817	0.9296	(89)
MIT 2	16.9155	17.3126	18.0329	18.8452	19.4977	19.8321	19.9101	19.9075	19.7132	18.9985	17.8863	16.8995	(90)
Living area fraction	17.0764	17.4625	18.1638	18.9560	19.5945	19.9249	20.0036	20.0007	fLA = Living area / (4) =	19.1041	18.0201	17.0603	(91)
MIT	17.0764	17.4625	18.1638	18.9560	19.5945	19.9249	20.0036	20.0007	19.8057	19.1041	18.0201	17.0603	(92)
Temperature adjustment	16.9264	17.3125	18.0138	18.8060	19.4445	19.7749	19.8536	19.8507	19.6557	18.9541	17.8701	16.9103	(93)
adjusted MIT	16.9264	17.3125	18.0138	18.8060	19.4445	19.7749	19.8536	19.8507	19.6557	18.9541	17.8701	16.9103	(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	0.8819	0.8528	0.7914	0.6915	0.5503	0.3600	0.2245	0.2376	0.4818	0.7113	0.8374	0.8926	(94)
Useful gains	913.1785	994.6202	1062.1629	1062.5915	889.8552	611.0461	355.4337	353.8024	642.8199	815.9624	862.3712	859.7110	(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	1980.2684	1935.7379	1766.3491	1489.2798	1072.9924	655.3314	364.2126	363.7344	736.6467	1176.0920	1601.5974	1929.7210	(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	793.9149	632.4311	523.9145	307.2155	136.2541	0.0000	0.0000	0.0000	0.0000	267.9364	532.2429	796.0874	(98)
Space heating												3989.9969	(98)
Space heating per m2												28.0393	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4413.7133	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	793.9149	632.4311	523.9145	307.2155	136.2541	0.0000	0.0000	0.0000	0.0000	267.9364	532.2429	796.0874	(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)	878.2244	699.5919	579.5514	339.8402	150.7236	0.0000	0.0000	0.0000	0.0000	296.3898	588.7643	880.6277	(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	87.8797	87.6810	87.1760	86.1547	84.0661	79.7000	79.7000	79.7000	79.7000	85.7042	87.2488	87.9328	(217)	
Fuel for water heating, kWh/month	245.4130	216.6505	228.4990	206.7714	207.2992	194.8245	186.5829	205.4634	205.3274	215.5612	224.5081	239.2016	(219)	
Water heating fuel used												2576.1020	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4413.7133	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													100.3763	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													175.3763	(231)
Electricity for lighting (calculated in Appendix L)													504.0013	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =													-882.9989	(233)
Total delivered energy for all uses													6786.1942	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4413.7133	10.2300	451.5229	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2576.1020	10.2300	263.5352	(247)
Mechanical ventilation fans	100.3763	36.7200	36.8582	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	504.0013	36.7200	185.0693	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-882.9989	36.7200	-324.2372	(252)
Total energy cost			743.2884	(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	4413.7133	0.2160	953.3621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2576.1020	0.2160	556.4380	(264)
Space and water heating			1509.8001	(265)
Pumps and fans	175.3763	0.5190	91.0203	(267)
Energy for lighting	504.0013	0.5190	261.5767	(268)
Energy saving/generation technologies				
PV Unit	-882.9989	0.5190	-458.2764	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total kg/year

1404.1207 (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	4413.7133	1.2200	5384.7303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.1020	1.2200	3142.8445 (264)
Space and water heating			8527.5748 (265)
Pumps and fans	175.3763	3.0700	538.4054 (267)
Energy for lighting	504.0013	3.0700	1547.2841 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			7902.4576 (272)
Primary energy kWh/m2/year			55.5338 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 122	-271 kg (19.3%)

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

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

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 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	£818	£678	£140
Space heating	£619	£621	-£3
Water heating	£264	£139	£125
Lighting	£185	£185	£0
Generated (PV)	-£324	-£324	£0
Total cost of fuels	£743	£622	£122
Total cost of uses	£744	£621	£122
Delivered energy	48 kWh/m²	38 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	56 kWh/m ²	45 kWh/m ²	11 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.6000 (1b)	x 2.4100 (2b)	= 136.4060 (1b) - (3b)
First floor	56.6000 (1c)	x 2.6900 (2c)	= 152.2540 (1c) - (3c)
Second floor	29.1000 (1d)	x 2.3300 (2d)	= 67.8030 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.4630 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	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												4.9600	
Infiltration rate												0.2480 (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) =	0.2480 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate													
	0.3162	0.3100	0.3038	0.2728	0.2666	0.2356	0.2356	0.2294	0.2480	0.2666	0.2790	0.2914 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5662	0.5600	0.5538	0.5228	0.5166	0.5000	0.5000	0.5000	0.5000	0.5166	0.5290	0.5414 (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	66.6037	65.8744	65.1450	61.4984	60.7691	58.8164	58.8164	58.8164	58.8164	60.7691	62.2277	63.6864 (38)
Heat transfer coeff	176.9088	176.1795	175.4502	171.8035	171.0742	169.1215	169.1215	169.1215	169.1215	171.0742	172.5329	173.9915 (39)
Average = Sum(39)m / 12 =												172.1251 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2432	1.2381	1.2330	1.2073	1.2022	1.1885	1.1885	1.1885	1.1885	1.2022	1.2125	1.2227 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9213 (42)
Average daily hot water use (litres/day)												103.5818 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9400	109.7967	105.6535	101.5102	97.3669	93.2236	93.2236	97.3669	101.5102	105.6535	109.7967	113.9400 (44)
Energy content	168.9697	147.7820	152.4978	132.9513	127.5699	110.0831	102.0082	117.0559	118.4539	138.0466	150.6887	163.6382 (45)
Energy content (annual)												Total = Sum(45)m = 1629.7453 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3455	22.1673	22.8747	19.9427	19.1355	16.5125	15.3012	17.5584	17.7681	20.7070	22.6033	24.5457 (46)
Water storage loss:												190.0000 (47)
Store volume												1.4514 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7837 (55)
Enter (49) or (54) in (55)												
Total storage loss	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9377	182.0756	189.0700	162.9409	152.7436	134.2196	126.9492	142.9274	149.7942	174.6188	187.4319	201.6061 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1128 (H8)
Utilisation factor												0.5929 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.5818 (H14)
Volume ratio Veff/V												1.0571 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-945.4432 (H17)
Solar input	-27.4160	-45.7494	-77.9164	-104.4234	-129.0063	-126.8337	-125.1575	-109.3508	-85.6436	-58.4845	-32.5193	-22.9425 (63)
Solar input (sum of months) = Sum(63)m =												-945.4432 (63)
Output from w/h	179.5217	136.3263	111.1536	58.5175	23.7373	7.3859	1.7917	33.5766	64.1507	116.1344	154.9126	178.6636 (64)
Total per year (kWh/year) = Sum(64)m =												1065.8719 (64)
Heat gains from water heating, kWh/month	86.5568	76.5724	79.9633	68.1980	62.5559	55.9118	53.8705	59.6183	64.4582	75.1583	79.4985	84.7841 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804	175.2804 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.3466	63.3694	51.5355	39.0157	29.1647	24.6220	26.6050	34.5822	46.4161	58.9359	68.7869	73.3295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	465.6899	470.5223	458.3448	432.4204	399.6954	368.9385	348.3910	343.5586	355.7361	381.6606	414.3856	445.1424 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494	55.4494 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536	-116.8536 (71)
Water heating gains (Table 5)	116.3398	113.9471	107.4775	94.7194	84.0805	77.6553	72.4066	80.1321	89.5252	101.0192	110.4146	113.9571 (72)
Total internal gains	770.2525	764.7150	734.2340	683.0316	629.8167	588.0920	564.2789	575.1491	608.5537	658.4919	710.4633	749.3052 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast					12.3200	11.2829		0.7200	0.7000		0.7700		48.5508 (75)	
Southwest					5.8800	36.7938		0.7200	0.7000		0.7700		75.5642 (79)	
Northwest					0.6000	11.2829		0.7200	0.7000		0.7700		2.3645 (81)	
Southwest					5.2200	36.7938		0.7200	0.7000		0.7700		67.0825 (79)	
Southwest					0.7500	39.2172		0.6300	0.7000		1.0000		11.6740 (82)	
Solar gains	205.2360	368.2958	552.7020	765.1313	929.2529	954.0273	906.6985	779.6284	625.6360	420.2851	249.2531	173.4095	(83)	
Total gains	975.4885	1133.0108	1286.9361	1448.1629	1559.0697	1542.1194	1470.9774	1354.7776	1234.1897	1078.7770	959.7164	922.7148	(84)	

7. Mean internal temperature (heating season)

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

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.5350	19.6159	19.6974	20.1155	20.2013	20.4345	20.4345	20.4345	20.4345	20.2013	20.0305	19.8626
alpha	2.3023	2.3077	2.3132	2.3410	2.3468	2.3623	2.3623	2.3623	2.3623	2.3468	2.3354	2.3242
util living area	0.9464	0.9241	0.8859	0.8144	0.7083	0.5716	0.4503	0.4962	0.6827	0.8503	0.9258	0.9520 (86)
MIT	18.3344	18.6472	19.1507	19.8040	20.3516	20.7310	20.8905	20.8585	20.5657	19.8518	18.9965	18.2967 (87)
Th 2	19.8856	19.8897	19.8937	19.9141	19.9182	19.9292	19.9292	19.9292	19.9292	19.9182	19.9100	19.9019 (88)
util rest of house	0.9389	0.9137	0.8700	0.7876	0.6642	0.5027	0.3573	0.4026	0.6205	0.8227	0.9140	0.9454 (89)
MIT 2	16.3467	16.7980	17.5201	18.4504	19.1955	19.6821	19.8558	19.8284	19.4977	18.5396	17.3191	16.3006 (90)
Living area fraction	16.5241	16.9630	17.6656	18.5712	19.2987	19.7757	19.9482	19.9203	19.5930	18.6567	17.4688	16.4788 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3741	16.8130	17.5156	18.4212	19.1487	19.6257	19.7982	19.7703	19.4430	18.5067	17.3188	16.3288 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9033	0.8725	0.8238	0.7421	0.6279	0.4812	0.3450	0.3874	0.5876	0.7758	0.8732	0.9121 (94)
Useful gains	881.1848	988.5267	1060.1179	1074.6679	978.9060	741.9973	507.5433	524.8240	725.1821	836.8828	838.0444	841.6081 (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	2136.0172	2098.8312	1932.6972	1635.7726	1274.2820	849.9555	540.8764	569.9921	903.6137	1352.6387	1763.0819	2110.3073 (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	933.5953	746.1246	649.1990	403.9953	219.7597	0.0000	0.0000	0.0000	0.0000	383.7224	666.0270	943.9122 (98)
Space heating												4946.3356 (98)
Space heating per m2										(98) / (4) =		34.7599 (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												5471.6102 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	933.5953	746.1246	649.1990	403.9953	219.7597	0.0000	0.0000	0.0000	0.0000	383.7224	666.0270	943.9122 (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)	1032.7381	825.3591	718.1405	446.8975	243.0971	0.0000	0.0000	0.0000	0.0000	424.4716	736.7555	1044.1506 (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	88.4841	88.5632	88.6600	88.8901	89.2322	79.7000	79.7000	79.7000	79.7000	87.6656	88.1664	88.5088 (217)
(217)m	202.8858	153.9311	125.3707	65.8313	26.6017	9.2671	2.2480	42.1288	80.4902	132.4743	175.7048	201.8597 (219)
Fuel for water heating, kWh/month												1218.7935 (219)
Water heating fuel used												
Annual totals kWh/year												
Space heating fuel - main system												5471.6102 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												100.3763 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												225.3763 (231)
Electricity for lighting (calculated in Appendix L)												504.0013 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =										-795.1650		-795.1650 (233)
Total delivered energy for all uses												6624.6164 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5471.6102	3.4800	190.4120 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1218.7935	3.4800	42.4140 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-795.1650	13.1900	-104.8823 (252)
Total energy cost			344.1487 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.7717 (257)
SAP value			89.2346
SAP rating (Section 12)			89 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5471.6102	0.2160	1181.8678 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1218.7935	0.2160	263.2594 (264)
Space and water heating			1445.1272 (265)
Pumps and fans	225.3763	0.5190	116.9703 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1410.9836 (272)
CO2 emissions per m2			9.9200 (273)
EI value			89.9054
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											4.9600	
Infiltration rate											0.2480 (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) =	0.2480 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Adj infilt rate	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
	0.2728	0.2542	0.2542	0.2418	0.2418	0.2294	0.2294	0.2170	0.2170	0.2356	0.2294	0.2418 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5228	0.5042	0.5042	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/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 61.4984	Feb 59.3105	Mar 59.3105	Apr 58.8164	May 58.8164	Jun 58.8164	Jul 58.8164	Aug 58.8164	Sep 58.8164	Oct 58.8164	Nov 58.8164	Dec 58.8164 (38)
Heat transfer coeff	171.8035	169.6156	169.6156	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215	169.1215 (39)
Average = Sum(39)m / 12 =												169.4274 (39)

HLP	Jan 1.2073	Feb 1.1920	Mar 1.1920	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)												1.1906 (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:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	206.9377	182.0756	189.0700	162.9409	152.7436	134.2196	126.9492	142.9274	149.7942	174.6188	187.4319	201.6061 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2376 (H8)
Utilisation factor												0.5543 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.5818 (H14)
Volume ratio Veff/V												1.0571 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-982.9869 (H17)
Solar input	-32.2693	-45.8849	-78.8651	-106.4073	-124.3630	-134.0858	-127.6391	-116.3347	-90.9041	-62.5155	-38.1661	-25.5520 (63)
	Solar input (sum of months) = Sum(63)m =											-982.9869 (63)
Output from w/h	174.6684	136.1908	110.2049	56.5336	28.3805	0.1338	0.0000	26.5927	58.8901	112.1033	149.2658	176.0541 (64)
	Total per year (kWh/year) = Sum(64)m =											1029.0181 (64)
Heat gains from water heating, kWh/month	86.5568	76.5724	79.9633	68.1980	62.5559	55.9118	53.8705	59.6183	64.4582	75.1583	79.4985	84.7841 (65)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1155	20.3750	20.3750	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345	20.4345
alpha	2.3410	2.3583	2.3583	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623	2.3623
util living area	0.9321	0.9096	0.8593	0.7698	0.6385	0.4568	0.3369	0.3555	0.5869	0.7969	0.9001	0.9396 (86)
MIT	18.7080	18.9823	19.4905	20.0756	20.5737	20.8690	20.9563	20.9509	20.7458	20.1745	19.3767	18.6901 (87)
Th 2	19.9141	19.9264	19.9264	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292	19.9292 (88)
util rest of house	0.9224	0.8970	0.8395	0.7368	0.5837	0.3767	0.2353	0.2493	0.5085	0.7583	0.8835	0.9309 (89)
MIT 2	16.9012	17.2995	18.0204	18.8320	19.4886	19.8296	19.9095	19.9068	19.7091	18.9892	17.8737	16.8848 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0625	17.4497	18.1516	18.9430	19.5854	19.9223	20.0029	20.0000	19.8016	19.0950	18.0078	17.0459 (92)
Temperature adjustment												
adjusted MIT	16.9125	17.2997	18.0016	18.7930	19.4354	19.7723	19.8529	19.8500	19.6516	18.9450	17.8578	16.8959 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8834	0.8544	0.7935	0.6949	0.5553	0.3641	0.2276	0.2410	0.4857	0.7141	0.8393	0.8942 (94)
Useful gains	906.4983	988.4926	1056.2681	1056.0824	884.9450	609.5309	355.0543	353.3706	640.5489	811.4549	856.5183	852.8317 (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	1977.8854	1933.5618	1764.2716	1487.0812	1071.4579	654.8956	364.1014	363.6076	735.9553	1174.5469	1599.5203	1927.2967 (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	797.1120	635.0865	526.7546	310.3191	138.7656	0.0000	0.0000	0.0000	0.0000	270.1404	534.9615	799.4020 (98)
Space heating												4012.5417 (98)
Space heating per m2												(98) / (4) = 28.1978 (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												4438.6524 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	797.1120	635.0865	526.7546	310.3191	138.7656	0.0000	0.0000	0.0000	0.0000	270.1404	534.9615	799.4020 (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)	881.7611	702.5293	582.6931	343.2734	153.5018	0.0000	0.0000	0.0000	0.0000	298.8279	591.7715	884.2942 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	174.6684	136.1908	110.2049	56.5336	28.3805	0.1338	0.0000	26.5927	58.8901	112.1033	149.2658	176.0541 (64)
Efficiency of water heater	88.2700	88.3066	88.3478	88.5676	88.3852	79.7000	79.7000	79.7000	79.7000	86.9755	87.8277	79.7000 (216)
(217)m	88.2700	88.3066	88.3478	88.5676	88.3852	79.7000	79.7000	79.7000	79.7000	86.9755	87.8277	88.2614 (217)
Fuel for water heating, kWh/month	197.8797	154.2249	124.7398	63.8310	32.1100	0.1679	0.0000	33.3660	73.8897	128.8907	169.9529	199.4691 (219)
Water heating fuel used	197.8797	154.2249	124.7398	63.8310	32.1100	0.1679	0.0000	33.3660	73.8897	128.8907	169.9529	1178.5219 (219)
Annual totals kWh/year												
Space heating fuel - main system												4438.6524 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												100.3763 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												225.3763 (231)
Electricity for lighting (calculated in Appendix L)												504.0013 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =										-882.9989		-882.9989 (233)
Total delivered energy for all uses												5463.5530 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4438.6524	10.2300	454.0741 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1178.5219	10.2300	120.5628 (247)
Mechanical ventilation fans	100.3763	36.7200	36.8582 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	504.0013	36.7200	185.0693 (250)
Additional standing charges			103.0000 (251)

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Energy saving/generation technologies			
PV Unit	-882.9989	36.7200	-324.2372 (252)
Total energy cost			621.2272 (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	4438.6524	0.2160	958.7489 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.5219	0.2160	254.5607 (264)
Space and water heating			1213.3096 (265)
Pumps and fans	225.3763	0.5190	116.9703 (267)
Energy for lighting	504.0013	0.5190	261.5767 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			1133.5802 (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	4438.6524	1.2200	5415.1559 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.5219	1.2200	1437.7967 (264)
Space and water heating			6852.9526 (265)
Pumps and fans	225.3763	3.0700	691.9054 (267)
Energy for lighting	504.0013	3.0700	1547.2841 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			6381.3354 (272)
Primary energy kWh/m2/year			44.8442 (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 East
Overshading	Average or unknown
Thermal mass parameter	87.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	470.53 (P1)
Transmission heat loss coefficient	110.31 (P7)
Summer heat loss coefficient	580.84 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	12.3200	106.0502	0.7200	0.7000	0.9000	533.3814
South West	5.8800	127.3119	0.7200	0.7000	0.9000	305.6059
North West	0.6000	106.0502	0.7200	0.7000	0.9000	25.9764
South West	5.2200	127.3119	0.7200	0.7000	0.9000	271.3032
South West	0.7500	205.2157	0.6300	0.7000	1.0000	61.0876

total: 1197.3544

Solar gains	Jun 1291	Jul 1197	Aug 1049	(P3)
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Internal gains	608	585	595	
Total summer gains	1900	1782	1644	(P5)
Summer gain/loss ratio	3.27	3.07	2.83	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 87.4)	1.39	1.39	1.39	
Threshold temperature	20.06	21.76	21.52	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			