

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-149				Issued on Date	27/11/2023
Assessment Reference	As Built	Prop Type Ref	LVv4 Det As			
Property	6, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR					
SAP Rating	87 B	DER	13.13	TER	17.16	
Environmental	88 B	% DER<TER	23.47			
CO ₂ Emissions (t/year)	1.17	DFEE	48.98	TFEE	57.34	
General Requirements Compliance	Pass	% DFEE<TFEE	14.57			
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 114 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) 17.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.13 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 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)	0.11 (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: 4.73 (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 East: 9.64 m², No overhang
Windows facing South: 0.60 m², No overhang
Windows facing West: 10.50 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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											4.7300	
Infiltration rate											0.2365 (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) =	0.2365 (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	0.3015	0.2956	0.2897	0.2602	0.2542	0.2247	0.2247	0.2188	0.2365	0.2542	0.2661	0.2779 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5515	0.5456	0.5397	0.5102	0.5042	0.5000	0.5000	0.5000	0.5000	0.5042	0.5161	0.5279 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	52.5835	52.0198	51.4561	48.6376	48.0739	47.6699	47.6699	47.6699	47.6699	48.0739	49.2013	50.3287 (38)
Heat transfer coeff	139.3162	138.7525	138.1888	135.3703	134.8066	134.4026	134.4026	134.4026	134.4026	134.8066	135.9340	137.0614 (39)
Average = Sum(39)m / 12 =												135.9873 (39)
HLP	1.2272	1.2223	1.2173	1.1925	1.1875	1.1840	1.1840	1.1840	1.1840	1.1875	1.1974	1.2074 (40)
HLP (average)												1.1979 (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	2.8344 (42)
Average daily hot water use (litres/day)	101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
Solar input	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Heat gains from water heating, kWh/month												
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	490.7768	488.4925	472.2256	445.8038	418.6057	392.6914	376.0448	382.5749	396.3140	422.9676	453.6048	476.9389 (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	
East					9.6400	19.6403	0.7200	0.7000	0.7700	66.1284	(76)	
South					0.6000	46.7521	0.7200	0.7000	0.7700	9.7975	(78)	
West					5.2800	19.6403	0.7200	0.7000	0.7700	36.2197	(80)	
West					5.2200	19.6403	0.7200	0.7000	0.7700	35.8081	(80)	

Solar gains	147.9538	286.3087	465.5241	672.2304	819.6051	837.5357	797.9477	687.9639	539.0032	337.9967	183.8780	122.0789 (83)
Total gains	638.7305	774.8013	937.7496	1118.0342	1238.2108	1230.2271	1173.9925	1070.5388	935.3172	760.9643	637.4828	599.0179 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2676	20.3499	20.4329	20.8583	20.9456	21.0085	21.0085	21.0085	21.0085	20.9456	20.7718	20.6010
alpha	2.3512	2.3567	2.3622	2.3906	2.3964	2.4006	2.4006	2.4006	2.4006	2.3964	2.3848	2.3734
util living area	0.9648	0.9446	0.9040	0.8245	0.7099	0.5726	0.4503	0.5003	0.7029	0.8791	0.9491	0.9694 (86)
MIT	18.2074	18.5430	19.1057	19.8159	20.3794	20.7417	20.8961	20.8628	20.5523	19.7858	18.8800	18.1682 (87)
Th 2	19.8983	19.9022	19.9062	19.9260	19.9300	19.9329	19.9329	19.9329	19.9329	19.9300	19.9220	19.9141 (88)
util rest of house	0.9597	0.9366	0.8900	0.7986	0.6659	0.5035	0.3573	0.4061	0.6415	0.8553	0.9404	0.9649 (89)
MIT 2	16.1672	16.6537	17.4629	18.4737	19.2388	19.6965	19.8636	19.8356	19.4859	18.4575	17.1579	16.1185 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.3951	16.8647	17.6464	18.6236	19.3662	19.8133	19.9790	19.9503	19.6050	18.6059	17.3502	16.3474 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.2451	16.7147	17.4964	18.4736	19.2162	19.6633	19.8290	19.8003	19.4550	18.4559	17.2002	16.1974 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9324	0.9019	0.8475	0.7551	0.6321	0.4843	0.3475	0.3933	0.6092	0.8110	0.9071	0.9402 (94)
Useful gains	595.5645	698.7921	794.7246	844.2674	782.7116	595.8075	408.0081	421.0804	569.7584	617.1622	578.2695	563.1702 (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	1664.1492	1639.3246	1519.5801	1295.9816	1013.2389	680.5174	433.9804	457.0087	719.7299	1059.0267	1372.9655	1644.3873 (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												

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	795.0270	632.0378	539.2925	325.2343	171.5124	0.0000	0.0000	0.0000	0.0000	328.7472	572.1811	804.4255 (98)
Space heating												4168.4578 (98)
Space heating per m2											(98) / (4) =	36.7200 (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												4600.9468 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	795.0270	632.0378	539.2925	325.2343	171.5124	0.0000	0.0000	0.0000	0.0000	328.7472	572.1811	804.4255 (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)	877.5133	697.6135	595.2456	358.9782	189.3072	0.0000	0.0000	0.0000	0.0000	362.8556	631.5465	887.8869 (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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Efficiency of water heater	88.1433	87.9446	87.5135	86.5852	84.9634	79.9000	79.9000	79.9000	79.9000	86.5205	87.6772	79.9000 (216)
Fuel for water heating, kWh/month	237.0585	209.2122	220.3177	198.9399	198.1756	187.5348	179.3802	197.8379	197.8025	206.4766	216.2891	230.9483 (219)
Water heating fuel used												2479.9735 (219)
Annual totals kWh/year												
Space heating fuel - main system												4600.9468 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												81.1539 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												156.1539 (231)
Electricity for lighting (calculated in Appendix L)												443.6236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =										-675.5997		-675.5997 (233)
Total delivered energy for all uses												7005.0980 (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	4600.9468	0.2160	993.8045 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.9735	0.2160	535.6743 (264)
Space and water heating			1529.4788 (265)
Pumps and fans	156.1539	0.5190	81.0439 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total CO2, kg/year			1490.1270 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1300 (273)

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

	DER	TFA	N	EF
Total Floor Area		113.5200		
Assumed number of occupants		2.8344		
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190		
CO2 emissions from appliances, equation (L14)		14.4344		2C2
CO2 emissions from cooking, equation (L16)		1.6475		2C3
Total CO2 emissions		29.2119		2C4
Residual CO2 emissions offset from biofuel CHP		0.0000		2C5
Additional allowable electricity generation, kWh/m²/year		0.0000		2C6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000		2C7
Net CO2 emissions		29.2119		2C8

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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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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) =	0.1385 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3885 (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) =	0.3885 (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	0.4953	0.4856	0.4759	0.4273	0.4176	0.3690	0.3690	0.3593	0.3885	0.4176	0.4370	0.4564 (22b)		
Effective ac	0.6226	0.6179	0.6132	0.5913	0.5872	0.5681	0.5681	0.5646	0.5754	0.5872	0.5955	0.6042 (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)			20.7400	1.3258	27.4962		(27)					
150mm EPS B&B			56.7600	0.1300	7.3788		(28a)					
140mm Timber Frame	153.8700	22.8600	131.0100	0.1800	23.5818		(29a)					
400mm Mineral Wool	56.7600		56.7600	0.1300	7.3788		(30)					
Total net area of external elements Aum(A, m2)			267.3900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.9556		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5035 (36)					
Total fabric heat loss						(33) + (36) =	79.4591 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.3633	Feb 58.9092	Mar 58.4641	Apr 56.3736	May 55.9825	Jun 54.1617	Jul 54.1617	Aug 53.8245	Sep 54.8630	Oct 55.9825	Nov 56.7737	Dec 57.6009 (38)
Heat transfer coeff	138.8224	138.3683	137.9232	135.8327	135.4416	133.6208	133.6208	133.2836	134.3222	135.4416	136.2328	137.0600 (39)
Average = Sum(39)m / 12 =												135.8308 (39)
HLP	Jan 1.2229	Feb 1.2189	Mar 1.2150	Apr 1.1966	May 1.1931	Jun 1.1771	Jul 1.1771	Aug 1.1741	Sep 1.1832	Oct 1.1931	Nov 1.2001	Dec 1.2074 (40)
HLP (average)												1.1965 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy conte	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Energy content (annual)										Total = Sum(45)m =	1597.2519 (45)	
Distribution loss (46)m = 0.15 x (45)m												
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5003 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	24.3051	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	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	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (64)
Heat gains from water heating, kWh/month	93.7644	83.1146	88.3967	80.7786	80.2735	73.3266	71.9436	76.8473	76.0544	83.6875	86.5587	92.0270 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	126.0275	123.6825	118.8128	112.1925	107.8944	101.8425	96.6984	103.2893	105.6311	112.4832	120.2205	123.6923	(72)
Total internal gains	496.1825	493.8982	477.6313	451.2095	424.0114	398.0971	381.4505	387.9806	401.7197	428.3733	459.0105	482.3446	(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	
East					9.6400	19.6403		0.6300	0.7000	0.7700		57.8624 (76)	
South					0.6000	46.7521		0.6300	0.7000	0.7700		8.5728 (78)	
West					10.5000	19.6403		0.6300	0.7000	0.7700		63.0244 (80)	

Solar gains	129.4595	250.5201	407.3336	588.2016	717.1545	732.8437	698.2043	601.9684	471.6278	295.7471	160.8933	106.8191	(83)
Total gains	625.6420	744.4184	884.9648	1039.4111	1141.1659	1130.9408	1079.6548	989.9490	873.3475	724.1204	619.9038	589.1637	(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	56.7872	56.9736	57.1574	58.0371	58.2047	58.9978	58.9978	59.1470	58.6897	58.2047	57.8666	57.5174
alpha	4.7858	4.7982	4.8105	4.8691	4.8803	4.9332	4.9332	4.9431	4.9126	4.8803	4.8578	4.8345
util living area	0.9986	0.9965	0.9889	0.9576	0.8682	0.6988	0.5318	0.5959	0.8546	0.9807	0.9970	0.9990 (86)
MIT	19.6173	19.7859	20.0803	20.4683	20.7793	20.9466	20.9887	20.9809	20.8516	20.4267	19.9542	19.5966 (87)
Th 2	19.9017	19.9049	19.9080	19.9228	19.9255	19.9384	19.9384	19.9408	19.9334	19.9255	19.9199	19.9141 (88)
util rest of house	0.9981	0.9953	0.9847	0.9414	0.8198	0.6051	0.4101	0.4702	0.7829	0.9706	0.9958	0.9986 (89)
MIT 2	18.0585	18.3070	18.7371	19.2995	19.7109	19.9034	19.9343	19.9330	19.8132	19.2520	18.5640	18.0369 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.2326	18.4722	18.8871	19.4300	19.8302	20.0199	20.0521	20.0501	19.9292	19.3832	18.7193	18.2111 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2326	18.4722	18.8871	19.4300	19.8302	20.0199	20.0521	20.0501	19.9292	19.3832	18.7193	18.2111 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	623.7304	739.0932	866.5433	968.4951	929.8245	693.1137	457.2667	479.0013	683.4088	697.5591	615.9180	587.8125	(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	1934.1547	1877.9611	1708.4695	1430.3217	1101.1695	724.2173	461.2733	486.4954	782.9845	1189.6119	1582.9318	1920.3618	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	974.9557	765.3193	626.3931	332.5152	127.4807	0.0000	0.0000	0.0000	0.0000	366.0873	696.2499	991.4167	(98)
Space heating												4880.4178	(98)
Space heating per m2												42.9917	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												5219.6982 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	974.9557	765.3193	626.3931	332.5152	127.4807	0.0000	0.0000	0.0000	0.0000	366.0873	696.2499	991.4167 (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)	1042.7334	818.5233	669.9391	355.6312	136.3430	0.0000	0.0000	0.0000	0.0000	391.5372	744.6523	1060.3387 (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	213.9786	188.5315	197.8350	177.1176	173.4042	154.7055	148.3521	163.0998	162.9093	183.6720	194.5014	208.7533 (64)
Efficiency of water heater (217)m	88.3675	88.1635	87.6782	86.4705	84.0082	79.8000	79.8000	79.8000	79.8000	86.6197	87.9257	79.8000 (216)
Fuel for water heating, kWh/month	242.1462	213.8432	225.6377	204.8302	206.4132	193.8665	185.9049	204.3857	204.1471	212.0442	221.2112	236.0463 (219)
Water heating fuel used												2550.4762 (219)
Annual totals kWh/year												
Space heating fuel - main system												5219.6982 (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)												443.6236 (232)
Total delivered energy for all uses												8288.7980 (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	5219.6982	0.2160	1127.4548 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2550.4762	0.2160	550.9029 (264)
Space and water heating			1678.3577 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Total CO2, kg/m2/year			1947.5233 (272)
Emissions per m2 for space and water heating			14.7847 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0282 (272b)
Emissions per m2 for pumps and fans			0.3429 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7847 * 1.00) + 2.0282 + 0.3429, rounded to 2 d.p.			17.1600 (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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.7300
Infiltration rate					0.3750 (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) =	0.3750 (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	0.4781	0.4687	0.4593	0.4124	0.4031	0.3562	0.3562	0.3468	0.3750	0.4031	0.4218	0.4406 (22b)
Effective ac	0.6143	0.6098	0.6055	0.5851	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5890	0.5971 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			9.0000	510.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9654.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.0433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	58.5646	58.1416	57.7269	55.7791	55.4147	53.7183	53.7183	53.4042	54.3718	55.4147	56.1519	56.9227 (38)
Average = Sum(39)m / 12 =	145.2974	144.8743	144.4596	142.5119	142.1475	140.4511	140.4511	140.1369	141.1045	142.1475	142.8847	143.6554 (39)
												142.5102 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2799	1.2762	1.2725	1.2554	1.2522	1.2372	1.2372	1.2345	1.2430	1.2522	1.2587	1.2655 (40)
HLP (average)												1.2554 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy conte	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Energy content (annual)										Total = Sum(45)m =		1597.2519 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.1902	30.7776	31.7597	27.6889	26.5681	22.9263	21.2446	24.3784	24.6696	28.7500	31.3829	34.0798 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	47.2986	45.7999	42.6877	38.4567	35.7098	31.8420	28.5545	32.7667	34.2633	38.6425	43.5874	45.8062	(72)
Total internal gains	414.4536	413.0157	398.5062	374.4737	348.8268	325.0967	310.3066	314.4580	327.3519	351.5326	379.3774	401.4586	(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
East				9.6400		19.6403		0.7200		0.7000		0.7700		66.1284 (76)
South				0.6000		46.7521		0.7200		0.7000		0.7700		9.7975 (78)
West				5.2800		19.6403		0.7200		0.7000		0.7700		36.2197 (80)
West				5.2200		19.6403		0.7200		0.7000		0.7700		35.8081 (80)
Solar gains	147.9538	286.3087	465.5241	672.2304	819.6051	837.5357	797.9477	687.9639	539.0032	337.9967	183.8780			122.0789 (83)
Total gains	562.4074	699.3245	864.0303	1046.7041	1168.4319	1162.6324	1108.2543	1002.4219	866.3552	689.5293	563.2554			523.5375 (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	18.4566	18.5105	18.5637	18.8174	18.8656	19.0935	19.0935	19.1363	19.0051	18.8656	18.7683	18.6676	
alpha	2.2304	2.2340	2.2376	2.2545	2.2577	2.2729	2.2729	2.2758	2.2670	2.2577	2.2512	2.2445	
util living area	0.9703	0.9515	0.9141	0.8412	0.7346	0.6014	0.4809	0.5332	0.7333	0.8960	0.9573	0.9745	(86)
MIT	17.9007	18.2492	18.8440	19.5969	20.2282	20.6659	20.8576	20.8154	20.4349	19.5675	18.5972	17.8472	(87)
Th 2	19.8566	19.8595	19.8624	19.8759	19.8785	19.8903	19.8903	19.8925	19.8858	19.8785	19.8733	19.8680	(88)
util rest of house	0.9659	0.9444	0.9013	0.8167	0.6913	0.5307	0.3817	0.4342	0.6731	0.8745	0.9499	0.9707	(89)
MIT 2	17.0270	17.3732	17.9596	18.6964	19.2878	19.6793	19.8248	19.8018	19.4961	18.6867	17.7309	16.9812	(90)
Living area fraction	17.1246	17.4710	18.0584	18.7970	19.3929	19.7895	19.9402	19.9150	19.6010	18.7851	17.8277	17.0780	(91)
MIT	17.1246	17.4710	18.0584	18.7970	19.3929	19.7895	19.9402	19.9150	19.6010	18.7851	17.8277	17.0780	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1246	17.4710	18.0584	18.7970	19.3929	19.7895	19.9402	19.9150	19.6010	18.7851	17.8277	17.0780	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9507	0.9240	0.8747	0.7881	0.6698	0.5236	0.3865	0.4364	0.6550	0.8472	0.9309	0.9571	(94)
Ext temp.	534.6879	646.1468	755.7317	824.8754	782.5874	608.7238	428.3445	437.4730	567.4582	584.1516	524.3437	501.0846	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1863.3790	1821.2204	1669.7185	1410.4422	1093.5206	728.8755	469.1328	492.5783	776.2119	1163.4904	1532.8235	1849.9897	(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	988.5462	789.6494	680.0062	421.6081	231.3343	0.0000	0.0000	0.0000	0.0000	431.0280	726.1055	1003.5854	(98)
Space heating per m2												5271.8630	(98)
												(98) / (4) =	46.4399 (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	1320.2401	1039.3380	1065.0406	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7311	0.7908	0.7565	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	965.1665	821.9472	805.7298	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1470.9507	1404.9268	1283.3254	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	364.1646	433.7368	355.3311	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1153.2325 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	91.0412	108.4342	88.8328	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												288.3081 (107)
Space cooling per m2												2.5397 (108)
Energy for space heating												46.4399 (99)
Energy for space cooling												2.5397 (108)
Total												48.9797 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1385 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3885	(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) =	0.3885 (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	0.4953	0.4856	0.4759	0.4273	0.4176	0.3690	0.3690	0.3593	0.3885	0.4176	0.4370	0.4564 (22b)
Effective ac	0.6226	0.6179	0.6132	0.5913	0.5872	0.5681	0.5681	0.5646	0.5754	0.5872	0.5955	0.6042 (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)			20.7400	1.3258	27.4962		(27)					
150mm EPS B&B			56.7600	0.1300	7.3788		(28a)					
140mm Timber Frame	153.8700	22.8600	131.0100	0.1800	23.5818		(29a)					
400mm Mineral Wool	56.7600		56.7600	0.1300	7.3788		(30)					
Total net area of external elements Aum(A, m2)			267.3900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		67.9556		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5035 (36)					
Total fabric heat loss						(33) + (36) =	79.4591 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.3633	Feb 58.9092	Mar 58.4641	Apr 56.3736	May 55.9825	Jun 54.1617	Jul 54.1617	Aug 53.8245	Sep 54.8630	Oct 55.9825	Nov 56.7737	Dec 57.6009 (38)
Heat transfer coeff	138.8224	138.3683	137.9232	135.8327	135.4416	133.6208	133.6208	133.2836	134.3222	135.4416	136.2328	137.0600 (39)
Average = Sum(39)m / 12 =												135.8308 (39)
HLP	Jan 1.2229	Feb 1.2189	Mar 1.2150	Apr 1.1966	May 1.1931	Jun 1.1771	Jul 1.1771	Aug 1.1741	Sep 1.1832	Oct 1.1931	Nov 1.2001	Dec 1.2074 (40)
HLP (average)												1.1965 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1597.2519 (45)
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	35.1902	30.7776	31.7597	27.6889	26.5681	22.9263	21.2446	24.3784	24.6696	28.7500	31.3829	34.0798 (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	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	141.7192	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1198	22.3112	18.1447	13.7367	10.2683	8.6690	9.3671	12.1757	16.3422	20.7502	24.2186	25.8180	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5194	279.3888	272.1580	256.7645	237.3329	219.0699	206.8692	203.9998	211.2306	226.6241	246.0557	264.3187	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	37.1719	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	47.2986	45.7999	42.6877	38.4567	35.7098	31.8420	28.5545	32.7667	34.2633	38.6425	43.5874	45.8062	(72)
Total internal gains	414.4536	413.0157	398.5062	374.4737	348.8268	325.0967	310.3066	314.4580	327.3519	351.5326	379.3774	401.4586	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	9.6400	19.6403	0.6300		0.7000	0.7700	57.8624 (76)
South	0.6000	46.7521	0.6300		0.7000	0.7700	8.5728 (78)
West	10.5000	19.6403	0.6300		0.7000	0.7700	63.0244 (80)

Solar gains	129.4595	250.5201	407.3336	588.2016	717.1545	732.8437	698.2043	601.9684	471.6278	295.7471	160.8933	106.8191 (83)
Total gains	543.9132	663.5359	805.8398	962.6753	1065.9813	1057.9404	1008.5108	916.4264	798.9798	647.2797	540.2707	508.2776 (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	56.7872	56.9736	57.1574	58.0371	58.2047	58.9978	58.9978	59.1470	58.6897	58.2047	57.8666	57.5174	
alpha	4.7858	4.7982	4.8105	4.8691	4.8803	4.9332	4.9332	4.9431	4.9126	4.8803	4.8578	4.8345	
util living area	0.9993	0.9979	0.9924	0.9680	0.8911	0.7327	0.5653	0.6356	0.8861	0.9877	0.9984	0.9995	(86)
MIT	19.5509	19.7208	20.0187	20.4161	20.7458	20.9341	20.9853	20.9748	20.8201	20.3685	19.8898	19.5307	(87)
Th 2	19.9017	19.9049	19.9080	19.9228	19.9255	19.9384	19.9384	19.9408	19.9334	19.9255	19.9199	19.9141	(88)
util rest of house	0.9990	0.9971	0.9895	0.9551	0.8477	0.6395	0.4379	0.5054	0.8227	0.9810	0.9977	0.9993	(89)
MIT 2	18.5770	18.7491	19.0480	19.4487	19.7528	19.9081	19.9347	19.9335	19.8296	19.4099	18.9300	18.5666	(90)
Living area fraction									fLA = Living area / (4) =			0.1117	(91)
MIT	18.6858	18.8577	19.1564	19.5568	19.8637	20.0227	20.0521	20.0498	19.9402	19.5170	19.0372	18.6742	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6858	18.8577	19.1564	19.5568	19.8637	20.0227	20.0521	20.0498	19.9402	19.5170	19.0372	18.6742	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9961	0.9868	0.9494	0.8448	0.6476	0.4521	0.5197	0.8232	0.9773	0.9968	0.9990	(94)
Ext temp.	543.1291	660.9439	795.1901	913.9833	900.4947	685.1170	455.9359	476.2561	657.6951	632.5931	538.5602	507.7546	(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	1997.0698	1931.2996	1745.6153	1447.5411	1105.7050	724.5862	461.2658	486.4651	784.4724	1207.7330	1626.2405	1983.8411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1081.7319	853.6790	707.1164	384.1616	152.6765	0.0000	0.0000	0.0000	0.0000	427.9040	783.1298	1098.2084	(98)
Space heating												5488.6076	(98)
Space heating per m2										(98) / (4) =		48.3493	(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	1256.0357	988.7941	1012.9557	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8596	0.9204	0.8891	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.6626	910.1107	900.6611	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1348.5835	1288.3436	1182.8112	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	193.6230	281.4052	209.9196	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												684.9479	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	48.4058	70.3513	52.4799	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												171.2370 (107)
Space cooling per m2												1.5084 (108)
Energy for space heating												48.3493 (99)
Energy for space cooling												1.5084 (108)
Total												49.8577 (109)
Target Fabric Energy Efficiency (TFEE)												57.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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																4.7300	
Infiltration rate																0.2365 (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) =		0.2365 (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																	
	0.2602	0.2424	0.2424	0.2306	0.2306	0.2188	0.2188	0.2069	0.2069	0.2247	0.2188	0.2306	(22b)				
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5102	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	48.6376	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Heat transfer coeff	135.3703	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
Average = Sum(39)m / 12 =												134.4833 (39)
HLP	1.1925	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (40)
HLP (average)												1.1847 (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 2.8344 (42)
Average daily hot water use (litres/day) 101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
Solar input	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
												2107.6679 (64)
RHI water heating demand												2108 (64)
Heat gains from water heating, kWh/month	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653 (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	
East				9.6400	25.1925		0.7200	0.7000		0.7700	84.8228 (76)	
South				0.6000	56.7559		0.7200	0.7000		0.7700	11.8939 (78)	
West				5.2800	25.1925		0.7200	0.7000		0.7700	46.4590 (80)	
West				5.2200	25.1925		0.7200	0.7000		0.7700	45.9310 (80)	

Solar gains	189.1068	311.4018	509.3871	737.5315	848.2363	949.4947	873.0687	786.9866	617.4890	391.3993	234.2747	147.6815 (83)
Total gains	899.7720	1016.9831	1188.8903	1376.4190	1445.1524	1509.1023	1411.0676	1334.3152	1188.3679	1003.1257	891.4116	839.5468 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.8583	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	
alpha	2.3906	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	
util living area	0.9210	0.8950	0.8342	0.7307	0.5915	0.4142	0.3007	0.3162	0.5417	0.7687	0.8856	0.9294 (86)
MIT	18.8784	19.1435	19.6578	20.2161	20.6568	20.8998	20.9680	20.9642	20.7970	20.2726	19.5006	18.8389 (87)
Th 2	19.9260	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329 (88)
util rest of house	0.9100	0.8808	0.8119	0.6951	0.5362	0.3388	0.2086	0.2200	0.4645	0.7271	0.8672	0.9194 (89)
MIT 2	17.1467	17.5272	18.2511	19.0139	19.5844	19.8583	19.9188	19.9170	19.7612	19.1147	18.0452	17.0955 (90)
Living area fraction												
MIT	17.3402	17.7077	18.4082	19.1482	19.7042	19.9747	20.0360	20.0340	19.8769	19.2440	18.2078	17.2903 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1902	17.5577	18.2582	18.9982	19.5542	19.8247	19.8860	19.8840	19.7269	19.0940	18.0578	17.1403 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8706	0.8385	0.7684	0.6590	0.5147	0.3308	0.2044	0.2154	0.4482	0.6878	0.8238	0.8818 (94)
Useful gains	783.3679	852.7631	913.5892	907.1221	743.8283	499.1785	288.4009	287.4593	532.6033	689.9541	734.3655	740.2882 (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												
	1596.0381	1566.8256	1432.4954	1209.3769	867.4627	527.4861	293.8061	293.5362	594.9867	953.4573	1298.0273	1564.4829 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	604.6266	479.8500	386.0662	217.6235	91.9840	0.0000	0.0000	0.0000	0.0000	196.0463	405.8364	613.2009 (98)
Space heating												2995.2341 (98)
RHI space heating demand												2995 (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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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											4.7300	
Infiltration rate											0.2365 (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) =	0.2365 (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	0.3015	0.2956	0.2897	0.2602	0.2542	0.2247	0.2247	0.2188	0.2365	0.2542	0.2661	0.2779 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5515	0.5456	0.5397	0.5102	0.5042	0.5000	0.5000	0.5000	0.5000	0.5042	0.5161	0.5279 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (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	52.5835	52.0198	51.4561	48.6376	48.0739	47.6699	47.6699	47.6699	47.6699	48.0739	49.2013	50.3287 (38)
Heat transfer coeff	139.3162	138.7525	138.1888	135.3703	134.8066	134.4026	134.4026	134.4026	134.4026	134.8066	135.9340	137.0614 (39)
Average = Sum(39)m / 12 =												135.9873 (39)
HLP	1.2272	1.2223	1.2173	1.1925	1.1875	1.1840	1.1840	1.1840	1.1840	1.1875	1.1974	1.2074 (40)
HLP (average)												1.1979 (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 2.8344 (42)
Average daily hot water use (litres/day) 101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (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												
	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum(64)m =				2107.6679 (64)
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	Specific data or Table 6c	factor Table 6d	W						
East	9.6400	19.6403	0.7200	0.7000	0.7700	66.1284 (76)						
South	0.6000	46.7521	0.7200	0.7000	0.7700	9.7975 (78)						
West	5.2800	19.6403	0.7200	0.7000	0.7700	36.2197 (80)						
West	5.2200	19.6403	0.7200	0.7000	0.7700	35.8081 (80)						
Solar gains	147.9538	286.3087	465.5241	672.2304	819.6051	837.5357	797.9477	687.9639	539.0032	337.9967	183.8780	122.0789 (83)
Total gains	858.6190	991.8901	1145.0272	1311.1179	1416.5212	1397.1433	1335.9466	1235.2925	1109.8821	949.7231	841.0149	813.9442 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2676	20.3499	20.4329	20.8583	20.9456	21.0085	21.0085	21.0085	21.0085	20.9456	20.7718	20.6010
alpha	2.3512	2.3567	2.3622	2.3906	2.3964	2.4006	2.4006	2.4006	2.4006	2.3964	2.3848	2.3734
util living area	0.9372	0.9122	0.8652	0.7788	0.6614	0.5242	0.4055	0.4480	0.6403	0.8271	0.9139	0.9435 (86)
MIT	18.5151	18.8259	19.3399	19.9800	20.4752	20.7882	20.9176	20.8926	20.6405	19.9788	19.1500	18.4762 (87)
Th 2	19.8983	19.9022	19.9062	19.9260	19.9300	19.9329	19.9329	19.9329	19.9329	19.9300	19.9220	19.9141 (88)
util rest of house	0.9287	0.9005	0.8471	0.7492	0.6156	0.4569	0.3187	0.3596	0.5765	0.7968	0.9005	0.9358 (89)
MIT 2	16.6083	17.0551	17.7878	18.6903	19.3538	19.7424	19.8791	19.8584	19.5828	18.7145	17.5395	16.5610 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.8213	17.2529	17.9612	18.8344	19.4791	19.8592	19.9951	19.9739	19.7009	18.8558	17.7194	16.7749 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6713	17.1029	17.8112	18.6844	19.3291	19.7092	19.8451	19.8239	19.5509	18.7058	17.5694	16.6249 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8920	0.8591	0.8024	0.7086	0.5867	0.4416	0.3112	0.3499	0.5507	0.7532	0.8597	0.9013 (94)
Useful gains	765.9216	852.1727	918.7382	929.1088	831.1002	616.9986	415.6940	432.2323	611.1707	715.3750	722.9968	733.6042 (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												
	1723.5165	1693.1797	1563.0819	1324.5156	1028.4507	686.6870	436.1438	460.1878	732.6189	1092.7089	1423.1487	1702.9763 (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												

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Space heating	712.4506	565.1567	479.3917	284.6929	146.8288	0.0000	0.0000	0.0000	0.0000	280.7365	504.1093	721.2128 (98)
Space heating per m2												3694.5794 (98)
												(98) / (4) = 32.5456 (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												4077.9022 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	712.4506	565.1567	479.3917	284.6929	146.8288	0.0000	0.0000	0.0000	0.0000	280.7365	504.1093	721.2128 (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)	786.3693	623.7933	529.1300	314.2306	162.0627	0.0000	0.0000	0.0000	0.0000	309.8637	556.4121	796.0406 (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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
Efficiency of water heater	87.9296	87.7150	87.2486	86.2461	84.5515	79.9000	79.9000	79.9000	79.9000	86.1153	87.4006	79.9000 (216)
Fuel for water heating, kWh/month	237.6346	209.7596	220.9865	199.7221	199.1411	187.5348	179.3802	197.8379	197.8025	207.4483	216.9737	231.4958 (219)
Water heating fuel used												2485.7172 (219)
Annual totals kWh/year												
Space heating fuel - main system												4077.9022 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												81.1539 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												156.1539 (231)
Electricity for lighting (calculated in Appendix L)												443.6236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =										-675.5997		-675.5997 (233)
Total delivered energy for all uses												6487.7972 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4077.9022	3.4800	141.9110 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2485.7172	3.4800	86.5030 (247)
Mechanical ventilation fans	81.1539	13.1900	10.7042 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.6236	13.1900	58.5140 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-675.5997	13.1900	-89.1116 (252)
Total energy cost			338.4130 (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] =	0.8966 (257)
SAP value		87.4920
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	4077.9022	0.2160	880.8269 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2485.7172	0.2160	536.9149 (264)
Space and water heating			1417.7418 (265)
Pumps and fans	156.1539	0.5190	81.0439 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)

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Total kg/year	1378.3901 (272)
CO2 emissions per m2	12.1400 (273)
EI value	88.3482
EI rating	88 (274)
EI band	B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, 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	$3.48 / 0.8457 = 4.115$, stars = 4
Water heating environmental impact	$0.216 / 0.8457 = 0.2554$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.7300
Infiltration rate					0.2365 (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)	=	0.2365 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2602	0.2424	0.2424	0.2306	0.2306	0.2188	0.2188	0.2069	0.2069	0.2247	0.2188	0.2306 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5102	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss							(33) + (36) = 86.7328 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.6376	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Average = Sum(39)m / 12 =	135.3703	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
	134.4833 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1925	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Calculation Type: New Build (As Built)

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

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260 (64)
								Total per year (kWh/year) = Sum (64)m =				2107.6679 (64)
Heat gains from water heating, kWh/month												
	89.7426	79.4820	84.3749	76.8865	76.2516	69.4345	67.9218	72.8254	72.1623	79.6657	82.6666	88.0052 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	120.6218	118.2768	113.4071	106.7868	102.4887	96.4368	91.2927	97.8836	100.2254	107.0775	114.8148	118.2866 (72)
Total internal gains												
	710.6652	705.5814	679.5032	638.8875	596.9161	559.6076	537.9989	547.3286	570.8789	611.7264	657.1369	691.8653 (73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a	Table 6b	Specific data	Specific data	Specific data	factor	W	
					W/m2		or Table 6b	or Table 6c		Table 6d		
East				9.6400	25.1925		0.7200	0.7000		0.7700	84.8228 (76)	
South				0.6000	56.7559		0.7200	0.7000		0.7700	11.8939 (78)	
West				5.2800	25.1925		0.7200	0.7000		0.7700	46.4590 (80)	
West				5.2200	25.1925		0.7200	0.7000		0.7700	45.9310 (80)	

Solar gains	189.1068	311.4018	509.3871	737.5315	848.2363	949.4947	873.0687	786.9866	617.4890	391.3993	234.2747	147.6815 (83)
Total gains	899.7720	1016.9831	1188.8903	1376.4190	1445.1524	1509.1023	1411.0676	1334.3152	1188.3679	1003.1257	891.4116	839.5468 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.8583	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085
alpha	2.3906	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006
util living area	0.9210	0.8950	0.8342	0.7307	0.5915	0.4142	0.3007	0.3162	0.5417	0.7687	0.8856	0.9294 (86)
MIT	18.8784	19.1435	19.6578	20.2161	20.6568	20.8998	20.9680	20.9642	20.7970	20.2726	19.5006	18.8389 (87)
Th 2	19.9260	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329 (88)
util rest of house	0.9100	0.8808	0.8119	0.6951	0.5362	0.3388	0.2086	0.2200	0.4645	0.7271	0.8672	0.9194 (89)
MIT 2	17.1467	17.5272	18.2511	19.0139	19.5844	19.8583	19.9188	19.9170	19.7612	19.1147	18.0452	17.0955 (90)
Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	17.3402	17.7077	18.4082	19.1482	19.7042	19.9747	20.0360	20.0340	19.8769	19.2440	18.2078	17.2903 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1902	17.5577	18.2582	18.9982	19.5542	19.8247	19.8860	19.8840	19.7269	19.0940	18.0578	17.1403 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8706	0.8385	0.7684	0.6590	0.5147	0.3308	0.2044	0.2154	0.4482	0.6878	0.8238	0.8818 (94)
Useful gains	783.3679	852.7631	913.5892	907.1221	743.8283	499.1785	288.4009	287.4593	532.6033	689.9541	734.3655	740.2882 (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												
	1596.0381	1566.8256	1432.4954	1209.3769	867.4627	527.4861	293.8061	293.5362	594.9867	953.4573	1298.0273	1564.4829 (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												

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604.6266	479.8500	386.0662	217.6235	91.9840	0.0000	0.0000	0.0000	0.0000	196.0463	405.8364	613.2009 (98)
Space heating											2995.2341 (98)
Space heating per m2											(98) / (4) = 26.3851 (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	3305.9979 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	604.6266	479.8500	386.0662	217.6235	91.9840	0.0000	0.0000	0.0000	0.0000	196.0463	405.8364	613.2009	(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)	667.3583	529.6358	426.1216	240.2025	101.5276	0.0000	0.0000	0.0000	0.0000	216.3867	447.9431	676.8222	(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	208.9512	183.9908	192.8077	172.2525	168.3768	149.8403	143.3248	158.0725	158.0442	178.6447	189.6363	203.7260	(64)
Efficiency of water heater	87.5875	87.3576	86.7314	85.5390	83.3790	79.9000	79.9000	79.9000	79.9000	85.1625	86.8942	79.9000	(216)
Fuel for water heating, kWh/month	238.5628	210.6180	222.3044	201.3732	201.9417	187.5348	179.3802	197.8379	197.8025	209.7693	218.2383	232.3727	(219)
Water heating fuel used												2497.7358	(219)
Annual totals kWh/year													
Space heating fuel - main system												3305.9979	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

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

mechanical ventilation fans (SFP = 0.2302)	81.1539 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	156.1539 (231)
Electricity for lighting (calculated in Appendix L)	443.6236 (232)

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

PV Unit 0 (0.80 * 0.99 * 961 * 1.00) =	-760.9470	-760.9470 (233)
Total delivered energy for all uses		5642.5641 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3305.9979	10.2300	338.2036	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2497.7358	10.2300	255.5184	(247)
Mechanical ventilation fans	81.1539	36.7200	29.7997	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	443.6236	36.7200	162.8986	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-760.9470	36.7200	-279.4197	(252)
Total energy cost			637.5405	(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	3305.9979	0.2160	714.0955	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2497.7358	0.2160	539.5109	(264)
Space and water heating			1253.6065	(265)
Pumps and fans	156.1539	0.5190	81.0439	(267)
Energy for lighting	443.6236	0.5190	230.2407	(268)
Energy saving/generation technologies				
PV Unit	-760.9470	0.5190	-394.9315	(269)
Total kg/year			1169.9595	(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	3305.9979	1.2200	4033.3174	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

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Water heating (other fuel)	2497.7358	1.2200	3047.2376 (264)
Space and water heating			7080.5550 (265)
Pumps and fans	156.1539	3.0700	479.3923 (267)
Energy for lighting	443.6236	3.0700	1361.9245 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			6585.7645 (272)
Primary energy kWh/m2/year			58.0141 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 118	-263 kg (22.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£118	2.31 kg/m²	B 89 B 90
Total Savings	£118	2.31 kg/m²	

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

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 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	£220	£239	-£18
Mains gas	£697	£560	£137
Space heating	£499	£501	-£2
Water heating	£256	£135	£120
Lighting	£163	£163	£0
Generated (PV)	-£279	-£279	£0
Total cost of fuels	£638	£520	£119
Total cost of uses	£639	£520	£118
Delivered energy	50 kWh/m²	38 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.7300
Infiltration rate					0.2365 (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)	=	0.2365 (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	0.3015	0.2956	0.2897	0.2602	0.2542	0.2247	0.2247	0.2188	0.2365	0.2542	0.2661	0.2779 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5515	0.5456	0.5397	0.5102	0.5042	0.5000	0.5000	0.5000	0.5000	0.5042	0.5161	0.5279 (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)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss						(33) + (36) =	86.7328 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5835	52.0198	51.4561	48.6376	48.0739	47.6699	47.6699	47.6699	47.6699	48.0739	49.2013	50.3287 (38)
Average = Sum(39)m / 12 =	139.3162	138.7525	138.1888	135.3703	134.8066	134.4026	134.4026	134.4026	134.4026	134.8066	135.9340	137.0614 (39)
												135.9873 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2272	1.2223	1.2173	1.1925	1.1875	1.1840	1.1840	1.1840	1.1840	1.1875	1.1974	1.2074 (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												2.8344 (42)
Average daily hot water use (litres/day)												101.5166 (43)
Daily hot water use	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

Energy conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	1597.2519 (45)
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	201.9576	177.6739	184.4183	158.7309	148.5889	130.4656	123.3042	138.9824	145.8733	170.2553	182.8682	196.7323 (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												1.1355 (H8)
Utilisation factor												0.5855 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.5166 (H14)
Volume ratio Veff/V												1.0786 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-933.7062 (H17)
Solar input	-27.0756	-45.1814	-76.9491	-103.1270	-127.4047	-125.2591	-123.6038	-107.9933	-84.5804	-57.7584	-32.1156	-22.6577 (63)
												-933.7062 (63)
Output from w/h	174.8820	132.4925	107.4692	55.6039	21.1842	5.2064	0.0000	30.9891	61.2929	112.4969	150.7527	174.0747 (64)
												1026.4443 (64)
Heat gains from water heating, kWh/month	84.1477	74.4285	77.6634	66.0692	60.4212	53.9347	51.9053	57.5533	62.4255	72.9542	77.2522	82.4103 (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	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	(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)	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	(71)
Water heating gains (Table 5)	113.1017	110.7567	104.3862	91.7628	81.2113	74.9092	69.7652	77.3566	86.7021	98.0567	107.2947	110.7665	(72)
Total internal gains	703.1452	698.0613	670.4823	623.8634	575.6388	538.0801	516.4714	526.8016	557.3556	602.7056	649.6169	684.3452	(73)

6. Solar gains

[Jan]					Area	Solar flux		g	FF	Access		Gains	
					m2	Table 6a		Specific data	Specific data	factor		W	
						W/m2		or Table 6b	or Table 6c	Table 6d			

East					9.6400		19.6403	0.7200	0.7000		0.7700		66.1284 (76)
South					0.6000		46.7521	0.7200	0.7000		0.7700		9.7975 (78)
West					5.2800		19.6403	0.7200	0.7000		0.7700		36.2197 (80)
West					5.2200		19.6403	0.7200	0.7000		0.7700		35.8081 (80)

Solar gains	147.9538	286.3087	465.5241	672.2304		819.6051	837.5357	797.9477	687.9639	539.0032	337.9967	183.8780	122.0789 (83)
Total gains	851.0989	984.3701	1136.0064	1296.0938		1395.2439	1375.6158	1314.4191	1214.7656	1096.3589	940.7022	833.4949	806.4242 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2676	20.3499	20.4329	20.8583	20.9456	21.0085	21.0085	21.0085	21.0085	20.9456	20.7718	20.6010	
alpha	2.3512	2.3567	2.3622	2.3906	2.3964	2.4006	2.4006	2.4006	2.4006	2.3964	2.3848	2.3734	
util living area	0.9383	0.9134	0.8669	0.7823	0.6670	0.5301	0.4110	0.4540	0.6449	0.8296	0.9153	0.9445	(86)
MIT	18.5050	18.8166	19.3304	19.9682	20.4648	20.7828	20.9151	20.8894	20.6345	19.9704	19.1406	18.4658	(87)
Th 2	19.8983	19.9022	19.9062	19.9260	19.9300	19.9329	19.9329	19.9329	19.9329	19.9300	19.9220	19.9141	(88)
util rest of house	0.9298	0.9018	0.8490	0.7530	0.6213	0.4625	0.3234	0.3648	0.5812	0.7996	0.9021	0.9369	(89)
MIT 2	16.5939	17.0420	17.7747	18.6749	19.3415	19.7372	19.8773	19.8560	19.5763	18.7034	17.5263	16.5462	(90)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1117 (91)
MIT	16.8074	17.2402	17.9484	18.8194	19.4669	19.8540	19.9932	19.9714	19.6945	18.8450	17.7066	16.7606 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6574	17.0902	17.7984	18.6694	19.3169	19.7040	19.8432	19.8214	19.5445	18.6950	17.5566	16.6106 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8935	0.8606	0.8043	0.7121	0.5919	0.4468	0.3156	0.3548	0.5549	0.7559	0.8614	0.9027	(94)
Useful gains	760.4185	847.1739	913.6904	922.9930	825.8210	614.5656	414.8110	431.0407	608.3510	711.0907	718.0013	727.9610	(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	1721.5841	1691.4192	1561.3180	1322.4809	1026.8124	685.9863	435.8968	459.8510	731.7563	1091.2539	1421.4103	1701.0196	(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	715.1072	567.3328	481.8349	287.6312	149.5377	0.0000	0.0000	0.0000	0.0000	282.8415	506.4545	723.9556	(98)
Space heating per m2												3714.6954	(98)
												(98) / (4) =	32.7228 (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	4100.1053 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	715.1072	567.3328	481.8349	287.6312	149.5377	0.0000	0.0000	0.0000	0.0000	282.8415	506.4545	723.9556	(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)	789.3015	626.1952	531.8266	317.4738	165.0526	0.0000	0.0000	0.0000	0.0000	312.1871	559.0005	799.0680	(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	174.8820	132.4925	107.4692	55.6039	21.1842	5.2064	0.0000	30.9891	61.2929	112.4969	150.7527	174.0747	(64)
Efficiency of water heater (217)m	88.2770	88.3598	88.4401	88.6762	89.1191	79.9000	79.9000	79.9000	79.9000	87.2742	87.8999	79.9000	(216)
Fuel for water heating, kWh/month	198.1059	149.9466	121.5163	62.7044	23.7706	6.5162	0.0000	38.7849	76.7120	128.9004	171.5050	197.1230	(219)
Water heating fuel used												1175.5854	(219)
Annual totals kWh/year													
Space heating fuel - main system												4100.1053	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)	
mechanical ventilation fans (SFP = 0.2302)	81.1539 (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	206.1539 (231)
Electricity for lighting (calculated in Appendix L)	443.6236 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.99 * 853 * 1.00) =	-675.5997	-675.5997 (233)
Total delivered energy for all uses		5249.8684 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4100.1053	3.4800	142.6837	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1175.5854	3.4800	40.9104	(247)
Mechanical ventilation fans	81.1539	13.1900	10.7042	(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	443.6236	13.1900	58.5140	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-675.5997	13.1900	-89.1116	(252)
Total energy cost			300.1881	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7954 (257)
 SAP value 88.9049
 SAP rating (Section 12) 89 (258)
 SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4100.1053	0.2160	885.6227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1175.5854	0.2160	253.9264 (264)
Space and water heating			1139.5492 (265)
Pumps and fans	206.1539	0.5190	106.9939 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-675.5997	0.5190	-350.6362 (269)
Total kg/year			1126.1474 (272)
CO2 emissions per m2			9.9200 (273)
EI value			90.4805
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	56.7600 (1b)	x 2.4000 (2b)	= 136.2240 (1b) - (3b)
First floor	56.7600 (1c)	x 2.6900 (2c)	= 152.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 288.9084 (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												4.7300
Infiltration rate												0.2365 (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) =	0.2365 (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	0.2602	0.2424	0.2424	0.2306	0.2306	0.2188	0.2188	0.2069	0.2069	0.2247	0.2188	0.2306 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5102	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			15.5200	1.3258	20.5758		(27)
French Door (Uw = 1.40)			5.2200	1.3258	6.9205		(27)
150mm EPS B&B			56.7600	0.1800	10.2168	75.0000	4257.0000 (28a)
140mm Timber Frame	153.8700	22.8600	131.0100	0.1900	24.8919	9.0000	1179.0900 (29a)
400mm Mineral Wool	56.7600		56.7600	0.1100	6.2436	9.0000	510.8400 (30)
Total net area of external elements Aum(A, m ²)			267.3900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 71.6045		(33)
Timber GF			111.3600			9.0000	1002.2400 (32c)
Timber FF			130.2700			9.0000	1172.4300 (32c)
Internal Floor			56.7600			18.0000	1021.6800 (32d)
Internal Ceiling			56.7600			18.0000	1021.6800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10164.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.5433 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1282 (36)
Total fabric heat loss							(33) + (36) = 86.7328 (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	48.6376	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699	47.6699 (38)
Heat transfer coeff	135.3703	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026	134.4026 (39)
Average = Sum(39)m / 12 =												134.4833 (39)
HLP	1.1925	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840	1.1840 (40)
HLP (average)												1.1847 (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 2.8344 (42)
 Average daily hot water use (litres/day) 101.5166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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 conte	111.6683	107.6076	103.5470	99.4863	95.4256	91.3650	91.3650	95.4256	99.4863	103.5470	107.6076	111.6683 (44)
Energy content (annual)	165.6008	144.8356	149.4573	130.3005	125.0264	107.8883	99.9744	114.7221	116.0922	135.2943	147.6843	160.3756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1597.2519 (45)
	24.8401	21.7253	22.4186	19.5451	18.7540	16.1832	14.9962	17.2083	17.4138	20.2941	22.1526	24.0563 (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												
	201.9576	177.6739	184.4183	158.7309	148.5889	130.4656	123.3042	138.9824	145.8733	170.2553	182.8682	196.7323 (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												1.2628 (H8)
Utilisation factor												0.5470 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												101.5166 (H14)
Volume ratio Veff/V												1.0786 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-970.1482 (H17)
Solar input	-31.8478	-45.2856	-77.8350	-105.0175	-122.7387	-132.3345	-125.9720	-114.8153	-89.7168	-61.6990	-37.6676	-25.2183 (63)
								Solar input (sum of months) = Sum (63)m =				-970.1482 (63)
Output from w/h												
	170.1098	132.3883	106.5833	53.7134	25.8502	0.0000	0.0000	24.1671	56.1565	108.5563	145.2007	171.5141 (64)
								Total per year (kWh/year) = Sum (64)m =				994.2395 (64)
Heat gains from water heating, kWh/month												
	84.1477	74.4285	77.6634	66.0692	60.4212	53.9347	51.9053	57.5533	62.4255	72.9542	77.2522	82.4103 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631	170.0631 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.7995	55.7780	45.3617	34.3417	25.6708	21.6724	23.4178	30.4393	40.8556	51.8756	60.5465	64.5449 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	412.7156	416.9983	406.2060	383.2306	354.2282	326.9701	308.7600	304.4773	315.2695	338.2450	367.2473	394.5055 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407	54.8407 (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)												
	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754	-113.3754 (71)
Water heating gains (Table 5)												
	113.1017	110.7567	104.3862	91.7628	81.2113	74.9092	69.7652	77.3566	86.7021	98.0567	107.2947	110.7665 (72)
Total internal gains												
	703.1452	698.0613	670.4823	623.8634	575.6388	538.0801	516.4714	526.8016	557.3556	602.7056	649.6169	684.3452 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains
				m2	Table 6a	Specific data		Specific data		factor		W
					W/m2	or Table 6b		or Table 6c		Table 6d		
East				9.6400	25.1925		0.7200		0.7000		0.7700	84.8228 (76)
South				0.6000	56.7559		0.7200		0.7000		0.7700	11.8939 (78)
West				5.2800	25.1925		0.7200		0.7000		0.7700	46.4590 (80)
West				5.2200	25.1925		0.7200		0.7000		0.7700	45.9310 (80)

Solar gains	189.1068	311.4018	509.3871	737.5315	848.2363	949.4947	873.0687	786.9866	617.4890	391.3993	234.2747	147.6815 (83)
Total gains	892.2520	1009.4631	1179.8694	1361.3950	1423.8750	1487.5748	1389.5401	1313.7882	1174.8447	994.1048	883.8916	832.0267 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.8583	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085	21.0085
alpha	2.3906	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006	2.4006
util living area												
	0.9222	0.8964	0.8362	0.7344	0.5972	0.4191	0.3049	0.3207	0.5460	0.7715	0.8873	0.9306 (86)
MIT	18.8687	19.1347	19.6492	20.2062	20.6493	20.8972	20.9670	20.9631	20.7933	20.2658	19.4920	18.8290 (87)
Th 2	19.9260	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329	19.9329 (88)
util rest of house												
	0.9113	0.8823	0.8140	0.6990	0.5419	0.3432	0.2117	0.2233	0.4687	0.7302	0.8690	0.9207 (89)
MIT 2	17.1331	17.5147	18.2394	19.0015	19.5762	19.8562	19.9183	19.9165	19.7578	19.1062	18.0333	17.0814 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Living area fraction									fLA = Living area / (4) =		0.1117 (91)	
MIT	17.3270	17.6957	18.3969	19.1360	19.6960	19.9725	20.0355	20.0334	19.8735	19.2357	18.1963	17.2766 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1770	17.5457	18.2469	18.9860	19.5460	19.8225	19.8855	19.8834	19.7235	19.0857	18.0463	17.1266 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8722	0.8401	0.7705	0.6626	0.5198	0.3349	0.2074	0.2186	0.4520	0.6906	0.8258	0.8833	(94)
Useful gains	778.2123	848.0838	909.0905	902.0704	740.1406	498.1267	288.1521	287.1799	531.0133	686.5650	729.8895	734.9653	(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	1594.2515	1565.2106	1430.9671	1207.7479	866.3651	527.1944	293.7348	293.4561	594.5239	952.3414	1296.4826	1562.6495	(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	607.1332	481.9093	388.2762	220.0878	93.9111	0.0000	0.0000	0.0000	0.0000	197.7377	407.9471	615.7971	(98)
Space heating												3012.7993	(98)
Space heating per m2										(98) / (4) =		26.5398	(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													3325.3855 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	607.1332	481.9093	388.2762	220.0878	93.9111	0.0000	0.0000	0.0000	0.0000	197.7377	407.9471	615.7971	(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)	670.1249	531.9087	428.5609	242.9225	103.6546	0.0000	0.0000	0.0000	0.0000	218.2535	450.2727	679.6877	(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	170.1098	132.3883	106.5833	53.7134	25.8502	0.0000	0.0000	24.1671	56.1565	108.5563	145.2007	171.5141	(64)
Efficiency of water heater (217)m	88.0202	88.0586	88.0601	88.2807	88.0547	79.9000	79.9000	79.9000	79.9000	86.4947	87.5233	79.9000	(216)
Fuel for water heating, kWh/month	193.2623	150.3412	121.0348	60.8438	29.3569	0.0000	0.0000	30.2467	70.2834	125.5062	165.8995	194.8320	(219)
Water heating fuel used												1141.6068	(219)
Annual totals kWh/year													
Space heating fuel - main system												3325.3855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)													
mechanical ventilation fans (SFP = 0.2302)													81.1539 (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													206.1539 (231)
Electricity for lighting (calculated in Appendix L)													443.6236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 + 961 * 1.00) =									-760.9470			-760.9470	(233)
Total delivered energy for all uses												4355.8228	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3325.3855	10.2300	340.1869	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1141.6068	10.2300	116.7864	(247)
Mechanical ventilation fans	81.1539	36.7200	29.7997	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	443.6236	36.7200	162.8986	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-760.9470	36.7200	-279.4197	(252)
Total energy cost			519.1519	(255)

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3325.3855	0.2160	718.2833 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1141.6068	0.2160	246.5871 (264)
Space and water heating			964.8703 (265)
Pumps and fans	206.1539	0.5190	106.9939 (267)
Energy for lighting	443.6236	0.5190	230.2407 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	0.5190	-394.9315 (269)
Total kg/year			907.1733 (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	3325.3855	1.2200	4056.9703 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1141.6068	1.2200	1392.7603 (264)
Space and water heating			5449.7306 (265)
Pumps and fans	206.1539	3.0700	632.8923 (267)
Energy for lighting	443.6236	3.0700	1361.9245 (268)
Energy saving/generation technologies			
PV Unit	-760.9470	3.0700	-2336.1073 (269)
Primary energy kWh/year			5108.4401 (272)
Primary energy kWh/m2/year			45.0004 (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	89.5 (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	381.36 (P1)
Transmission heat loss coefficient	86.73 (37)
Summer heat loss coefficient	468.09 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
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
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	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.6400	125.2818	0.7200	0.7000	0.9000	493.0381
South	0.6000	118.5567	0.7200	0.7000	0.9000	29.0397
West	5.2800	125.2818	0.7200	0.7000	0.9000	270.0458
West	5.2200	125.2818	0.7200	0.7000	0.9000	266.9771
total:						1059.1008

	Jun	Jul	Aug	
Solar gains	1138	1059	935	(P3)
Internal gains	557	535	544	
Total summer gains	1695	1594	1479	(P5)

Summer gain/loss ratio	3.62	3.41	3.16	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 89.5)	1.37	1.37	1.37	
Threshold temperature	20.39	22.08	21.83	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium