

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-175				Issued on Date	30/09/2022
Assessment Reference	As Built	Prop Type Ref	A30L End Op			
Property	12, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS					
SAP Rating		88 B	DER	12.27	TER	17.22
Environmental		90 B	% DER<TER	28.74		
CO ₂ Emissions (t/year)		0.92	DFEE	40.94	TFEE	48.59
General Requirements Compliance		Pass	% DFEE<TFEE	15.74		
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

End-Terrace House, total floor area 96 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) 17.22 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.27 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.9 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	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (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: 4.27 (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 COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

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 (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.33 m², No overhang
Windows facing South: 6.91 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 0.64 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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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												4.2700
Infiltration rate												0.2135 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1975 (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	0.2518	0.2469	0.2419	0.2172	0.2123	0.1876	0.1876	0.1827	0.1975	0.2123	0.2222	0.2320 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5018	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.3950	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.9196	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7870 (39)
HLP	Jan 1.0196	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0182 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)												1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (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	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3629	22.5271	18.3203	13.8696	10.3677	8.7529	9.4578	12.2936	16.5004	20.9510	24.4530	26.0678 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.7623	252.3541	245.8230	231.9190	214.3677	197.8719	186.8517	184.2600	190.7911	204.6951	222.2464	238.7422 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986 (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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887 (71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629 (72)
Total internal gains	418.0496	415.5304	400.0676	375.2859	350.0589	326.0738	310.7686	317.4096	330.4230	355.4293	383.9896	405.4687 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.3300	10.6334	0.7200	0.7000	0.7700		12.3674 (74)		
South				3.5800	46.7521	0.7200	0.7000	0.7700		58.4585 (78)		
South				3.3300	46.7521	0.7200	0.7000	0.7700		54.3762 (78)		
Solar gains	125.2021	208.4289	275.5563	330.5568	364.1379	359.8328	347.5380	322.0677	294.1847	227.4520	149.0044	107.8097 (83)
Total gains	543.2518	623.9593	675.6239	705.8427	714.1968	685.9066	658.3066	639.4774	624.6078	582.8813	532.9940	513.2783 (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	25.4761	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138
alpha	2.6984	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9653	0.9488	0.9244	0.8827	0.8109	0.6955	0.5630	0.5926	0.7573	0.8912	0.9499	0.9699 (86)
MIT	18.7434	19.0037	19.3879	19.8617	20.3289	20.6977	20.8789	20.8560	20.5901	19.9890	19.2667	18.6732 (87)
Th 2	20.0671	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683 (88)
util rest of house	0.9605	0.9417	0.9136	0.8642	0.7773	0.6339	0.4696	0.5023	0.7045	0.8705	0.9419	0.9657 (89)
MIT 2	17.0260	17.4026	17.9565	18.6334	19.2852	19.7709	19.9791	19.9568	19.6411	18.8228	17.7881	16.9251 (90)
Living area fraction	17.4312	17.7803	18.2942	18.9232	19.5315	19.9896	20.1914	20.1690	19.8651	19.0980	18.1370	17.3376 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2812	17.6303	18.1442	18.7732	19.3815	19.8396	20.0414	20.0190	19.7151	18.9480	17.9870	17.1876 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9396	0.9163	0.8838	0.8318	0.7479	0.6168	0.4666	0.4971	0.6812	0.8384	0.9165	0.9465 (94)
Ext temp.	510.4577	571.7120	597.1471	587.1275	534.1378	423.0351	307.1870	317.8587	425.4751	488.6704	488.4668	485.8389 (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	1271.1170	1244.7091	1138.5105	965.3523	751.0537	512.3033	336.4788	353.8480	549.0115	816.2214	1064.4717	1269.8595 (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	565.9305	452.2540	402.7744	272.3219	161.3854	0.0000	0.0000	0.0000	0.0000	243.6979	414.7236	583.3113 (98)
Space heating per m2												3096.3990 (98)
												(98) / (4) = 32.2407 (99)

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3421.4354 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	565.9305	452.2540	402.7744	272.3219	161.3854	0.0000	0.0000	0.0000	0.0000	243.6979	414.7236	583.3113	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	625.3376	499.7282	445.0546	300.9081	178.3264	0.0000	0.0000	0.0000	0.0000	269.2795	458.2581	644.5429	(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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522	(64)
Efficiency of water heater (217)m	89.7248	89.6690	89.5714	89.3885	89.0132	87.3000	87.3000	87.3000	87.3000	89.2787	89.5994	87.3000	(216)
Fuel for water heating, kWh/month	194.5114	170.6659	177.3475	156.3959	151.7895	135.1935	126.9036	143.3113	144.3385	162.5280	174.8756	188.7850	(219)
Water heating fuel used												1926.6458	(219)
Annual totals kWh/year													
Space heating fuel - main system												3421.4354	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													67.9061 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													142.9061 (231)
Electricity for lighting (calculated in Appendix L)													447.9166 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1068 * 1.00) =													-546.8521 (233)
Total delivered energy for all uses													5392.0518 (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	3421.4354	0.2160	739.0300 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.6458	0.2160	416.1555 (264)
Space and water heating			1155.1855 (265)
Pumps and fans	142.9061	0.5190	74.1683 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Energy saving/generation technologies			
PV Unit	-546.8521	0.5190	-283.8162 (269)
Total CO2, kg/year			1178.0063 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2700 (273)

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

DER		12.2700	ZC1
Total Floor Area		96.0400	
Assumed number of occupants	TFA	2.6997	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	15.4107	ZC2
CO2 emissions from cooking, equation (L16)		1.9137	ZC3
Total CO2 emissions		29.5944	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.5944	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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																3 * 10 =	30.0000 (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) =					30.0000 / (5) =	0.1230 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3730 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3450 (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	0.4399	0.4313	0.4226	0.3795	0.3709	0.3278	0.3278	0.3191	0.3450	0.3709	0.3881	0.4054 (22b)					
Effective ac	0.5967	0.5930	0.5893	0.5720	0.5688	0.5537	0.5537	0.5509	0.5595	0.5688	0.5753	0.5822 (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)			10.2400	1.3258	13.5758		(27)					
150mm EPS B&B			48.0200	0.1300	6.2426		(28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1800	15.7608		(29a)					
400mm Mineral Wool	48.0200		48.0200	0.1300	6.2426		(30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.9418		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5299 (36)					
Total fabric heat loss						(33) + (36) =	53.4717 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.0387	Feb 47.7363	Mar 47.4398	Apr 46.0475	May 45.7869	Jun 44.5742	Jul 44.5742	Aug 44.3497	Sep 45.0414	Oct 45.7869	Nov 46.3140	Dec 46.8649 (38)
Heat transfer coeff	101.5104	101.2079	100.9115	99.5191	99.2586	98.0459	98.0459	97.8213	98.5130	99.2586	99.7856	100.3366 (39)
Average = Sum(39)m / 12 =												99.5179 (39)
HLP	Jan 1.0570	Feb 1.0538	Mar 1.0507	Apr 1.0362	May 1.0335	Jun 1.0209	Jul 1.0209	Aug 1.0185	Sep 1.0257	Oct 1.0335	Nov 1.0390	Dec 1.0447 (40)
HLP (average)												1.0362 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Daily hot water use	Jan 108.1501	Feb 104.2174	Mar 100.2847	Apr 96.3520	May 92.4192	Jun 88.4865	Jul 88.4865	Aug 92.4192	Sep 96.3520	Oct 100.2847	Nov 104.2174	Dec 108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum(45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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												

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Combi 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	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	47.5160	47.0958	43.6372	45.0917	47.0958	47.5160	50.9589	49.3151	50.9589	50.9589	50.9589	(61)
Solar input	211.3425	186.2999	195.7075	173.7114	168.1833	148.1264	141.9164	158.2035	159.9507	181.9907	192.3465	206.2818	206.2818	206.2818	(62)
Output from w/h	0.0000	0.0000	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)
Heat gains from water heating, kWh/month	211.3425	186.2999	195.7075	173.7114	168.1833	148.1264	141.9164	158.2035	159.9507	181.9907	192.3465	206.2818	206.2818	206.2818	(64)
	66.0673	58.1474	60.8686	53.8390	52.0355	45.6520	43.4671	48.7173	49.2635	56.3078	59.8867	64.3846	64.3846	64.3846	(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	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3629	22.5271	18.3203	13.8696	10.3677	8.7529	9.4578	12.2936	16.5004	20.9510	24.4530	26.0678	26.0678	26.0678	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.7623	252.3541	245.8230	231.9190	214.3677	197.8719	186.8517	184.2600	190.7911	204.6951	222.2464	238.7422	238.7422	238.7422	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	(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	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	(71)
Water heating gains (Table 5)	88.8001	86.5289	81.8127	74.7763	69.9402	63.4055	58.4236	65.4802	68.4216	75.6825	83.1760	86.5384	86.5384	86.5384	(72)
Total internal gains	430.4211	427.9059	412.4517	387.0607	361.1714	336.5261	321.2288	328.5295	342.2089	367.8244	396.3712	417.8442	417.8442	417.8442	(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										
North	3.3300	10.6334	0.6300	0.7000	0.7700	10.8215	(74)								
South	6.9100	46.7521	0.6300	0.7000	0.7700	98.7303	(78)								
Solar gains	109.5519	182.3753	241.1117	289.2372	318.6206	314.8537	304.0957	281.8093	257.4116	199.0205	130.3789	94.3335	94.3335	94.3335	(83)
Total gains	539.9729	610.2812	653.5634	676.2979	679.7920	651.3797	625.3246	610.3388	599.6205	566.8449	526.7500	512.1776	512.1776	512.1776	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)															21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)															
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
alpha	65.7021	65.8984	66.0920	67.0167	67.1926	68.0237	68.0237	68.1799	67.7012	67.1926	66.8377	66.4707			
util living area	5.3801	5.3932	5.4061	5.4678	5.4795	5.5349	5.5349	5.5453	5.5134	5.4795	5.4558	5.4314			
	0.9986	0.9969	0.9929	0.9808	0.9428	0.8307	0.6598	0.6959	0.8942	0.9828	0.9968	0.9989	(86)		
MIT	19.8500	19.9837	20.1890	20.4599	20.7181	20.9135	20.9812	20.9747	20.8564	20.5252	20.1397	19.8295	(87)		
Th 2	20.0361	20.0387	20.0413	20.0533	20.0555	20.0660	20.0660	20.0679	20.0619	20.0555	20.0510	20.0462	(88)		
util rest of house	0.9981	0.9958	0.9902	0.9729	0.9163	0.7540	0.5348	0.5747	0.8376	0.9740	0.9956	0.9986	(89)		
MIT 2	18.4940	18.6911	18.9921	19.3922	19.7533	20.0003	20.0580	20.0561	19.9372	19.4900	18.9284	18.4713	(90)		
Living area fraction									fLA = Living area / (4) =			0.2359	(91)		
MIT	18.8140	18.9961	19.2745	19.6441	19.9810	20.2158	20.2758	20.2729	20.1541	19.7343	19.2142	18.7918	(92)		
Temperature adjustment												0.0000			
adjusted MIT	18.8140	18.9961	19.2745	19.6441	19.9810	20.2158	20.2758	20.2729	20.1541	19.7343	19.2142	18.7918	(93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	0.9971	0.9941	0.9873	0.9683	0.9137	0.7679	0.5645	0.6032	0.8442	0.9700	0.9939	0.9978	(94)		
Ext temp.	538.4259	606.6831	645.2653	654.8844	621.1148	500.1965	352.9674	368.1697	506.1917	549.8322	523.5373	511.0673	(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	1473.3187	1426.6331	1289.0948	1069.2430	821.9575	550.6021	360.4011	378.8492	596.4066	906.6568	1208.8254	1464.0879	(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	695.5602	551.0064	479.0091	298.3382	149.4270	0.0000	0.0000	0.0000	0.0000	265.4775	493.4074	709.0473	(98)		
Space heating per m2												3641.2732	(98)		
												37.9141	(99)		

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

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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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3898.5794 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	695.5602	551.0064	479.0091	298.3382	149.4270	0.0000	0.0000	0.0000	0.0000	265.4775	493.4074	709.0473	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	744.7112	589.9426	512.8578	319.4199	159.9861	0.0000	0.0000	0.0000	0.0000	284.2371	528.2735	759.1513	(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	211.3425	186.2999	195.7075	173.7114	168.1833	148.1264	141.9164	158.2035	159.9507	181.9907	192.3465	206.2818	(64)
Efficiency of water heater	87.8257	87.6155	87.2180	86.4009	84.7551	80.3000	80.3000	80.3000	80.3000	86.0006	87.3194	87.9082	(217)
Fuel for water heating, kWh/month	240.6384	212.6335	224.3889	201.0528	198.4345	184.4663	176.7328	197.0156	199.1914	211.6156	220.2792	234.6560	(219)
Water heating fuel used												2501.1051	(219)
Annual totals kWh/year													
Space heating fuel - main system												3898.5794	(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)												447.9166	(232)
Total delivered energy for all uses												6922.6011	(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	3898.5794	0.2160	842.0931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2501.1051	0.2160	540.2387 (264)
Space and water heating			1382.3319 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Total CO2, kg/m2/year			1653.7256 (272)
Emissions per m2 for space and water heating			14.3933 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4205 (272b)
Emissions per m2 for pumps and fans			0.4053 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3933 * 1.00) + 2.4205 + 0.4053, rounded to 2 d.p.			17.2200 (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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1230 (8)
Pressure test					Yes
Measured/design AP50					4.2700
Infiltration rate					0.3365 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3112 (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	0.3968	0.3891	0.3813	0.3424	0.3346	0.2957	0.2957	0.2879	0.3112	0.3346	0.3501	0.3657 (22b)
Effective ac	0.5787	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5414	0.5484	0.5560	0.5613	0.5669 (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)			6.9100	1.3258	9.1610		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)
Total net area of external elements Aum(A, m ²)			195.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)
Timber Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)
Timber GF			78.5700			9.0000	707.1300 (32c)
Timber FF			87.3600			9.0000	786.2400 (32c)
Internal Floor			48.0200			18.0000	864.3600 (32d)
Internal Ceiling			48.0200			9.0000	432.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 8548.4300 (34)
89.0091 (35)
11.1109 (36)
(33) + (36) = 57.5246 (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	46.5890	46.3428	46.1016	44.9684	44.7563	43.7694	43.7694	43.5866	44.1495	44.7563	45.1853	45.6337 (38)
Heat transfer coeff	104.1136	103.8674	103.6262	102.4930	102.2810	101.2940	101.2940	101.1112	101.6742	102.2810	102.7099	103.1583 (39)
Average = Sum(39)m / 12 =												102.4920 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0841	1.0815	1.0790	1.0672	1.0650	1.0547	1.0547	1.0528	1.0587	1.0650	1.0694	1.0741 (40)
HLP (average)												1.0672 (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
Average daily hot water use (litres/day)
2.6997 (42)
98.3183 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1546.9300 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.0815	29.8079	30.7591	26.8165	25.7311	22.2040	20.5752	23.6104	23.8924	27.8443	30.3942	33.0061 (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	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3629	22.5271	18.3203	13.8696	10.3677	8.7529	9.4578	12.2936	16.5004	20.9510	24.4530	26.0678	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.7623	252.3541	245.8230	231.9190	214.3677	197.8719	186.8517	184.2600	190.7911	204.6951	222.2464	238.7422	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	(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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	(71)
Water heating gains (Table 5)	45.8085	44.3570	41.3429	37.2452	34.5848	30.8388	27.6549	31.7344	33.1839	37.4251	42.2141	44.3631	(72)
Total internal gains	384.4295	382.7340	368.9819	346.5295	322.8159	300.9594	287.4602	291.7837	303.9711	326.5670	352.4093	372.6688	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			3.3300		10.6334		0.7200		0.7000		0.7700		12.3674 (74)
South			3.5800		46.7521		0.7200		0.7000		0.7700		58.4585 (78)
South			3.3300		46.7521		0.7200		0.7000		0.7700		54.3762 (78)
Solar gains	125.2021	208.4289	275.5563	330.5568	364.1379	359.8328	347.5380	322.0677	294.1847	227.4520	149.0044	107.8097	(83)
Total gains	509.6316	591.1629	644.5381	677.0863	686.9538	660.7922	634.9981	613.8514	598.1559	554.0190	501.4137	480.4785	(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	22.8074	22.8615	22.9147	23.1681	23.2161	23.4423	23.4423	23.4847	23.3546	23.2161	23.1191	23.0186
alpha	2.5205	2.5241	2.5276	2.5445	2.5477	2.5628	2.5628	2.5656	2.5570	2.5477	2.5413	2.5346
util living area	0.9675	0.9519	0.9292	0.8898	0.8230	0.7124	0.5840	0.6143	0.7735	0.8991	0.9534	0.9717 (86)
MIT	18.4566	18.7323	19.1512	19.6894	20.2063	20.6334	20.8455	20.8181	20.5075	19.8367	19.0502	18.4048 (87)
Th 2	20.0139	20.0160	20.0180	20.0277	20.0295	20.0380	20.0380	20.0396	20.0347	20.0295	20.0259	20.0220 (88)
util rest of house	0.9630	0.9453	0.9189	0.8720	0.7904	0.6513	0.4882	0.5225	0.7220	0.8795	0.9459	0.9678 (89)
MIT 2	17.6754	17.9491	18.3638	18.8973	19.3941	19.7892	19.9591	19.9418	19.6810	19.0480	18.2737	17.6297 (90)
Living area fraction	17.8597	18.1339	18.5496	19.0842	19.5857	19.9884	20.1682	20.1486	19.8760	19.2341	18.4569	17.8126 (91)
MIT	17.8597	18.1339	18.5496	19.0842	19.5857	19.9884	20.1682	20.1486	19.8760	19.2341	18.4569	17.8126 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8597	18.1339	18.5496	19.0842	19.5857	19.9884	20.1682	20.1486	19.8760	19.2341	18.4569	17.8126 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9496	0.9286	0.8993	0.8511	0.7731	0.6477	0.5024	0.5339	0.7122	0.8595	0.9298	0.9556	(94)
Useful gains	483.9495	548.9608	579.6259	576.2711	531.0741	428.0062	319.0029	327.7519	426.0260	476.1921	466.1957	459.1392	(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	1411.7483	1374.5698	1248.6542	1043.8074	806.5596	545.8102	361.4373	379.0245	587.2742	883.1022	1166.4662	1404.2523	(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	690.2823	554.8093	497.7571	336.6261	204.9613	0.0000	0.0000	0.0000	0.0000	302.7411	504.1948	703.1642	(98)
Space heating	3794.5362 (98)												
Space heating per m2	(98) / (4) = 39.5100 (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	952.1635	749.5755	768.4452	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	0.6890	0.7607	0.7433	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	656.0009	570.1793	571.1536	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	876.5283	844.2881	821.8184	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	158.7798	203.9370	186.4946	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												549.2113 (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	39.6949	50.9842	46.6237	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.3028 (107)
Space cooling per m2												1.4296 (108)
Energy for space heating												39.5100 (99)
Energy for space cooling												1.4296 (108)
Total												40.9396 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.9 (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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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																3 * 10 =	30.0000 (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) =					30.0000 / (5) =	0.1230 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3730 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3450 (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	0.4399	0.4313	0.4226	0.3795	0.3709	0.3278	0.3278	0.3191	0.3450	0.3709	0.3881	0.4054 (22b)					
Effective ac	0.5967	0.5930	0.5893	0.5720	0.5688	0.5537	0.5537	0.5509	0.5595	0.5688	0.5753	0.5822 (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)			10.2400	1.3258	13.5758		(27)					
150mm EPS B&B			48.0200	0.1300	6.2426		(28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1800	15.7608		(29a)					
400mm Mineral Wool	48.0200		48.0200	0.1300	6.2426		(30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		43.9418		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5299 (36)					
Total fabric heat loss						(33) + (36) =	53.4717 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.0387	Feb 47.7363	Mar 47.4398	Apr 46.0475	May 45.7869	Jun 44.5742	Jul 44.5742	Aug 44.3497	Sep 45.0414	Oct 45.7869	Nov 46.3140	Dec 46.8649 (38)
Heat transfer coeff	101.5104	101.2079	100.9115	99.5191	99.2586	98.0459	98.0459	97.8213	98.5130	99.2586	99.7856	100.3366 (39)
Average = Sum(39)m / 12 =												99.5179 (39)
HLP	Jan 1.0570	Feb 1.0538	Mar 1.0507	Apr 1.0362	May 1.0335	Jun 1.0209	Jul 1.0209	Aug 1.0185	Sep 1.0257	Oct 1.0335	Nov 1.0390	Dec 1.0447 (40)
HLP (average)												1.0362 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Daily hot water use	Jan 108.1501	Feb 104.2174	Mar 100.2847	Apr 96.3520	May 92.4192	Jun 88.4865	Jul 88.4865	Aug 92.4192	Sep 96.3520	Oct 100.2847	Nov 104.2174	Dec 108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum(45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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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)
	34.0815	29.8079	30.7591	26.8165	25.7311	22.2040	20.5752	23.6104	23.8924	27.8443	30.3942	33.0061 (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	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	134.9859	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3629	22.5271	18.3203	13.8696	10.3677	8.7529	9.4578	12.2936	16.5004	20.9510	24.4530	26.0678	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.7623	252.3541	245.8230	231.9190	214.3677	197.8719	186.8517	184.2600	190.7911	204.6951	222.2464	238.7422	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	36.4986	(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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	(71)
Water heating gains (Table 5)	45.8085	44.3570	41.3429	37.2452	34.5848	30.8388	27.6549	31.7344	33.1839	37.4251	42.2141	44.3631	(72)
Total internal gains	384.4295	382.7340	368.9819	346.5295	322.8159	300.9594	287.4602	291.7837	303.9711	326.5670	352.4093	372.6688	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c	Access factor Table 6d		Gains W
North				3.3300	10.6334	0.6300			0.7000	0.7700		10.8215 (74)
South				6.9100	46.7521	0.6300			0.7000	0.7700		98.7303 (78)
Solar gains	109.5519	182.3753	241.1117	289.2372	318.6206	314.8537	304.0957	281.8093	257.4116	199.0205	130.3789	94.3335 (83)
Total gains	493.9813	565.1093	610.0936	635.7667	641.4366	615.8131	591.5559	573.5930	561.3828	525.5875	482.7882	467.0023 (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	65.7021	65.8984	66.0920	67.0167	67.1926	68.0237	68.0237	68.1799	67.7012	67.1926	66.8377	66.4707		
alpha	5.3801	5.3932	5.4061	5.4678	5.4795	5.5349	5.5349	5.5453	5.5134	5.4795	5.4558	5.4314		
util living area	0.9991	0.9978	0.9948	0.9854	0.9542	0.8548	0.6899	0.7292	0.9149	0.9877	0.9979	0.9993	(86)	
MIT	19.8046	19.9394	20.1472	20.4231	20.6892	20.8988	20.9767	20.9682	20.8338	20.4873	20.0965	19.7847	(87)	
Th 2	20.0361	20.0387	20.0413	20.0533	20.0555	20.0660	20.0660	20.0679	20.0619	20.0555	20.0510	20.0462	(88)	
util rest of house	0.9987	0.9971	0.9929	0.9791	0.9316	0.7826	0.5628	0.6073	0.8649	0.9812	0.9971	0.9991	(89)	
MIT 2	18.9379	19.0746	19.2837	19.5665	19.8239	20.0119	20.0590	20.0574	19.9601	19.6331	19.2416	18.9262	(90)	
Living area fraction	19.1424	19.2786	19.4874	19.7686	20.0281	20.2211	20.2755	20.2723	20.1662	19.8346	19.4433	19.1288	(92)	
MIT	19.1424	19.2786	19.4874	19.7686	20.0281	20.2211	20.2755	20.2723	20.1662	19.8346	19.4433	19.1288	(93)	
Temperature adjustment														
adjusted MIT	19.1424	19.2786	19.4874	19.7686	20.0281	20.2211	20.2755	20.2723	20.1662	19.8346	19.4433	19.1288		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.1574	563.0000	604.8288	620.9500	597.0615	490.4027	350.9379	364.9974	489.3270	514.6448	481.0116	466.4293	(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	1506.6590	1455.2308	1310.5814	1081.6341	826.6348	551.1301	360.3725	378.7966	597.6034	916.6147	1231.6846	1497.9010	(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	754.0452	599.5791	525.0799	331.6926	170.8025	0.0000	0.0000	0.0000	0.0000	299.0656	540.4846	767.4150	(98)
Space heating												3988.1645	(98)
Space heating per m2												41.5261	(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	921.6313	725.5396	743.4420	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7958	0.8822	0.8641	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	733.4679	640.0812	642.4385	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	823.9554	793.5115	774.7630	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	65.1510	114.1521	98.4494	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												277.7525	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	16.2878	28.5380	24.6124	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											69.4381 (107)
Space cooling per m2											0.7230 (108)
Energy for space heating											41.5261 (99)
Energy for space cooling											0.7230 (108)
Total											42.2491 (109)
Target Fabric Energy Efficiency (TFEE)											48.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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												4.2700
Infiltration rate												0.2135 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1975 (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												
	0.2172	0.2024	0.2024	0.1926	0.1926	0.1827	0.1827	0.1728	0.1728	0.1876	0.1827	0.1926 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.2504	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7750 (39)
HLP	Jan 1.0181	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0181 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum (45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (64)
RHI water heating demand												1712 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4072	56.3177	45.8007	34.6740	25.9193	21.8821	23.6444	30.7339	41.2510	52.3776	61.1324	65.1695 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.7796	376.6479	366.8999	346.1477	319.9517	295.3312	278.8832	275.0149	284.7628	305.5151	331.7111	356.3316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980 (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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887 (71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629 (72)
Total internal gains	623.5079	618.0114	593.0217	554.7157	515.5912	481.0590	461.3834	471.0015	493.5420	532.0725	574.5303	606.5564 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	W/m2	Specific data	factor	W
					or Table 6b	Table 6d	
North		3.3300	13.4839	0.7200	0.7000	0.7700	15.6828 (74)
South		3.5800	56.7559	0.7200	0.7000	0.7700	70.9672 (78)
South		3.3300	56.7559	0.7200	0.7000	0.7700	66.0114 (78)

Solar gains	152.6613	216.0655	288.5421	351.1065	369.1585	401.7396	373.6230	358.4789	323.7726	251.2114	181.0096	124.5047 (83)
Total gains	776.1692	834.0769	881.5638	905.8222	884.7497	882.7986	835.0064	829.4804	817.3146	783.2839	755.5399	731.0611 (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	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9137	0.8942	0.8542	0.7890	0.6786	0.5051	0.3677	0.3699	0.5801	0.7707	0.8765	0.9225 (86)
MIT	19.3413	19.5150	19.8675	20.2667	20.6503	20.8928	20.9682	20.9677	20.8309	20.4385	19.8421	19.2905 (87)
Th 2	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683 (88)
util rest of house	0.9026	0.8807	0.8349	0.7594	0.6290	0.4290	0.2710	0.2727	0.5089	0.7324	0.8582	0.9122 (89)
MIT 2	17.8843	18.1310	18.6303	19.1855	19.6967	19.9824	20.0526	20.0523	19.9187	19.4276	18.6022	17.8132 (90)
Living area fraction	18.2281	18.4576	18.9222	19.4406	19.9217	20.1972	20.2686	20.2683	20.1339	19.6661	18.8948	18.1618 (91)
MIT	18.2281	18.4576	18.9222	19.4406	19.9217	20.1972	20.2686	20.2683	20.1339	19.6661	18.8948	18.1618 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0781	18.3076	18.7722	19.2906	19.7717	20.0472	20.1186	20.1183	19.9839	19.5161	18.7448	18.0118 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8718	0.8486	0.8026	0.7308	0.6116	0.4271	0.2764	0.2781	0.5019	0.7061	0.8257	0.8823 (94)
Ext temp.	676.6296	707.7627	707.5043	662.0008	541.0740	377.0844	230.8115	230.6960	410.2507	553.0984	623.8645	645.0292 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1239.5986	1213.1519	1092.3595	908.3886	652.3280	405.4925	236.4799	236.4507	457.9689	734.8912	1011.4588	1223.3390 (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	418.8489	339.6216	286.3323	177.3992	82.7730	0.0000	0.0000	0.0000	0.0000	135.2538	279.0679	430.2625 (98)
RHI space heating demand												2150 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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												4.2700
Infiltration rate												0.2135 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1975 (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	0.2518	0.2469	0.2419	0.2172	0.2123	0.1876	0.1876	0.1827	0.1975	0.2123	0.2222	0.2320 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5018	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.3950	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.9196	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7870 (39)
HLP	Jan 1.0196	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0182 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum (45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (65)
										Total per year (kWh/year) = Sum (64)m =		1712.4962 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4072	56.3177	45.8007	34.6740	25.9193	21.8821	23.6444	30.7339	41.2510	52.3776	61.1324	65.1695 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.7796	376.6479	366.8999	346.1477	319.9517	295.3312	278.8832	275.0149	284.7628	305.5151	331.7111	356.3316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980 (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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887 (71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629 (72)
Total internal gains	623.5079	618.0114	593.0217	554.7157	515.5912	481.0590	461.3834	471.0015	493.5420	532.0725	574.5303	606.5564 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.3300	10.6334	0.7200	0.7000	0.7700		12.3674 (74)		
South				3.5800	46.7521	0.7200	0.7000	0.7700		58.4585 (78)		
South				3.3300	46.7521	0.7200	0.7000	0.7700		54.3762 (78)		

Solar gains	125.2021	208.4289	275.5563	330.5568	364.1379	359.8328	347.5380	322.0677	294.1847	227.4520	149.0044	107.8097 (83)
Total gains	748.7100	826.4404	868.5779	885.2725	879.7290	840.8918	808.9213	793.0692	787.7267	759.5245	723.5347	714.3661 (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	25.4761	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138
alpha	2.6984	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9303	0.9082	0.8768	0.8252	0.7417	0.6153	0.4818	0.5067	0.6711	0.8257	0.9057	0.9375 (86)
MIT	19.0930	19.3260	19.6663	20.0802	20.4781	20.7797	20.9177	20.9025	20.7032	20.2079	19.5695	19.0226 (87)
Th 2	20.0671	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683 (88)
util rest of house	0.9215	0.8969	0.8610	0.8011	0.7028	0.5520	0.3950	0.4216	0.6135	0.7974	0.8921	0.9296 (89)
MIT 2	17.5264	17.8599	18.3453	18.9289	19.4732	19.8584	20.0099	19.9959	19.7697	19.1153	18.2152	17.4264 (90)
Living area fraction	17.8960	18.2058	18.6570	19.2005	19.7103	20.0758	20.2241	20.2098	19.9900	19.3731	18.5347	17.8030 (92)
MIT	17.8960	18.2058	18.6570	19.2005	19.7103	20.0758	20.2241	20.2098	19.9900	19.3731	18.5347	17.8030 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7460	18.0558	18.5070	19.0505	19.5603	19.9258	20.0741	20.0598	19.8400	19.2231	18.3847	17.6530 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8927	0.8656	0.8285	0.7700	0.6788	0.5414	0.3956	0.4207	0.5978	0.7667	0.8606	0.9019 (94)
Useful gains	668.3380	715.3958	719.5886	681.6930	597.1750	455.2840	319.9743	333.6793	470.8715	582.3156	622.6993	644.2918 (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	1316.6303	1286.3105	1173.9855	992.4681	768.5406	520.7298	339.6816	357.8364	561.2236	843.1260	1103.3644	1315.3700 (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	482.3295	383.6546	338.0713	223.7580	127.4960	0.0000	0.0000	0.0000	0.0000	194.0430	346.0789	499.2821 (98)
Space heating												2594.7134 (98)
Space heating per m2												(98) / (4) = 27.0170 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2867.0867 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	482.3295	383.6546	338.0713	223.7580	127.4960	0.0000	0.0000	0.0000	0.0000	194.0430	346.0789	499.2821	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	532.9608	423.9278	373.5594	247.2464	140.8795	0.0000	0.0000	0.0000	0.0000	214.4121	382.4077	551.6930	(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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522	(64)
Efficiency of water heater (217)m	89.6271	89.5639	89.4518	89.2421	88.8248	87.3000	87.3000	87.3000	87.3000	89.1026	89.4778	87.3000	(216)
Fuel for water heating, kWh/month	194.7235	170.8662	177.5845	156.6525	152.1113	135.1935	126.9036	143.3113	144.3385	162.8491	175.1132	188.9792	(219)
Water heating fuel used												1928.6264	(219)
Annual totals kWh/year													
Space heating fuel - main system												2867.0867	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													67.9061 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													142.9061 (231)
Electricity for lighting (calculated in Appendix L)													447.9166 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1068 * 1.00) =										-546.8521			-546.8521 (233)
Total delivered energy for all uses													4839.6837 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2867.0867	3.4800	99.7746 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1928.6264	3.4800	67.1162 (247)
Mechanical ventilation fans	67.9061	13.1900	8.9568 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	447.9166	13.1900	59.0802 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-546.8521	13.1900	-72.1298 (252)
Total energy cost			292.6905 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.8716 (257)
SAP rating (Section 12)		87.8412
SAP band		88 (258)
		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	2867.0867	0.2160	619.2907 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1928.6264	0.2160	416.5833 (264)
Space and water heating			1035.8740 (265)
Pumps and fans	142.9061	0.5190	74.1683 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Energy saving/generation technologies			
PV Unit	-546.8521	0.5190	-283.8162 (269)
Total kg/year			1058.6948 (272)
CO2 emissions per m2			11.0200 (273)
EI value			89.9415
EI rating			90 (274)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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												4.2700
Infiltration rate												0.2135 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1975 (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												
	0.2172	0.2024	0.2024	0.1926	0.1926	0.1827	0.1827	0.1728	0.1728	0.1876	0.1827	0.1926 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.2504	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7750 (39)
HLP	Jan 1.0181	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0181 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

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

Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum (45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (65)
										Total per year (kWh/year) = Sum (64)m =		1712.4962 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4072	56.3177	45.8007	34.6740	25.9193	21.8821	23.6444	30.7339	41.2510	52.3776	61.1324	65.1695 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.7796	376.6479	366.8999	346.1477	319.9517	295.3312	278.8832	275.0149	284.7628	305.5151	331.7111	356.3316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980 (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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887 (71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629 (72)
Total internal gains	623.5079	618.0114	593.0217	554.7157	515.5912	481.0590	461.3834	471.0015	493.5420	532.0725	574.5303	606.5564 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				3.3300	13.4839	0.7200	0.7000		0.7700		15.6828 (74)	
South				3.5800	56.7559	0.7200	0.7000		0.7700		70.9672 (78)	
South				3.3300	56.7559	0.7200	0.7000		0.7700		66.0114 (78)	
Solar gains	152.6613	216.0655	288.5421	351.1065	369.1585	401.7396	373.6230	358.4789	323.7726	251.2114	181.0096	124.5047 (83)
Total gains	776.1692	834.0769	881.5638	905.8222	884.7497	882.7986	835.0064	829.4804	817.3146	783.2839	755.5399	731.0611 (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	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009
util living area	0.9137	0.8942	0.8542	0.7890	0.6786	0.5051	0.3677	0.3699	0.5801	0.7707	0.8765	0.9225 (86)
MIT	19.3413	19.5150	19.8675	20.2667	20.6503	20.8928	20.9682	20.9677	20.8309	20.4385	19.8421	19.2905 (87)
Th 2	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683 (88)
util rest of house	0.9026	0.8807	0.8349	0.7594	0.6290	0.4290	0.2710	0.2727	0.5089	0.7324	0.8582	0.9122 (89)
MIT 2	17.8843	18.1310	18.6303	19.1855	19.6967	19.9824	20.0526	20.0523	19.9187	19.4276	18.6022	17.8132 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.2281	18.4576	18.9222	19.4406	19.9217	20.1972	20.2686	20.2683	20.1339	19.6661	18.8948	18.1618 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.0781	18.3076	18.7722	19.2906	19.7717	20.0472	20.1186	20.1183	19.9839	19.5161	18.7448	18.0118 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8718	0.8486	0.8026	0.7308	0.6116	0.4271	0.2764	0.2781	0.5019	0.7061	0.8257	0.8823 (94)
Ext temp.	676.6296	707.7627	707.5043	662.0008	541.0740	377.0844	230.8115	230.6960	410.2507	553.0984	623.8645	645.0292 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1239.5986	1213.1519	1092.3595	908.3886	652.3280	405.4925	236.4799	236.4507	457.9689	734.8912	1011.4588	1223.3390 (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	418.8489	339.6216	286.3323	177.3992	82.7730	0.0000	0.0000	0.0000	0.0000	135.2538	279.0679	430.2625 (98)
Space heating per m2										(98) / (4) =		22.3819 (99)

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2375.2035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.8489	339.6216	286.3323	177.3992	82.7730	0.0000	0.0000	0.0000	0.0000	135.2538	279.0679	430.2625	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	462.8165	375.2725	316.3892	196.0212	91.4618	0.0000	0.0000	0.0000	0.0000	149.4517	308.3623	475.4282	(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	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522	(64)
Efficiency of water heater (217)m	89.5347	89.4811	89.3316	89.0612	88.4886	87.3000	87.3000	87.3000	87.3000	88.8150	89.3227	87.3000	(216)
Fuel for water heating, kWh/month	194.9244	171.0242	177.8235	156.9707	152.6892	135.1935	126.9036	143.3113	144.3385	163.3764	175.4174	189.1793	(219)
Water heating fuel used												1931.1520	(219)
Annual totals kWh/year													
Space heating fuel - main system												2375.2035	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													67.9061 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													142.9061 (231)
Electricity for lighting (calculated in Appendix L)													447.9166 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1179 * 1.00) =										-603.6874			-603.6874 (233)
Total delivered energy for all uses													4293.4909 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2375.2035	3.7400	88.8326 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1931.1520	3.7400	72.2251 (247)
Mechanical ventilation fans	67.9061	20.4300	13.8732 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	447.9166	20.4300	91.5094 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-603.6874	20.4300	-123.3333 (252)
Total energy cost			253.4294 (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	2375.2035	0.2160	513.0440 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1931.1520	0.2160	417.1288 (264)
Space and water heating			930.1728 (265)
Pumps and fans	142.9061	0.5190	74.1683 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Energy saving/generation technologies			
PV Unit	-603.6874	0.5190	-313.3138 (269)
Total kg/year			923.4960 (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	2375.2035	1.2200	2897.7483 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1931.1520	1.2200	2356.0055 (264)
Space and water heating			5253.7538 (265)
Pumps and fans	142.9061	3.0700	438.7217 (267)
Energy for lighting	447.9166	3.0700	1375.1040 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
 PV Unit -603.6874 3.0700 -1853.3203 (269)
 Primary energy kWh/year 5214.2592 (272)
 Primary energy kWh/m2/year 54.2926 (273)

SAP 2012 EPC IMPROVEMENTS

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

(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	+ 1.1	-£ 28	-192 kg (20.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 2.00 kg/m²	B 89	A 92
Total Savings	£28 2.00 kg/m²		

Potential energy efficiency rating: B 89
 Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£121	£131	-£10
Mains gas	£256	£218	£38
Space heating	£213	£213	£0
Water heating	£72	£45	£28
Lighting	£92	£92	£0
Generated (PV)	-£123	-£123	£0
Total cost of fuels	£254	£226	£28
Total cost of uses	£254	£227	£28
Delivered energy	45 kWh/m²	35 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	43 kWh/m²	11 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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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												4.2700
Infiltration rate												0.2135 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1975 (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	0.2518	0.2469	0.2419	0.2172	0.2123	0.1876	0.1876	0.1827	0.1975	0.2123	0.2222	0.2320 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5018	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.3950	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.9196	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7870 (39)
HLP	Jan 1.0196	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0182 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total = Sum (45)m =		1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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												1.1724 (H8)
Utilisation factor												0.5738 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.3183 (H14)
Volume ratio Veff/V												0.7628 (H15)
Solar storage volume factor												0.9459 (H16)
Solar input												-865.5611 (H17)
Solar input	-25.0995	-41.8839	-71.3331	-95.6004	-118.1063	-116.1173	-114.5828	-100.1115	-78.4074	-53.5430	-29.7717	-21.0040 (63)
Solar input (sum of months) = Sum (63)m =												-865.5611 (63)
Output from w/h	149.4255	111.1505	87.5195	44.1995	17.0063	1.9067	0.0000	24.9992	47.6001	91.5598	126.9159	148.4482 (64)
Total per year (kWh/year) = Sum (64)m =												850.7311 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4072	56.3177	45.8007	34.6740	25.9193	21.8821	23.6444	30.7339	41.2510	52.3776	61.1324	65.1695	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.7796	376.6479	366.8999	346.1477	319.9517	295.3312	278.8832	275.0149	284.7628	305.5151	331.7111	356.3316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	(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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	(71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629	(72)
Total internal gains	623.5079	618.0114	593.0217	554.7157	515.5912	481.0590	461.3834	471.0015	493.5420	532.0725	574.5303	606.5564	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.3300	10.6334	0.7200	0.7000	0.7700	12.3674 (74)			
South				3.5800	46.7521	0.7200	0.7000	0.7700	58.4585 (78)			
South				3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)			
Solar gains	125.2021	208.4289	275.5563	330.5568	364.1379	359.8328	347.5380	322.0677	294.1847	227.4520	149.0044	107.8097 (83)
Total gains	748.7100	826.4404	868.5779	885.2725	879.7290	840.8918	808.9213	793.0692	787.7267	759.5245	723.5347	714.3661 (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	25.4761	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	
alpha	2.6984	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	
util living area	0.9303	0.9082	0.8768	0.8252	0.7417	0.6153	0.4818	0.5067	0.6711	0.8257	0.9057	0.9375	(86)
MIT	19.0930	19.3260	19.6663	20.0802	20.4781	20.7797	20.9177	20.9025	20.7032	20.2079	19.5695	19.0226	(87)
Th 2	20.0671	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	(88)
util rest of house	0.9215	0.8969	0.8610	0.8011	0.7028	0.5520	0.3950	0.4216	0.6135	0.7974	0.8921	0.9296	(89)
MIT 2	17.5264	17.8599	18.3453	18.9289	19.4732	19.8584	20.0099	19.9959	19.7697	19.1153	18.2152	17.4264	(90)
Living area fraction	17.8960	18.2058	18.6570	19.2005	19.7103	20.0758	20.2241	20.2098	19.9900	19.3731	18.5347	17.8030	(91)
MIT	17.8960	18.2058	18.6570	19.2005	19.7103	20.0758	20.2241	20.2098	19.9900	19.3731	18.5347	17.8030	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7460	18.0558	18.5070	19.0505	19.5603	19.9258	20.0741	20.0598	19.8400	19.2231	18.3847	17.6530	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8927	0.8656	0.8285	0.7700	0.6788	0.5414	0.3956	0.4207	0.5978	0.7667	0.8606	0.9019	(94)
Useful gains	668.3380	715.3958	719.5886	681.6930	597.1750	455.2840	319.9743	333.6793	470.8715	582.3156	622.6993	644.2918	(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	1316.6303	1286.3105	1173.9855	992.4681	768.5406	520.7298	339.6816	357.8364	561.2236	843.1260	1103.3644	1315.3700	(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	482.3295	383.6546	338.0713	223.7580	127.4960	0.0000	0.0000	0.0000	0.0000	194.0430	346.0789	499.2821	(98)
Space heating												2594.7134	(98)
Space heating per m2												27.0170	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2867.0867 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	482.3295	383.6546	338.0713	223.7580	127.4960	0.0000	0.0000	0.0000	0.0000	194.0430	346.0789	499.2821	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	532.9608	423.9278	373.5594	247.2464	140.8795	0.0000	0.0000	0.0000	0.0000	214.4121	382.4077	551.6930	(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	149.4255	111.1505	87.5195	44.1995	17.0063	1.9067	0.0000	24.9992	47.6001	91.5598	126.9159	148.4482	(64)
Efficiency of water heater (217)m	89.7221	89.7609	89.8229	89.9561	90.1113	87.3000	87.3000	87.3000	87.3000	89.4489	89.6186	87.3000	(216)
Fuel for water heating, kWh/month	166.5425	123.8295	97.4356	49.1346	18.8726	2.1840	0.0000	28.6360	54.5247	102.3599	141.6178	165.4091	(219)
Water heating fuel used												950.5463	(219)
Annual totals kWh/year													
Space heating fuel - main system												2867.0867	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													67.9061 (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													192.9061 (231)
Electricity for lighting (calculated in Appendix L)													447.9166 (232)
Energy saving/generation technologies (Appendices M,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1068 * 1.00) =										-546.8521		-546.8521	(233)
Total delivered energy for all uses												3911.6036	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2867.0867	3.4800	99.7746 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	950.5463	3.4800	33.0790 (247)
Mechanical ventilation fans	67.9061	13.1900	8.9568 (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	447.9166	13.1900	59.0802 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-546.8521	13.1900	-72.1298 (252)
Total energy cost			265.2484 (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] =	0.7899 (257)
SAP value		88.9812
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2867.0867	0.2160	619.2907 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	950.5463	0.2160	205.3180 (264)
Space and water heating			824.6087 (265)
Pumps and fans	192.9061	0.5190	100.1183 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Energy saving/generation technologies			
PV Unit	-546.8521	0.5190	-283.8162 (269)
Total kg/year			873.3795 (272)
CO2 emissions per m2			9.0900 (273)
EI value			91.7022
EI rating			92 (274)
EI band			A

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	48.0200 (1b)	x 2.4100 (2b)	= 115.7282 (1b) - (3b)
First floor	48.0200 (1c)	x 2.6700 (2c)	= 128.2134 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.9416 (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											4.2700		
Infiltration rate											0.2135	(18)	
Number of sides sheltered											1	(19)	
Shelter factor									(20) = 1 - [0.075 x (19)] =		0.9250	(20)	
Infiltration rate adjusted to include shelter factor									(21) = (18) x (20) =		0.1975	(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													
	0.2172	0.2024	0.2024	0.1926	0.1926	0.1827	0.1827	0.1728	0.1728	0.1876	0.1827	0.1926 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			6.9100	1.3258	9.1610		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
150mm EPS B&B			48.0200	0.1700	8.1634	75.0000	3601.5000 (28a)					
140mm Timber Frame	99.9200	12.3600	87.5600	0.1900	16.6364	9.0000	788.0400 (29a)					
400mm Mineral Wool	48.0200		48.0200	0.1100	5.2822	9.0000	432.1800 (30)					
Total net area of external elements Aum(A, m2)			195.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.4138		(33)					
Timebr Frame			46.8400	0.0000	0.0000	20.0000	936.8000 (32)					
Timber GF			78.5700			9.0000	707.1300 (32c)					
Timber FF			87.3600			9.0000	786.2400 (32c)					
Internal Floor			48.0200			18.0000	864.3600 (32d)					
Internal Ceiling			48.0200			18.0000	864.3600 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8980.6100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.5091 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1109 (36)					
Total fabric heat loss						(33) + (36) =	57.5246 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.2504	Feb 40.2504	Mar 40.2504	Apr 40.2504	May 40.2504	Jun 40.2504	Jul 40.2504	Aug 40.2504	Sep 40.2504	Oct 40.2504	Nov 40.2504	Dec 40.2504 (38)
Heat transfer coeff	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750	97.7750 (39)
Average = Sum(39)m / 12 =												97.7750 (39)
HLP	Jan 1.0181	Feb 1.0181	Mar 1.0181	Apr 1.0181	May 1.0181	Jun 1.0181	Jul 1.0181	Aug 1.0181	Sep 1.0181	Oct 1.0181	Nov 1.0181	Dec 1.0181 (40)
HLP (average)												1.0181 (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												2.6997 (42)
Average daily hot water use (litres/day)												98.3183 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	108.1501	104.2174	100.2847	96.3520	92.4192	88.4865	88.4865	92.4192	96.3520	100.2847	104.2174	108.1501 (44)
Energy conte	160.3835	140.2725	144.7486	126.1954	121.0875	104.4893	96.8247	111.1077	112.4347	131.0318	143.0315	155.3229 (45)
Energy content (annual)										Total =	Sum (45)m =	1546.9300 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0575	21.0409	21.7123	18.9293	18.1631	15.6734	14.5237	16.6662	16.8652	19.6548	21.4547	23.2984 (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)
Combi loss	14.1415	12.7619	14.1040	13.6046	14.0251	13.5347	13.9622	14.0030	13.5728	14.0710	13.6561	14.1293 (61)
Total heat required for water heating calculated for each month	174.5250	153.0344	158.8526	139.8000	135.1126	118.0240	110.7868	125.1107	126.0075	145.1028	156.6875	169.4522 (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												1.3039 (H8)
Utilisation factor												0.5356 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.3183 (H14)
Volume ratio Veff/V												0.7628 (H15)
Solar storage volume factor												0.9459 (H16)
Solar input												-898.4233 (H17)
Solar input	-29.4933	-41.9375	-72.0806	-97.2534	-113.6644	-122.5507	-116.6587	-106.3268	-83.0839	-57.1375	-34.8828	-23.3538 (63)
Solar input (sum of months) = Sum (63)m =												-898.4233 (63)
Output from w/h	145.0318	111.0969	86.7720	42.5466	21.4482	0.0000	0.0000	18.7839	42.9236	87.9653	121.8048	146.0984 (64)
Total per year (kWh/year) = Sum (64)m =												824.4715 (64)
Heat gains from water heating, kWh/month	56.8629	49.8311	51.6549	45.3611	43.7679	38.1264	35.6847	40.4441	40.7777	47.0858	50.9720	55.1772 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	161.9831	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4072	56.3177	45.8007	34.6740	25.9193	21.8821	23.6444	30.7339	41.2510	52.3776	61.1324	65.1695	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	372.7796	376.6479	366.8999	346.1477	319.9517	295.3312	278.8832	275.0149	284.7628	305.5151	331.7111	356.3316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	53.8980	(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)	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	-107.9887	(71)
Water heating gains (Table 5)	76.4286	74.1534	69.4286	63.0015	58.8278	52.9533	47.9634	54.3603	56.6357	63.2874	70.7944	74.1629	(72)
Total internal gains	623.5079	618.0114	593.0217	554.7157	515.5912	481.0590	461.3834	471.0015	493.5420	532.0725	574.5303	606.5564	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.3300	13.4839	0.7200	0.7000	0.7700	15.6828 (74)			
South				3.5800	56.7559	0.7200	0.7000	0.7700	70.9672 (78)			
South				3.3300	56.7559	0.7200	0.7000	0.7700	66.0114 (78)			
Solar gains	152.6613	216.0655	288.5421	351.1065	369.1585	401.7396	373.6230	358.4789	323.7726	251.2114	181.0096	124.5047 (83)
Total gains	776.1692	834.0769	881.5638	905.8222	884.7497	882.7986	835.0064	829.4804	817.3146	783.2839	755.5399	731.0611 (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	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	25.5138	
alpha	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	2.7009	
util living area	0.9137	0.8942	0.8542	0.7890	0.6786	0.5051	0.3677	0.3699	0.5801	0.7707	0.8765	0.9225 (86)	
MIT	19.3413	19.5150	19.8675	20.2667	20.6503	20.8928	20.9682	20.9677	20.8309	20.4385	19.8421	19.2905 (87)	
Th 2	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683	20.0683 (88)	
util rest of house	0.9026	0.8807	0.8349	0.7594	0.6290	0.4290	0.2710	0.2727	0.5089	0.7324	0.8582	0.9122 (89)	
MIT 2	17.8843	18.1310	18.6303	19.1855	19.6967	19.9824	20.0526	20.0523	19.9187	19.4276	18.6022	17.8132 (90)	
Living area fraction									fLA =	Living area / (4) =		0.2359 (91)	
MIT	18.2281	18.4576	18.9222	19.4406	19.9217	20.1972	20.2686	20.2683	20.1339	19.6661	18.8948	18.1618 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.0781	18.3076	18.7722	19.2906	19.7717	20.0472	20.1186	20.1183	19.9839	19.5161	18.7448	18.0118 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8718	0.8486	0.8026	0.7308	0.6116	0.4271	0.2764	0.2781	0.5019	0.7061	0.8257	0.8823	(94)
Useful gains	676.6296	707.7627	707.5043	662.0008	541.0740	377.0844	230.8115	230.6960	410.2507	553.0984	623.8645	645.0292	(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	1239.5986	1213.1519	1092.3595	908.3886	652.3280	405.4925	236.4799	236.4507	457.9689	734.8912	1011.4588	1223.3390	(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	418.8489	339.6216	286.3323	177.3992	82.7730	0.0000	0.0000	0.0000	0.0000	135.2538	279.0679	430.2625	(98)
Space heating												2149.5592	(98)
Space heating per m2												22.3819	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2375.2035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.8489	339.6216	286.3323	177.3992	82.7730	0.0000	0.0000	0.0000	0.0000	135.2538	279.0679	430.2625	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	462.8165	375.2725	316.3892	196.0212	91.4618	0.0000	0.0000	0.0000	0.0000	149.4517	308.3623	475.4282	(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	145.0318	111.0969	86.7720	42.5466	21.4482	0.0000	0.0000	18.7839	42.9236	87.9653	121.8048	146.0984	(64)
Efficiency of water heater (217)m	89.6548	89.6896	89.7350	89.8628	89.8224	87.3000	87.3000	87.3000	87.3000	89.2113	89.5031	87.3000	(216)
Fuel for water heating, kWh/month	161.7670	123.8681	96.6981	47.3462	23.8784	0.0000	0.0000	21.5165	49.1679	98.6033	136.0899	162.9347	(219)
Water heating fuel used												921.8701	(219)
Annual totals kWh/year													
Space heating fuel - main system												2375.2035	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													67.9061 (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													192.9061 (231)
Electricity for lighting (calculated in Appendix L)													447.9166 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1179 * 1.00) =										-603.6874		-603.6874	(233)
Total delivered energy for all uses												3334.2090	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2375.2035	3.7400	88.8326 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	921.8701	3.7400	34.4779 (247)
Mechanical ventilation fans	67.9061	20.4300	13.8732 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Pump for solar water heating	50.0000	20.4300	10.2150 (249)
Energy for lighting	447.9166	20.4300	91.5094 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-603.6874	20.4300	-123.3333 (252)
Total energy cost			225.8973 (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	2375.2035	0.2160	513.0440 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	921.8701	0.2160	199.1240 (264)

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Space and water heating			712.1679 (265)
Pumps and fans	192.9061	0.5190	100.1183 (267)
Energy for lighting	447.9166	0.5190	232.4687 (268)
Energy saving/generation technologies			
PV Unit	-603.6874	0.5190	-313.3138 (269)
Total kg/year			731.4411 (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	2375.2035	1.2200	2897.7483 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	921.8701	1.2200	1124.6816 (264)
Space and water heating			4022.4299 (265)
Pumps and fans	192.9061	3.0700	592.2217 (267)
Energy for lighting	447.9166	3.0700	1375.1040 (268)
Energy saving/generation technologies			
PV Unit	-603.6874	3.0700	-1853.3203 (269)
Primary energy kWh/year			4136.4353 (272)
Primary energy kWh/m2/year			43.0699 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	93.5 (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	322.00 (P1)
Transmission heat loss coefficient	57.52 (37)
Summer heat loss coefficient	379.53 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.3300	81.1852	0.7200	0.7000	0.9000	110.3663
South	3.5800	112.2060	0.7200	0.7000	0.9000	163.9890
South	3.3300	112.2060	0.7200	0.7000	0.9000	152.5372
total:						426.8925

	Jun	Jul	Aug	
Solar gains	448	427	402	(P3)
Internal gains	478	458	468	
Total summer gains	926	885	870	(P5)
Summer gain/loss ratio	2.44	2.33	2.29	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 93.5)	1.35	1.35	1.35	
Threshold temperature	19.78	21.58	21.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			