

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-202				Issued on Date	09/06/2023
Assessment Reference	As Built	Prop Type Ref	C Det As			
Property	8, Gore Copse Drive, Fair Oak, EASTLEIGH, SO50 7QT					
SAP Rating	87 B	DER	14.03	TER	17.50	
Environmental	87 B	% DER<TER	19.84			
CO ₂ Emissions (t/year)	1.26	DFEE	51.33	TFEE	59.11	
General Requirements Compliance	Pass	% DFEE<TFEE	13.17			
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 111 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) 17.50 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (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	0.11 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.76 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC SYSTEM s18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.20 kWh/day	
Permitted by DBSCG 2.03	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): Medium OK

Based on:

Overshading:	Average
Windows facing North:	3.34 m ² , No overhang
Windows facing East:	7.17 m ² , No overhang
Windows facing South:	8.00 m ² , No overhang
Windows facing West:	8.00 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Photovoltaic array	0.66 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	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (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	(8)
Measured/design AP50												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2380 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(33)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.4599	Feb 50.9066	Mar 50.3534	Apr 47.5872	May 47.0340	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 47.0340	Nov 48.1405	Dec 49.2469 (38)
Heat transfer coeff	149.6774	149.1242	148.5709	145.8048	145.2515	144.7076	144.7076	144.7076	144.7076	145.2515	146.3580	147.4645 (39)
Average = Sum(39)m / 12 =												146.3611 (39)
HLP	Jan 1.3484	Feb 1.3435	Mar 1.3385	Apr 1.3136	May 1.3086	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3086	Nov 1.3185	Dec 1.3285 (40)
HLP (average)												1.3186 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum(45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
								Total per year (kWh/year) = Sum(64)m =				2102.5532 (64)
Heat gains from water heating, kWh/month	89.5663	79.3278	84.2157	76.7478	76.1185	69.3196	67.8154	72.7033	72.0387	79.5216	82.5094	87.8344 (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	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3368	21.6157	17.5791	13.3085	9.9483	8.3987	9.0751	11.7962	15.8329	20.1034	23.4637	25.0132 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.9850	275.8177	268.6793	253.4825	234.2993	216.2698	204.2250	201.3923	208.5307	223.7274	242.9106	260.9402 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035 (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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279 (71)
Water heating gains (Table 5)	120.3848	118.0473	113.1932	106.5941	102.3098	96.2772	91.1497	97.7194	100.0537	106.8839	114.5964	118.0570 (72)
Total internal gains	486.0170	483.7912	467.7621	441.6957	414.8679	389.2562	372.7603	379.2184	392.7276	419.0252	449.2812	472.3209 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					3.3400	10.6334	0.7200	0.7000	0.7700	12.4046 (74)		
East					7.1700	19.6403	0.7200	0.7000	0.7700	49.1847 (76)		
South					8.0000	46.7521	0.7200	0.7000	0.7700	130.6335 (78)		
West					3.4800	19.6403	0.7200	0.7000	0.7700	23.8721 (80)		
West					4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (80)		
Solar gains	247.1012	441.2193	648.0585	861.6594	1007.3478	1015.6034	972.9062	863.8445	723.0278	500.5296	299.9023	208.7968 (83)
Total gains	733.1182	925.0104	1115.8206	1303.3551	1422.2156	1404.8596	1345.6665	1243.0629	1115.7554	919.5549	749.1835	681.1177 (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	17.9941	18.0608	18.1281	18.4720	18.5424	18.6121	18.6121	18.6121	18.5424	18.4022	18.2641	
alpha	2.1996	2.2041	2.2085	2.2315	2.2362	2.2408	2.2408	2.2408	2.2362	2.2268	2.2176	
util living area	0.9515	0.9212	0.8717	0.7870	0.6730	0.5400	0.4220	0.4648	0.6523	0.8387	0.9289	0.9580 (86)
MIT	18.0781	18.4844	19.0774	19.7878	20.3527	20.7242	20.8867	20.8552	20.5541	19.7842	18.8069	18.0203 (87)
Th 2	19.8031	19.8069	19.8108	19.8302	19.8341	19.8380	19.8380	19.8380	19.8341	19.8341	19.8263	19.8186 (88)
util rest of house	0.9444	0.9100	0.8535	0.7566	0.6249	0.4674	0.3261	0.3677	0.5848	0.8083	0.9169	0.9518 (89)
MIT 2	15.9433	16.5265	17.3713	18.3712	19.1298	19.5938	19.7664	19.7405	19.4094	18.3953	17.0081	15.8661 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	16.2452	16.8034	17.6126	18.5715	19.3027	19.7537	19.9248	19.8982	19.5713	18.5918	17.2625	16.1708 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0952	16.6534	17.4626	18.4215	19.1527	19.6037	19.7748	19.7482	19.4213	18.4418	17.1125	16.0208 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9100	0.8674	0.8057	0.7120	0.5928	0.4514	0.3205	0.3595	0.5569	0.7611	0.8761	0.9203 (94)
Useful gains	667.1266	802.3983	898.9687	928.0427	843.0774	634.1144	431.3339	446.9371	621.4168	699.8726	656.3314	626.8377 (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	1765.4796	1752.7215	1628.7291	1388.2864	1082.5210	724.0732	459.4232	484.5101	770.0289	1139.0301	1465.4093	1743.1490 (97)

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Month fraction	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	817.1746	638.6172	542.9417	331.3755	178.1461	0.0000	0.0000	0.0000	0.0000	326.7331	582.5360	830.5356 (98)
Space heating												4248.0598 (98)
Space heating per m2										(98) / (4) =		38.2708 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4688.8077 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	817.1746	638.6172	542.9417	331.3755	178.1461	0.0000	0.0000	0.0000	0.0000	326.7331	582.5360	830.5356 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	901.9587	704.8755	599.2734	365.7566	196.6292	0.0000	0.0000	0.0000	0.0000	360.6326	642.9758	916.7059 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
Efficiency of water heater	88.1997	87.9702	87.5337	86.6381	85.0711	79.9000	79.9000	79.9000	79.9000	86.5112	87.7204	79.9000 (216)
Fuel for water heating, kWh/month	236.3058	208.6240	219.7200	198.3369	197.4542	187.1024	178.9795	197.3781	197.3373	205.9982	215.6435	230.2009 (219)
Water heating fuel used												2473.0810 (219)
Annual totals kWh/year												
Space heating fuel - main system												4688.8077 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												78.8662 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												153.8662 (231)
Electricity for lighting (calculated in Appendix L)												429.7957 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =										-563.9412		-563.9412 (233)
Total delivered energy for all uses												7181.6093 (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	4688.8077	0.2160	1012.7825 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2473.0810	0.2160	534.1855 (264)
Space and water heating			1546.9680 (265)
Pumps and fans	153.8662	0.5190	79.8566 (267)
Energy for lighting	429.7957	0.5190	223.0639 (268)
Energy saving/generation technologies			
PV Unit	-563.9412	0.5190	-292.6855 (269)
Total CO2, kg/year			1557.2030 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (273)

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

DER			14.0300 ZC1
Total Floor Area		TFA	111.0000
Assumed number of occupants		N	2.8207
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.5734 ZC2
CO2 emissions from cooking, equation (L16)			1.6820 ZC3
Total CO2 emissions			30.2854 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			30.2854 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (5)

2. Ventilation rate

											main	secondary	other	total	m3 per hour			
											heating	heating						
Number of chimneys											0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues											0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																	4 * 10 =	40.0000 (7a)
Number of passive vents																	0 * 10 =	0.0000 (7b)
Number of flueless gas fires																	0 * 40 =	0.0000 (7c)
											Air changes per hour							
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1420 (8)
Pressure test											Yes							
Measured/design AP50											5.0000							
Infiltration rate											0.3920 (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) =					0.3920 (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	0.4998	0.4900	0.4802	0.4312	0.4214	0.3724	0.3724	0.3626	0.3920	0.4214	0.4410	0.4606 (22b)						
Effective ac	0.6249	0.6200	0.6153	0.5930	0.5888	0.5693	0.5693	0.5657	0.5768	0.5888	0.5972	0.6061 (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					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			25.6200	1.3258	33.9659		(27)					
150mm EPS B&B			56.2000	0.1300	7.3060		(28a)					
140mm Timber Frame	161.1400	27.7400	133.4000	0.1800	24.0120		(29a)					
400mm Mineral Wool	54.8000		54.8000	0.1300	7.1240		(30)					
Bay Plane	1.4000		1.4000	0.1300	0.1820		(31)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.7099		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4536 (36)					
Total fabric heat loss						(33) + (36) =	89.1635 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.1013	Feb 57.6504	Mar 57.2084	Apr 55.1326	May 54.7442	Jun 52.9363	Jul 52.9363	Aug 52.6015	Sep 53.6327	Oct 54.7442	Nov 55.5299	Dec 56.3513 (38)
Heat transfer coeff	147.2648	146.8139	146.3719	144.2961	143.9078	142.0998	142.0998	141.7650	142.7962	143.9078	144.6934	145.5148 (39)
Average = Sum(39)m / 12 =												144.2943 (39)
HLP	Jan 1.3267	Feb 1.3226	Mar 1.3187	Apr 1.3000	May 1.2965	Jun 1.2802	Jul 1.2802	Aug 1.2772	Sep 1.2865	Oct 1.2965	Nov 1.3035	Dec 1.3109 (40)
HLP (average)												1.2999 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Daily hot water use	Jan 111.3107	Feb 107.2630	Mar 103.2154	Apr 99.1677	May 95.1201	Jun 91.0724	Jul 91.0724	Aug 95.1201	Sep 99.1677	Oct 103.2154	Nov 107.2630	Dec 111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum(45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

Temperature factor from Table 2b											0.5400 (49)
Enter (49) or (54) in (55)											0.8102 (55)
Total storage loss											
	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	25.1153 (56)
If cylinder contains dedicated solar storage											
	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624 (58)	
Total heat required for water heating calculated for each month											
	213.4483	188.0678	197.3564	176.7004	173.0038	154.3600	148.0320	162.7324	162.5376	183.2388	208.2397 (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	213.4483	188.0678	197.3564	176.7004	173.0038	154.3600	148.0320	162.7324	162.5376	183.2388	208.2397 (64)
								Total per year (kWh/year) = Sum(64)m = 2161.7456 (64)			
Heat gains from water heating, kWh/month											
	93.5881	82.9604	88.2376	80.6399	80.1403	73.2117	71.8372	76.7251	75.9308	83.5435	91.8563 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3368	21.6157	17.5791	13.3085	9.9483	8.3987	9.0751	11.7962	15.8329	20.1034	23.4637	25.0132 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.9850	275.8177	268.6793	253.4825	234.2993	216.2698	204.2250	201.3923	208.5307	223.7274	242.9106	260.9402 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035 (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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279 (71)
Water heating gains (Table 5)	125.7905	123.4530	118.5989	111.9999	107.7155	101.6829	96.5554	103.1251	105.4594	112.2896	120.0021	123.4627 (72)
Total internal gains	491.4227	489.1969	473.1678	447.1014	420.2736	394.6619	378.1660	384.6241	398.1333	424.4309	454.6869	477.7266 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.2200	10.6334	0.6300	0.7000	0.7700		10.4640 (74)	
East					6.9300	19.6403	0.6300	0.7000	0.7700		41.5961 (76)	
South					7.7400	46.7521	0.6300	0.7000	0.7700		110.5894 (78)	
West					7.7300	19.6403	0.6300	0.7000	0.7700		46.3979 (80)	

Solar gains	209.0475	373.2492	548.1730	728.7758	851.9347	858.8913	822.7928	730.5999	611.5611	423.4085	253.7131	176.6448 (83)
Total gains	700.4702	862.4461	1021.3408	1175.8771	1272.2083	1253.5532	1200.9588	1115.2240	1009.6945	847.8394	708.4000	654.3713 (84)

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	52.3434	52.5041	52.6626	53.4202	53.5644	54.2459	54.2459	54.3740	53.9814	53.5644	53.2736	52.9728
alpha	4.4896	4.5003	4.5108	4.5613	4.5710	4.6164	4.6164	4.6249	4.5988	4.5710	4.5516	4.5315
util living area	0.9975	0.9932	0.9805	0.9395	0.8406	0.6713	0.5080	0.5634	0.8112	0.9663	0.9944	0.9981 (86)
MIT	19.5568	19.7637	20.0798	20.4719	20.7784	20.9438	20.9875	20.9803	20.8628	20.4418	19.9244	19.5274 (87)
Th 2	19.8200	19.8231	19.8262	19.8409	19.8436	19.8564	19.8564	19.8588	19.8515	19.8436	19.8381	19.8323 (88)
util rest of house	0.9966	0.9908	0.9735	0.9174	0.7853	0.5725	0.3824	0.4341	0.7277	0.9496	0.9920	0.9975 (89)
MIT 2	17.9141	18.2175	18.6765	19.2377	19.6349	19.8210	19.8522	19.8513	19.7469	19.2098	18.4633	17.8795 (90)
Living area fraction									fLA = Living area / (4)			0.1414 (91)
MIT	18.1464	18.4362	18.8750	19.4123	19.7966	19.9798	20.0127	20.0109	19.9047	19.3841	18.6700	18.1126 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1464	18.4362	18.8750	19.4123	19.7966	19.9798	20.0127	20.0109	19.9047	19.3841	18.6700	18.1126 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9946	0.9866	0.9656	0.9071	0.7827	0.5840	0.4001	0.4522	0.7322	0.9405	0.9884	0.9959 (94)
Useful gains	696.6641	850.9250	986.2466	1066.6245	995.7220	732.0376	480.5274	504.2531	739.3111	797.4141	700.1776	651.7140 (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	2039.0899	1987.3051	1811.3518	1516.8826	1165.1691	764.4686	484.9501	511.9060	828.8897	1264.0937	1674.1028	2024.4858 (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	998.7648	763.6475	613.8782	324.1858	126.0686	0.0000	0.0000	0.0000	0.0000	347.2096	701.2261	1021.3422 (98)
Space heating												4896.3228 (98)
Space heating per m2										(98) / (4) =		44.1110 (99)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													5236.7089 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	998.7648	763.6475	613.8782	324.1858	126.0686	0.0000	0.0000	0.0000	0.0000	347.2096	701.2261	1021.3422	(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)	1068.1976	816.7352	656.5543	346.7228	134.8328	0.0000	0.0000	0.0000	0.0000	371.3472	749.9745	1092.3446	(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	213.4483	188.0678	197.3564	176.7004	173.0038	154.3600	148.0320	162.7324	162.5376	183.2388	194.0285	208.2397	(64)
Efficiency of water heater (217)m	88.4126	88.1640	87.6411	86.4125	83.9857	79.8000	79.8000	79.8000	79.8000	86.4937	87.9443	79.8000	(216)
Fuel for water heating, kWh/month	241.4229	213.3159	225.1870	204.4847	205.9919	193.4335	185.5037	203.9253	203.6812	211.8521	220.6266	235.3243	(219)
Water heating fuel used												2544.7492	(219)
Annual totals kWh/year													
Space heating fuel - main system												5236.7089	(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)												429.7957	(232)
Total delivered energy for all uses												8286.2538	(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	5236.7089	0.2160	1131.1291 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2544.7492	0.2160	549.6658 (264)
Space and water heating			1680.7950 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	429.7957	0.5190	223.0639 (268)
Total CO2, kg/m2/year			1942.7839 (272)
Emissions per m2 for space and water heating			15.1423 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0096 (272b)
Emissions per m2 for pumps and fans			0.3507 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1423 * 1.00) + 2.0096 + 0.3507, rounded to 2 d.p.			17.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (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) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					4.7600
Infiltration rate					0.3800 (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) =	0.3800 (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	0.4845	0.4750	0.4655	0.4180	0.4085	0.3610	0.3610	0.3515	0.3800	0.4085	0.4275	0.4465 (22b)
Effective ac	0.6173	0.6128	0.6083	0.5873	0.5834	0.5651	0.5651	0.5618	0.5722	0.5834	0.5914	0.5997 (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)			21.9900	1.3258	29.1534		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)
Total net area of external elements Aum(A, m ²)			273.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(33)
Timber GF			82.7100			9.0000	744.3900 (32c)
Timber FF			118.3700			9.0000	1065.3300 (32c)
Internal Floor			54.8000			18.0000	986.4000 (32d)
Internal Ceiling			54.8000			9.0000	493.2000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9202.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 82.9073 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.7148 (36)
Total fabric heat loss (33) + (36) = 98.2175 (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	57.4012	56.9775	56.5622	54.6115	54.2466	52.5476	52.5476	52.2330	53.2020	54.2466	54.9849	55.7568 (38)
Heat transfer coeff	155.6187	155.1950	154.7797	152.8291	152.4641	150.7652	150.7652	150.4505	151.4196	152.4641	153.2024	153.9743 (39)
Average = Sum(39)m / 12 =												152.8273 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4020	1.3982	1.3944	1.3768	1.3736	1.3582	1.3582	1.3554	1.3641	1.3736	1.3802	1.3872 (40)
HLP (average)												1.3768 (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 2.8207 (42)
Average daily hot water use (litres/day) 101.1916 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1592.1372 (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	35.0775	30.6790	31.6580	27.6002	26.4830	22.8529	21.1765	24.3004	24.5906	28.6580	31.2824	33.9707 (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	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3368	21.6157	17.5791	13.3085	9.9483	8.3987	9.0751	11.7962	15.8329	20.1034	23.4637	25.0132	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.9850	275.8177	268.6793	253.4825	234.2993	216.2698	204.2250	201.3923	208.5307	223.7274	242.9106	260.9402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	(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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	(71)
Water heating gains (Table 5)	47.1472	45.6533	42.5511	38.3336	35.5955	31.7401	28.4631	32.6618	34.1536	38.5188	43.4478	45.6595	(72)
Total internal gains	409.7794	408.3972	394.1199	370.4351	345.1535	321.7191	307.0737	311.1607	323.8276	347.6601	375.1326	396.9233	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				3.3400	10.6334	0.7200	0.7000	0.7700	12.4046 (74)				
East				7.1700	19.6403	0.7200	0.7000	0.7700	49.1847 (76)				
South				8.0000	46.7521	0.7200	0.7000	0.7700	130.6335 (78)				
West				3.4800	19.6403	0.7200	0.7000	0.7700	23.8721 (80)				
West				4.5200	19.6403	0.7200	0.7000	0.7700	31.0063 (80)				
Solar gains	247.1012	441.2193	648.0585	861.6594	1007.3478	1015.6034	972.9062	863.8445	723.0278	500.5296	299.9023	208.7968	(83)
Total gains	656.8806	849.6164	1042.1785	1232.0945	1352.5013	1337.3225	1279.9799	1175.0052	1046.8553	848.1898	675.0349	605.7202	(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	16.4267	16.4716	16.5158	16.7266	16.7666	16.9556	16.9556	16.9910	16.8823	16.7666	16.6858	16.6022	
alpha	2.0951	2.0981	2.1011	2.1151	2.1178	2.1304	2.1304	2.1327	2.1255	2.1178	2.1124	2.1068	
util living area	0.9575	0.9288	0.8822	0.8030	0.6952	0.5649	0.4477	0.4923	0.6794	0.8559	0.9379	0.9636	(86)
MIT	17.7795	18.2014	18.8282	19.5817	20.2111	20.6522	20.8500	20.8111	20.4473	19.5803	18.5347	17.7080	(87)
Th 2	19.7618	19.7647	19.7676	19.7811	19.7837	19.7955	19.7955	19.7977	19.7909	19.7837	19.7785	19.7732	(88)
util rest of house	0.9512	0.9186	0.8651	0.7737	0.6472	0.4902	0.3457	0.3901	0.6119	0.8275	0.9273	0.9582	(89)
MIT 2	16.8496	17.2658	17.8792	18.6105	19.1939	19.5833	19.7302	19.7099	19.4245	18.6304	17.6097	16.7863	(90)
Living area fraction	16.9811	17.3981	18.0135	18.7478	19.3378	19.7345	19.8886	19.8656	19.5692	18.7648	17.7406	16.9167	(91)
MIT	16.9811	17.3981	18.0135	18.7478	19.3378	19.7345	19.8886	19.8656	19.5692	18.7648	17.7406	16.9167	(92)
Temperature adjustment	16.9811	17.3981	18.0135	18.7478	19.3378	19.7345	19.8886	19.8656	19.5692	18.7648	17.7406	16.9167	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	611.6465	758.0359	869.2337	916.6066	848.3090	649.9629	453.3497	465.7689	625.6793	676.2852	609.3931	569.4543	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1973.4192	1939.6500	1782.0492	1505.0362	1164.4856	774.1058	495.8055	521.4056	828.1437	1244.8392	1630.1604	1958.0406	(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	1013.1589	794.0447	679.1347	423.6693	235.2354	0.0000	0.0000	0.0000	0.0000	423.0042	734.9524	1033.1082	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 48.0748 (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	

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1417.1925	1115.6621	1143.4240	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7351	0.7932	0.7641	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1041.8205	884.9124	873.7000	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1673.7554	1604.2863	1483.5850	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	454.9932	535.2142	453.7544	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1443.9617	(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	113.7483	133.8035	113.4386	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												360.9904	(107)
Space cooling per m2												3.2522	(108)
Energy for space heating												48.0748	(99)
Energy for space cooling												3.2522	(108)
Total												51.3270	(109)
Dwelling Fabric Energy Efficiency (DFEE)												51.3	(109)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (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) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3920 (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) =	0.3920 (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	0.4998	0.4900	0.4802	0.4312	0.4214	0.3724	0.3724	0.3626	0.3920	0.4214	0.4410	0.4606 (22b)
Effective ac	0.6249	0.6200	0.6153	0.5930	0.5888	0.5693	0.5693	0.5657	0.5768	0.5888	0.5972	0.6061 (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)			25.6200	1.3258	33.9659		(27)
150mm EPS B&B			56.2000	0.1300	7.3060		(28a)
140mm Timber Frame	161.1400	27.7400	133.4000	0.1800	24.0120		(29a)
400mm Mineral Wool	54.8000		54.8000	0.1300	7.1240		(30)
Bay Plane	1.4000		1.4000	0.1300	0.1820		(31)
Total net area of external elements Aum(A, m ²)			273.5400				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	74.7099	(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)							14.4536 (36)
Total fabric heat loss						(33) + (36) =	89.1635 (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	58.1013	57.6504	57.2084	55.1326	54.7442	52.9363	52.9363	52.6015	53.6327	54.7442	55.5299	56.3513 (38)
Heat transfer coeff	147.2648	146.8139	146.3719	144.2961	143.9078	142.0998	142.0998	141.7650	142.7962	143.9078	144.6934	145.5148 (39)
Average = Sum(39)m / 12 =												144.2943 (39)
HLP	1.3267	1.3226	1.3187	1.3000	1.2965	1.2802	1.2802	1.2772	1.2865	1.2965	1.3035	1.3109 (40)
HLP (average)												1.2999 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy content (annual)	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Distribution loss (46)m = 0.15 x (45)m												1592.1372 (45)
Water 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 (46)
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)

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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	35.0775	30.6790	31.6580	27.6002	26.4830	22.8529	21.1765	24.3004	24.5906	28.6580	31.2824	33.9707 (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	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	141.0348	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.3368	21.6157	17.5791	13.3085	9.9483	8.3987	9.0751	11.7962	15.8329	20.1034	23.4637	25.0132	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	272.9850	275.8177	268.6793	253.4825	234.2993	216.2698	204.2250	201.3923	208.5307	223.7274	242.9106	260.9402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	37.1035	(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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	(71)
Water heating gains (Table 5)	47.1472	45.6533	42.5511	38.3336	35.5955	31.7401	28.4631	32.6618	34.1536	38.5188	43.4478	45.6595	(72)
Total internal gains	409.7794	408.3972	394.1199	370.4351	345.1535	321.7191	307.0737	311.1607	323.8276	347.6601	375.1326	396.9233	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2200	10.6334	0.6300	0.7000	0.7700	10.4640	(74)
East	6.9300	19.6403	0.6300	0.7000	0.7700	41.5961	(76)
South	7.7400	46.7521	0.6300	0.7000	0.7700	110.5894	(78)
West	7.7300	19.6403	0.6300	0.7000	0.7700	46.3979	(80)

Solar gains	209.0475	373.2492	548.1730	728.7758	851.9347	858.8913	822.7928	730.5999	611.5611	423.4085	253.7131	176.6448	(83)
Total gains	618.8269	781.6464	942.2929	1099.2109	1197.0882	1180.6103	1129.8665	1041.7606	935.3887	771.0686	628.8457	573.5681	(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	52.3434	52.5041	52.6626	53.4202	53.5644	54.2459	54.2459	54.3740	53.9814	53.5644	53.2736	52.9728	
alpha	4.4896	4.5003	4.5108	4.5613	4.5710	4.6164	4.6164	4.6249	4.5988	4.5710	4.5516	4.5315	
util living area	0.9985	0.9954	0.9856	0.9514	0.8630	0.7013	0.5367	0.5971	0.8420	0.9760	0.9965	0.9989	(86)
MIT	19.4906	19.6993	20.0201	20.4233	20.7485	20.9327	20.9844	20.9751	20.8368	20.3868	19.8604	19.4615	(87)
Th 2	19.8200	19.8231	19.8262	19.8409	19.8436	19.8564	19.8564	19.8588	19.8515	19.8436	19.8381	19.8323	(88)
util rest of house	0.9979	0.9938	0.9802	0.9328	0.8117	0.6023	0.4056	0.4629	0.7642	0.9635	0.9951	0.9985	(89)
MIT 2	18.4527	18.6631	18.9833	19.3851	19.6785	19.8267	19.8527	19.8521	19.7636	19.3596	18.8361	18.4332	(90)
Living area fraction									fLA = Living area / (4) =			0.1414	(91)
MIT	18.5995	18.8097	19.1299	19.5319	19.8299	19.9832	20.0128	20.0109	19.9154	19.5049	18.9810	18.5787	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5995	18.8097	19.1299	19.5319	19.8299	19.9832	20.0128	20.0109	19.9154	19.5049	18.9810	18.5787	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	617.0354	775.2087	919.6383	1018.4523	970.7964	725.1440	479.3282	501.9847	719.6027	739.0594	624.7296	572.3854	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2105.8121	2042.1325	1848.6661	1534.1454	1169.9528	764.9456	484.9545	511.9039	830.4117	1281.4826	1719.0957	2092.3108	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1107.6498	851.3728	691.1967	371.2990	148.1723	0.0000	0.0000	0.0000	0.0000	403.5629	787.9435	1130.8245	(98)
Space heating												5492.0216	(98)
Space heating per m2												49.4777	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1335.7379	1051.5384	1077.4138	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8639	0.9219	0.8962	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1153.9005	969.4413	965.6146	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1490.5854	1428.8290	1327.8445	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	242.4131	341.7845	269.4991	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												853.6967 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			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	60.6033	85.4461	67.3748	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												213.4242 (107)
Energy for space heating												1.9227 (108)
Energy for space cooling												49.4777 (99)
Total												1.9227 (108)
Target Fabric Energy Efficiency (TFEE)												51.4004 (109)
												59.1 (109)

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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	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.7600		
Number of sides sheltered															0.2380 (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) =					0.2380 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(33)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.5872	Feb 46.4901	Mar 46.4901	Apr 46.4901	May 46.4901	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 46.4901	Nov 46.4901	Dec 46.4901 (38)
Heat transfer coeff	145.8048	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076 (39)
Average = Sum(39)m / 12 =												144.7990 (39)
HLP	Jan 1.3136	Feb 1.3037	Mar 1.3037	Apr 1.3037	May 1.3037	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3037	Nov 1.3037	Dec 1.3037 (40)
HLP (average)												1.3045 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum (45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
RHI water heating demand												2102.5532 (64)
Heat gains from water heating, kWh/month	89.5663	79.3278	84.2157	76.7478	76.1185	69.3196	67.8154	72.7033	72.0387	79.5216	82.5094	87.8344 (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	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8420	54.0393	43.9478	33.2713	24.8707	20.9969	22.6879	29.4905	39.5821	50.2586	58.6592	62.5330 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	407.4403	411.6682	401.0139	378.3321	349.7005	322.7908	304.8134	300.5855	311.2398	333.9215	362.5532	389.4629 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449 (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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279 (71)
Water heating gains (Table 5)	120.3848	118.0473	113.1932	106.5941	102.3098	96.2772	91.1497	97.7194	100.0537	106.8839	114.5964	118.0570 (72)
Total internal gains	702.8259	697.9137	672.3137	632.3564	591.0398	554.2237	532.8098	541.9543	565.0344	605.2229	649.9676	684.2118 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.3400	13.4839		0.7200		0.7000		0.7700		15.7299 (74)
East				7.1700	25.1925		0.7200		0.7000		0.7700		63.0892 (76)
South				8.0000	56.7559		0.7200		0.7000		0.7700		158.5859 (78)
West				3.4800	25.1925		0.7200		0.7000		0.7700		30.6207 (80)
West				4.5200	25.1925		0.7200		0.7000		0.7700		39.7717 (80)
Solar gains	307.7973	468.2678	694.8694	932.5587	1033.9040	1144.3543	1057.0244	977.1188	813.7201	566.2811	372.4574	246.1371	(83)
Total gains	1010.6232	1166.1815	1367.1831	1564.9150	1624.9437	1698.5780	1589.8341	1519.0730	1378.7545	1171.5040	1022.4250	930.3489	(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	18.4720	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121
alpha	2.2315	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408
util living area	0.9020	0.8687	0.8011	0.6973	0.5640	0.3938	0.2859	0.2979	0.5045	0.7272	0.8581	0.9136 (86)
MIT	18.7627	19.0694	19.6102	20.1755	20.6267	20.8862	20.9621	20.9587	20.7871	20.2580	19.4418	18.7054 (87)
Th 2	19.8302	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380 (88)
util rest of house	0.8884	0.8512	0.7751	0.6581	0.5056	0.3156	0.1906	0.1991	0.4243	0.6802	0.8356	0.9012 (89)
MIT 2	16.9334	17.3690	18.1235	18.8889	19.4680	19.7566	19.8225	19.8211	19.6650	19.0247	17.9076	16.8577 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	17.1921	17.6095	18.3338	19.0709	19.6319	19.9164	19.9837	19.9820	19.8237	19.1991	18.1246	17.1191 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0421	17.4595	18.1838	18.9209	19.4819	19.7664	19.8337	19.8320	19.6737	19.0491	17.9746	16.9691 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8435	0.8042	0.7297	0.6227	0.4860	0.3105	0.1902	0.1985	0.4119	0.6424	0.7883	0.8581 (94)
Ext temp.	852.4666	937.8931	997.5959	974.5179	789.6823	527.4627	302.4099	301.5654	567.8864	752.5594	805.9708	798.3728 (95)
Heat loss rate W	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1697.4801	1672.7445	1531.5572	1290.9249	923.5063	559.4956	308.7656	308.5132	632.9139	1020.0639	1385.5147	1659.6624 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	628.6900	493.8202	397.2672	227.8130	99.5650	0.0000	0.0000	0.0000	0.0000	199.0234	417.2716	640.7995 (98)
RHI space heating demand												3104.2499 (98)
												3104 (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	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50																4.7600	
Infiltration rate																0.2380 (18)	
Number of sides sheltered																0 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =						1.0000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =						0.2380 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(32)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.4599	Feb 50.9066	Mar 50.3534	Apr 47.5872	May 47.0340	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 47.0340	Nov 48.1405	Dec 49.2469 (38)
Heat transfer coeff	149.6774	149.1242	148.5709	145.8048	145.2515	144.7076	144.7076	144.7076	144.7076	145.2515	146.3580	147.4645 (39)
Average = Sum(39)m / 12 =												146.3611 (39)
HLP	Jan 1.3484	Feb 1.3435	Mar 1.3385	Apr 1.3136	May 1.3086	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3086	Nov 1.3185	Dec 1.3285 (40)
HLP (average)												1.3186 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum (45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
								Total per year (kWh/year) = Sum (64)m =				2102.5532 (64)
Heat gains from water heating, kWh/month	89.5663	79.3278	84.2157	76.7478	76.1185	69.3196	67.8154	72.7033	72.0387	79.5216	82.5094	87.8344 (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	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	60.8420	54.0393	43.9478	33.2713	24.8707	20.9969	22.6879	29.4905	39.5821	50.2586	58.6592	62.5330 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	407.4403	411.6682	401.0139	378.3321	349.7005	322.7908	304.8134	300.5855	311.2398	333.9215	362.5532	389.4629 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449 (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)												
	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279 (71)
Water heating gains (Table 5)												
	120.3848	118.0473	113.1932	106.5941	102.3098	96.2772	91.1497	97.7194	100.0537	106.8839	114.5964	118.0570 (72)
Total internal gains												
	702.8259	697.9137	672.3137	632.3564	591.0398	554.2237	532.8098	541.9543	565.0344	605.2229	649.9676	684.2118 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					3.3400	10.6334	0.7200	0.7000			0.7700			12.4046 (74)
East					7.1700	19.6403	0.7200	0.7000			0.7700			49.1847 (76)
South					8.0000	46.7521	0.7200	0.7000			0.7700			130.6335 (78)
West					3.4800	19.6403	0.7200	0.7000			0.7700			23.8721 (80)
West					4.5200	19.6403	0.7200	0.7000			0.7700			31.0063 (80)
Solar gains	247.1012	441.2193	648.0585	861.6594	1007.3478	1015.6034	972.9062	863.8445	723.0278	500.5296	299.9023	208.7968 (83)		
Total gains	949.9271	1139.1329	1320.3722	1494.0158	1598.3876	1569.8271	1505.7160	1405.7988	1288.0622	1105.7525	949.8699	893.0086 (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	17.9941	18.0608	18.1281	18.4720	18.5424	18.6121	18.6121	18.6121	18.6121	18.5424	18.4022	18.2641
alpha	2.1996	2.2041	2.2085	2.2315	2.2362	2.2408	2.2408	2.2408	2.2408	2.2362	2.2268	2.2176
util living area	0.9227	0.8881	0.8342	0.7457	0.6312	0.4994	0.3851	0.4223	0.5999	0.7901	0.8931	0.9309 (86)
MIT	18.3682	18.7436	19.2871	19.9329	20.4376	20.7659	20.9063	20.8814	20.6281	19.9527	19.0566	18.3122 (87)
Th 2	19.8031	19.8069	19.8108	19.8302	19.8341	19.8380	19.8380	19.8380	19.8380	19.8341	19.8263	19.8186 (88)
util rest of house	0.9121	0.8734	0.8125	0.7125	0.5820	0.4289	0.2952	0.3308	0.5318	0.7546	0.8766	0.9214 (89)
MIT 2	16.3561	16.8903	17.6580	18.5594	19.2296	19.6338	19.7798	19.7597	19.4876	18.6146	17.3572	16.2829 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	16.6407	17.1524	17.8884	18.7537	19.4004	19.7939	19.9391	19.9183	19.6489	18.8039	17.5976	16.5699 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4907	17.0024	17.7384	18.6037	19.2504	19.6439	19.7891	19.7683	19.4989	18.6539	17.4476	16.4199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8698	0.8265	0.7645	0.6715	0.5545	0.4162	0.2911	0.3249	0.5095	0.7102	0.8304	0.8813	(94)
Useful gains	826.2652	941.5199	1009.4881	1003.2956	886.2574	653.2857	438.3719	456.7734	656.2780	785.3257	788.8054	786.9791	(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	1824.6748	1804.7646	1669.6977	1414.8390	1096.7113	729.8969	461.4860	487.4254	781.2654	1169.8347	1514.4544	1802.0061	(97)

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Month fraction	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	742.8168	580.1005	491.1960	296.3113	156.5777	0.0000	0.0000	0.0000	0.0000	286.0746	522.4673	755.1801 (98)
Space heating												3830.7242 (98)
Space heating per m2										(98) / (4) =		34.5110 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4228.1725 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	742.8168	580.1005	491.1960	296.3113	156.5777	0.0000	0.0000	0.0000	0.0000	286.0746	522.4673	755.1801 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	819.8861	640.2875	542.1589	327.0544	172.8231	0.0000	0.0000	0.0000	0.0000	315.7557	576.6747	833.5322 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
Efficiency of water heater (217)m	88.0174	87.7750	87.3100	86.3552	84.7275	79.9000	79.9000	79.9000	79.9000	86.1706	87.4857	79.9000 (216)
Fuel for water heating, kWh/month	236.7952	209.0881	220.2830	198.9866	198.2550	187.1024	178.9795	197.3781	197.3373	206.8124	216.2220	230.6652 (219)
Water heating fuel used												2477.9047 (219)
Annual totals kWh/year												
Space heating fuel - main system												4228.1725 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												78.8662 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												153.8662 (231)
Electricity for lighting (calculated in Appendix L)												429.7957 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =										-563.9412		-563.9412 (233)
Total delivered energy for all uses												6725.7978 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4228.1725	3.4800	147.1404 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2477.9047	3.4800	86.2311 (247)
Mechanical ventilation fans	78.8662	13.1900	10.4025 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	429.7957	13.1900	56.6900 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-563.9412	13.1900	-74.3838 (252)
Total energy cost			355.9726 (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] =	0.9584 (257)
SAP value		86.6305
SAP rating (Section 12)		87 (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	4228.1725	0.2160	913.2852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2477.9047	0.2160	535.2274 (264)
Space and water heating			1448.5127 (265)
Pumps and fans	153.8662	0.5190	79.8566 (267)
Energy for lighting	429.7957	0.5190	223.0639 (268)

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Energy saving/generation technologies			
PV Unit	-563.9412	0.5190	-292.6855 (269)
Total kg/year			1458.7477 (272)
CO2 emissions per m2			13.1400 (273)
EI value			87.4697
EI rating			87 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$	stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$	stars = 4
Water heating energy efficiency	$3.48 / 0.8463 = 4.112$	stars = 4
Water heating environmental impact	$0.216 / 0.8463 = 0.2552$	stars = 4

FULL SAP CALCULATION PRINTOUT

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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	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2380 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.5027		(33)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.5872	Feb 46.4901	Mar 46.4901	Apr 46.4901	May 46.4901	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 46.4901	Nov 46.4901	Dec 46.4901 (38)
Heat transfer coeff	145.8048	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076 (39)
Average = Sum(39)m / 12 =												144.7990 (39)
HLP	Jan 1.3136	Feb 1.3037	Mar 1.3037	Apr 1.3037	May 1.3037	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3037	Nov 1.3037	Dec 1.3037 (40)
HLP (average)												1.3045 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

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

Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total =	Sum (45)m =	1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
Heat gains from water heating, kWh/month	89.5663	79.3278	84.2157	76.7478	76.1185	69.3196	67.8154	72.7033	72.0387	79.5216	82.5094	87.8344 (65)
Total per year (kWh/year) = Sum (64)m =												2102.5532 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8420	54.0393	43.9478	33.2713	24.8707	20.9969	22.6879	29.4905	39.5821	50.2586	58.6592	62.5330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	407.4403	411.6682	401.0139	378.3321	349.7005	322.7908	304.8134	300.5855	311.2398	333.9215	362.5532	389.4629	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	(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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	(71)
Water heating gains (Table 5)	120.3848	118.0473	113.1932	106.5941	102.3098	96.2772	91.1497	97.7194	100.0537	106.8839	114.5964	118.0570	(72)
Total internal gains	702.8259	697.9137	672.3137	632.3564	591.0398	554.2237	532.8098	541.9543	565.0344	605.2229	649.9676	684.2118	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.3400	13.4839		0.7200		0.7000		0.7700		15.7299 (74)
East				7.1700	25.1925		0.7200		0.7000		0.7700		63.0892 (76)
South				8.0000	56.7559		0.7200		0.7000		0.7700		158.5859 (78)
West				3.4800	25.1925		0.7200		0.7000		0.7700		30.6207 (80)
West				4.5200	25.1925		0.7200		0.7000		0.7700		39.7717 (80)
Solar gains	307.7973	468.2678	694.8694	932.5587	1033.9040	1144.3543	1057.0244	977.1188	813.7201	566.2811	372.4574	246.1371	(83)
Total gains	1010.6232	1166.1815	1367.1831	1564.9150	1624.9437	1698.5780	1589.8341	1519.0730	1378.7545	1171.5040	1022.4250	930.3489	(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	18.4720	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	
alpha	2.2315	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	
util living area	0.9020	0.8687	0.8011	0.6973	0.5640	0.3938	0.2859	0.2979	0.5045	0.7272	0.8581	0.9136	(86)
MIT	18.7627	19.0694	19.6102	20.1755	20.6267	20.8862	20.9621	20.9587	20.7871	20.2580	19.4418	18.7054	(87)
Th 2	19.8302	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	(88)
util rest of house	0.8884	0.8512	0.7751	0.6581	0.5056	0.3156	0.1906	0.1991	0.4243	0.6802	0.8356	0.9012	(89)
MIT 2	16.9334	17.3690	18.1235	18.8889	19.4680	19.7566	19.8225	19.8211	19.6650	19.0247	17.9076	16.8577	(90)
Living area fraction									fLA = Living area / (4) =			0.1414	(91)
MIT	17.1921	17.6095	18.3338	19.0709	19.6319	19.9164	19.9837	19.9820	19.8237	19.1991	18.1246	17.1191	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0421	17.4595	18.1838	18.9209	19.4819	19.7664	19.8337	19.8320	19.6737	19.0491	17.9746	16.9691	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8435	0.8042	0.7297	0.6227	0.4860	0.3105	0.1902	0.1985	0.4119	0.6424	0.7883	0.8581	(94)
Ext temp.	852.4666	937.8931	997.5959	974.5179	789.6823	527.4627	302.4099	301.5654	567.8864	752.5594	805.9708	798.3728	(95)
Heat loss rate W	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	1697.4801	1672.7445	1531.5572	1290.9249	923.5063	559.4956	308.7656	308.5132	632.9139	1020.0639	1385.5147	1659.6624	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	628.6900	493.8202	397.2672	227.8130	99.5650	0.0000	0.0000	0.0000	0.0000	199.0234	417.2716	640.7995 (98)
Space heating												3104.2499 (98)
Space heating per m2										(98) / (4) =		27.9662 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3426.3243 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	628.6900	493.8202	397.2672	227.8130	99.5650	0.0000	0.0000	0.0000	0.0000	199.0234	417.2716	640.7995 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	693.9183	545.0554	438.4848	251.4492	109.8952	0.0000	0.0000	0.0000	0.0000	219.6726	460.5646	707.2842 (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	208.4210	183.5270	192.3291	171.8353	167.9765	149.4948	143.0047	157.7051	157.6725	178.2114	189.1634	203.2124 (64)
Efficiency of water heater (217)m	87.6767	87.4277	86.8078	85.6673	83.5731	79.9000	79.9000	79.9000	79.9000	85.2093	86.9672	79.9000 (216)
Fuel for water heating, kWh/month	237.7154	209.9186	221.5573	200.5845	200.9934	187.1024	178.9795	197.3781	197.3373	209.1456	217.5113	231.5283 (219)
Water heating fuel used												2489.7517 (219)
Annual totals kWh/year												
Space heating fuel - main system												3426.3243 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												78.8662 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												153.8662 (231)
Electricity for lighting (calculated in Appendix L)												429.7957 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1179 * 1.00) =										-622.5526		-622.5526 (233)
Total delivered energy for all uses												5877.1853 (238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3426.3243	9.7400	333.7240 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2489.7517	9.7400	242.5018 (247)
Mechanical ventilation fans	78.8662	36.8500	29.0622 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	429.7957	36.8500	158.3797 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-622.5526	36.8500	-229.4106 (252)
Total energy cost			665.8946 (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	3426.3243	0.2160	740.0861 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.7517	0.2160	537.7864 (264)
Space and water heating			1277.8724 (265)
Pumps and fans	153.8662	0.5190	79.8566 (267)
Energy for lighting	429.7957	0.5190	223.0639 (268)
Energy saving/generation technologies			
PV Unit	-622.5526	0.5190	-323.1048 (269)
Total kg/year			1257.6881 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Space heating - main system 1	3426.3243	1.2200	4180.1157 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.7517	1.2200	3037.4971 (264)
Space and water heating			7217.6128 (265)
Pumps and fans	153.8662	3.0700	472.3692 (267)
Energy for lighting	429.7957	3.0700	1319.4727 (268)
Energy saving/generation technologies			
PV Unit	-622.5526	3.0700	-1911.2366 (269)
Primary energy kWh/year			7098.2181 (272)
Primary energy kWh/m2/year			63.9479 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 87

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 112	-262 kg (20.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£112 2.36 kg/m²	B 88	B 90
Total Savings	£112 2.36 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 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	£215	£234	-£18
Mains gas	£680	£550	£130
Space heating	£494	£496	-£2
Water heating	£243	£129	£113
Lighting	£158	£158	£0
Generated (PV)	-£229	-£229	£0
Total cost of fuels	£666	£555	£112
Total cost of uses	£666	£554	£111
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.0 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	64 kWh/m²	51 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (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	(8)
Measured/design AP50												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2380 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.3035	0.2975	0.2916	0.2618	0.2559	0.2261	0.2261	0.2202	0.2380	0.2559	0.2678	0.2797 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5535	0.5475	0.5416	0.5118	0.5059	0.5000	0.5000	0.5000	0.5000	0.5059	0.5178	0.5297 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(33)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.4599	Feb 50.9066	Mar 50.3534	Apr 47.5872	May 47.0340	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 47.0340	Nov 48.1405	Dec 49.2469 (38)
Heat transfer coeff	149.6774	149.1242	148.5709	145.8048	145.2515	144.7076	144.7076	144.7076	144.7076	145.2515	146.3580	147.4645 (39)
Average = Sum(39)m / 12 =												146.3611 (39)
HLP	Jan 1.3484	Feb 1.3435	Mar 1.3385	Apr 1.3136	May 1.3086	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3086	Nov 1.3185	Dec 1.3285 (40)
HLP (average)												1.3186 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum(45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)	
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)	
If cylinder contains dedicated solar storage												
13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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												
201.4273	177.2101	183.9397	158.3136	148.1885	130.1201	122.9841	138.6150	145.5015	169.8221	182.3953	196.2188 (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												1.1391 (H8)
Utilisation factor												0.5843 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.1916 (H14)
Volume ratio Veff/V												1.0821 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-931.8395 (H17)
Solar input	-27.0215	-45.0911	-76.7953	-102.9208	-127.1500	-125.0087	-123.3567	-107.7773	-84.4113	-57.6430	-32.0514	-22.6124 (63)
Solar input (sum of months) = Sum(63)m =												-931.8395 (63)
Output from w/h												
174.4058	132.1190	107.1445	55.3928	21.0385	5.1114	0.0000		30.8377	61.0903	112.1791	150.3440	173.6064 (64)
Total per year (kWh/year) = Sum(64)m =												1023.2694 (64)
Heat gains from water heating, kWh/month												
83.9714	74.2743	77.5042	65.9305	60.2881	53.8198	51.7989	57.4312	62.3019	72.8101	77.0949	82.2395 (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	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8420	54.0393	43.9478	33.2713	24.8707	20.9969	22.6879	29.4905	39.5821	50.2586	58.6592	62.5330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	407.4403	411.6682	401.0139	378.3321	349.7005	322.7908	304.8134	300.5855	311.2398	333.9215	362.5532	389.4629	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	(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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	(71)
Water heating gains (Table 5)	112.8647	110.5272	104.1724	91.5701	81.0324	74.7497	69.6222	77.1925	86.5304	97.8630	107.0763	110.5370	(72)
Total internal gains	695.3058	690.3936	663.2928	617.3323	569.7624	532.6962	511.2823	521.4273	551.5112	596.2020	642.4475	676.6917	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.3400	10.6334		0.7200	0.7000	0.7700		12.4046 (74)	
East					7.1700	19.6403		0.7200	0.7000	0.7700		49.1847 (76)	
South					8.0000	46.7521		0.7200	0.7000	0.7700		130.6335 (78)	
West					3.4800	19.6403		0.7200	0.7000	0.7700		23.8721 (80)	
West					4.5200	19.6403		0.7200	0.7000	0.7700		31.0063 (80)	
Solar gains	247.1012	441.2193	648.0585	861.6594	1007.3478	1015.6034	972.9062	863.8445	723.0278	500.5296	299.9023	208.7968	(83)
Total gains	942.4070	1131.6129	1311.3514	1478.9918	1577.1102	1548.2995	1484.1885	1385.2718	1274.5389	1096.7317	942.3499	885.4886	(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	17.9941	18.0608	18.1281	18.4720	18.5424	18.6121	18.6121	18.6121	18.6121	18.5424	18.4022	18.2641
alpha	2.1996	2.2041	2.2085	2.2315	2.2362	2.2408	2.2408	2.2408	2.2408	2.2362	2.2268	2.2176
util living area												
	0.9238	0.8893	0.8359	0.7489	0.6360	0.5044	0.3897	0.4273	0.6038	0.7925	0.8945	0.9319 (86)
MIT	18.3586	18.7350	19.2784	19.9222	20.4282	20.7610	20.9039	20.8785	20.6229	19.9452	19.0477	18.3023 (87)
Th 2	19.8031	19.8069	19.8108	19.8302	19.8341	19.8380	19.8380	19.8380	19.8380	19.8341	19.8263	19.8186 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9133	0.8748	0.8143	0.7159	0.5869	0.4336	0.2990	0.3351	0.5357	0.7572	0.8781	0.9225 (89)
Living area fraction	16.3425	16.8782	17.6462	18.5457	19.2185	19.6291	19.7782	19.7576	19.4822	18.6049	17.3450	16.2688 (90)
MIT	16.6277	17.1409	17.8770	18.7404	19.3896	19.7892	19.9374	19.9161	fLA = Living area / (4) =			0.1414 (91)
Temperature adjustment									19.6435	18.7945	17.5858	16.5564 (92)
adjusted MIT	16.4777	16.9909	17.7270	18.5904	19.2396	19.6392	19.7874	19.7661	19.4935	18.6445	17.4358	-0.1500
												16.4064 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8712	0.8279	0.7663	0.6746	0.5589	0.4205	0.2948	0.3289	0.5130	0.7126	0.8321	0.8827 (94)
Useful gains	821.0399	936.9062	1004.9033	997.7542	881.4302	651.0181	437.5334	455.6810	653.8269	781.5114	784.1489	781.5907 (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												
Month fracti	1822.7205	1803.0387	1668.0082	1412.9044	1095.1430	729.2144	461.2416	487.1039	780.4867	1168.4751	1512.7293	1800.0124 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	745.2504	582.0410	493.3500	298.9082	159.0023	0.0000	0.0000	0.0000	0.0000	287.9010	524.5779	757.7058 (98)
Space heating per m2												3848.7366 (98)
										(98) / (4) =		34.6733 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.6000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4248.0537 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	745.2504	582.0410	493.3500	298.9082	159.0023	0.0000	0.0000	0.0000	0.0000	287.9010	524.5779	757.7058 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	822.5722	642.4294	544.5364	329.9208	175.4992	0.0000	0.0000	0.0000	0.0000	317.7715	579.0043	836.3198 (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	174.4058	132.1190	107.1445	55.3928	21.0385	5.1114	0.0000	30.8377	61.0903	112.1791	150.3440	173.6064 (64)
Efficiency of water heater (217)m	88.3561	88.4097	88.4857	88.7420	89.2041	79.9000	79.9000	79.9000	79.9000	87.3212	87.9756	79.9000 (216)
Fuel for water heating, kWh/month	197.3897	149.4396	121.0868	62.4200	23.5847	6.3972	0.0000	38.5953	76.4584	128.4673	170.8928	196.4020 (219)
Water heating fuel used												1171.1339 (219)
Annual totals kWh/year												
Space heating fuel - main system												4248.0537 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:	
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)	
mechanical ventilation fans (SFP = 0.2294)	78.8662 (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	203.8662 (231)
Electricity for lighting (calculated in Appendix L)	429.7957 (232)

Energy saving/generation technologies (Appendices M, N and Q)	
PV Unit 0 (0.80 * 0.66 * 1068 * 1.00) =	-563.9412
Total delivered energy for all uses	5488.9082 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4248.0537	3.4800	147.8323 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1171.1339	3.4800	40.7555 (247)
Mechanical ventilation fans	78.8662	13.1900	10.4025 (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	429.7957	13.1900	56.6900 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-563.9412	13.1900	-74.3838 (252)
Total energy cost			317.7839 (255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8556 (257)
SAP value 88.0648
SAP rating (Section 12) 88 (258)
SAP band B

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

Energy Emission factor Emissions
kWh/year kg CO2/kWh kg CO2/year
Space heating - main system 1 4248.0537 0.2160 917.5796 (261)
Space heating - secondary 0.0000 0.0000 0.0000 (263)
Water heating (other fuel) 1171.1339 0.2160 252.9649 (264)
Space and water heating 203.8662 0.5190 105.8066 (267)
Pumps and fans 429.7957 0.5190 223.0639 (268)
Energy for lighting
Energy saving/generation technologies
PV Unit -563.9412 0.5190 -292.6855 (269)
Total kg/year 1206.7295 (272)
CO2 emissions per m2 10.8700 (273)
EI value 89.6345
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	56.2000 (1b)	x 2.4100 (2b)	= 135.4420 (1b) - (3b)
First floor	54.8000 (1c)	x 2.6700 (2c)	= 146.3160 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.7580 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.7600		
Number of sides sheltered															0.2380 (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) =					0.2380 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)					
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)					
Adj infilt rate																	
	0.2618	0.2440	0.2440	0.2321	0.2321	0.2202	0.2202	0.2083	0.2083	0.2261	0.2202	0.2321 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5118	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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)			21.9900	1.3258	29.1534		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
150mm EPS B&B			56.2000	0.1800	10.1160	75.0000	4215.0000 (28a)					
140mm Timber Frame	161.1400	28.6300	132.5100	0.1900	25.1769	9.0000	1192.5900 (29a)					
400mm Mineral Wool	54.8000		54.8000	0.1100	6.0280	9.0000	493.2000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			273.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5027		(33)					
Timber GF			82.7100			9.0000	744.3900 (32c)					
Timber FF			118.3700			9.0000	1065.3300 (32c)					
Internal Floor			54.8000			18.0000	986.4000 (32d)					
Internal Ceiling			54.8000			18.0000	986.4000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9695.9100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.3505 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.7148 (36)					
Total fabric heat loss						(33) + (36) =	98.2175 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.5872	Feb 46.4901	Mar 46.4901	Apr 46.4901	May 46.4901	Jun 46.4901	Jul 46.4901	Aug 46.4901	Sep 46.4901	Oct 46.4901	Nov 46.4901	Dec 46.4901 (38)
Heat transfer coeff	145.8048	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076	144.7076 (39)
Average = Sum(39)m / 12 =												144.7990 (39)
HLP	Jan 1.3136	Feb 1.3037	Mar 1.3037	Apr 1.3037	May 1.3037	Jun 1.3037	Jul 1.3037	Aug 1.3037	Sep 1.3037	Oct 1.3037	Nov 1.3037	Dec 1.3037 (40)
HLP (average)												1.3045 (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												2.8207 (42)
Average daily hot water use (litres/day)												101.1916 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	111.3107	107.2630	103.2154	99.1677	95.1201	91.0724	91.0724	95.1201	99.1677	103.2154	107.2630	111.3107 (44)
Energy conte	165.0706	144.3718	148.9787	129.8833	124.6261	107.5428	99.6543	114.3547	115.7205	134.8610	147.2114	159.8620 (45)
Energy content (annual)										Total = Sum(45)m =		1592.1372 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.7606	21.6558	22.3468	19.4825	18.6939	16.1314	14.9481	17.1532	17.3581	20.2292	22.0817	23.9793 (46)	
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)	
If cylinder contains dedicated solar storage												
13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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												
201.4273	177.2101	183.9397	158.3136	148.1885	130.1201	122.9841	138.6150	145.5015	169.8221	182.3953	196.2188 (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												1.2668 (H8)
Utilisation factor												0.5459 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.1916 (H14)
Volume ratio Veff/V												1.0821 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-968.1084 (H17)
Solar input	-31.7809	-45.1904	-77.6714	-104.7967	-122.4807	-132.0562	-125.7072	-114.5739	-89.5282	-61.5693	-37.5884	-25.1652 (63)
Solar input (sum of months) = Sum(63)m =												-968.1084 (63)
Output from w/h												
169.6464	132.0198	106.2684	53.5169	25.7079	0.0000	0.0000		24.0411	55.9733	108.2528	144.8069	171.0536 (64)
Total per year (kWh/year) = Sum(64)m =												991.2871 (64)
Heat gains from water heating, kWh/month												
83.9714	74.2743	77.5042	65.9305	60.2881	53.8198	51.7989	57.4312	62.3019	72.8101	77.0949	82.2395 (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	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	169.2418	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8420	54.0393	43.9478	33.2713	24.8707	20.9969	22.6879	29.4905	39.5821	50.2586	58.6592	62.5330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	407.4403	411.6682	401.0139	378.3321	349.7005	322.7908	304.8134	300.5855	311.2398	333.9215	362.5532	389.4629	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	54.7449	(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)	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	-112.8279	(71)
Water heating gains (Table 5)	112.8647	110.5272	104.1724	91.5701	81.0324	74.7497	69.6222	77.1925	86.5304	97.8630	107.0763	110.5370	(72)
Total internal gains	695.3058	690.3936	663.2928	617.3323	569.7624	532.6962	511.2823	521.4273	551.5112	596.2020	642.4475	676.6917	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.3400	13.4839		0.7200		0.7000		0.7700		15.7299 (74)
East				7.1700	25.1925		0.7200		0.7000		0.7700		63.0892 (76)
South				8.0000	56.7559		0.7200		0.7000		0.7700		158.5859 (78)
West				3.4800	25.1925		0.7200		0.7000		0.7700		30.6207 (80)
West				4.5200	25.1925		0.7200		0.7000		0.7700		39.7717 (80)
Solar gains	307.7973	468.2678	694.8694	932.5587	1033.9040	1144.3543	1057.0244	977.1188	813.7201	566.2811	372.4574	246.1371	(83)
Total gains	1003.1032	1158.6614	1358.1622	1549.8910	1603.6664	1677.0504	1568.3066	1498.5461	1365.2312	1162.4831	1014.9050	922.8289	(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	18.4720	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121	18.6121
alpha	2.2315	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408	2.2408
util living area	0.9032	0.8700	0.8030	0.7006	0.5689	0.3980	0.2894	0.3015	0.5081	0.7297	0.8597	0.9148 (86)
MIT	18.7536	19.0612	19.6024	20.1667	20.6198	20.8837	20.9611	20.9576	20.7839	20.2520	19.4339	18.6960 (87)
Th 2	19.8302	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380	19.8380 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	0.8897	0.8527	0.7771	0.6616	0.5104	0.3192	0.1931	0.2016	0.4276	0.6829	0.8374	0.9026 (89)
Living area fraction	16.9206	17.3576	18.1131	18.8780	19.4606	19.7547	19.8221	19.8206	19.6622	19.0175	17.8968	16.8444 (90)
MIT	17.1799	17.5986	18.3238	19.0603	19.6246	19.9144	19.9832	19.9814	fLA = Living area / (4) =			0.1414 (91)
Temperature adjustment									19.8209	19.1921	18.1142	17.1063 (92)
adjusted MIT	17.0299	17.4486	18.1738	18.9103	19.4746	19.7644	19.8332	19.8314	19.6709	19.0421	17.9642	-0.1500
												16.9563 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8450	0.8058	0.7315	0.6258	0.4903	0.3139	0.1927	0.2011	0.4150	0.6448	0.7901	0.8597 (94)	
Useful gains	847.6333	933.5950	993.5285	969.9469	786.2786	526.4613	302.1642	301.2994	566.5047	749.5918	801.8751	793.3356 (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													
Month fracti	1695.6942	1671.1692	1530.1023	1289.3814	922.4466	559.2058	308.6922	308.4336	632.4964	1019.0454	1384.0167	1657.8106 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating	630.9573	495.6499	399.2109	229.9928	101.3090	0.0000	0.0000	0.0000	0.0000	200.4735	419.1420	643.1694 (98)	
Space heating per m2												3119.9047 (98)	
												(98) / (4) =	28.1072 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.6000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3443.6035 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	630.9573	495.6499	399.2109	229.9928	101.3090	0.0000	0.0000	0.0000	0.0000	200.4735	419.1420	643.1694 (98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)	
Space heating fuel (main heating system)	696.4208	547.0750	440.6301	253.8552	111.8201	0.0000	0.0000	0.0000	0.0000	221.2732	462.6291	709.9000 (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	169.6464	132.0198	106.2684	53.5169	25.7079	0.0000	0.0000	24.0411	55.9733	108.2528	144.8069	171.0536 (64)	
Efficiency of water heater (217)m	88.1000	88.1180	88.1191	88.3662	88.2091	79.9000	79.9000	79.9000	79.9000	86.5365	87.5882	79.9000 (216)	
Fuel for water heating, kWh/month	192.5612	149.8216	120.5963	60.5627	29.1442	0.0000	0.0000	30.0890	70.0542	125.0949	165.3271	194.1125 (219)	
Water heating fuel used												1137.3638 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3443.6035 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans:	
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)	
mechanical ventilation fans (SFP = 0.2294)	78.8662 (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	203.8662 (231)
Electricity for lighting (calculated in Appendix L)	429.7957 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.66 * 1179 * 1.00) =	-622.5526	-622.5526 (233)
Total delivered energy for all uses		4592.0765 (238)

10a. Fuel costs - using BEDF prices (519)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3443.6035	9.7400	335.4070 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1137.3638	9.7400	110.7792 (247)	
Mechanical ventilation fans	78.8662	36.8500	29.0622 (249)	
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)	
Pump for solar water heating	50.0000	36.8500	18.4250 (249)	
Energy for lighting	429.7957	36.8500	158.3797 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-622.5526	36.8500	-229.4106 (252)	
Total energy cost			554.2800 (255)	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3443.6035	0.2160	743.8183 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1137.3638	0.2160	245.6706 (264)
Space and water heating			989.4889 (265)
Pumps and fans	203.8662	0.5190	105.8066 (267)
Energy for lighting	429.7957	0.5190	223.0639 (268)
Energy saving/generation technologies			
PV Unit	-622.5526	0.5190	-323.1048 (269)
Total kg/year			995.2546 (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	3443.6035	1.2200	4201.1962 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1137.3638	1.2200	1387.5838 (264)
Space and water heating			5588.7800 (265)
Pumps and fans	203.8662	3.0700	625.8692 (267)
Energy for lighting	429.7957	3.0700	1319.4727 (268)
Energy saving/generation technologies			
PV Unit	-622.5526	3.0700	-1911.2366 (269)
Primary energy kWh/year			5622.8853 (272)
Primary energy kWh/m2/year			50.6566 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	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	371.92 (P1)
Transmission heat loss coefficient	98.22 (37)
Summer heat loss coefficient	470.14 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.3400	87.1704	0.7200	0.7000	0.9000	118.8588
East	7.1700	125.2818	0.7200	0.7000	0.9000	366.7099
South	8.0000	118.5567	0.7200	0.7000	0.9000	387.1966
West	3.4800	125.2818	0.7200	0.7000	0.9000	177.9847
West	4.5200	125.2818	0.7200	0.7000	0.9000	231.1756
total:						1281.9256

Solar gains	Jun 1372	Jul 1282	Aug 1160	(P3)
Internal gains	551	530	539	
Total summer gains	1923	1812	1699	(P5)
Summer gain/loss ratio	4.09	3.85	3.61	(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	20.88	22.54	22.30	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Assessment of likelihood of high internal temperature:

Medium