

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-002			Issued on Date	08/01/2024
Assessment Reference	As Built	Prop Type Ref	GR Det As		
Property	2, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	87 B	DER	13.92	TER	17.63
Environmental	87 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.42	DFEE	49.77	TFEE	61.53
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Detached House, total floor area 124 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) 17.63 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.25 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.55 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

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

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North East: 10.01 m², No overhang
Windows facing South East: 2.27 m², No overhang
Windows facing South West: 7.64 m², No overhang
Windows facing North West: 1.55 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
Air permeability 3.6 m³/m²h
Photovoltaic array 0.66 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											3.5500	
Infiltration rate											0.1775	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1775 (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												
	0.2263	0.2219	0.2174	0.1953	0.1908	0.1686	0.1686	0.1642	0.1775	0.1908	0.1997	0.2086 (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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)												1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
Total per year (kWh/year) = Sum(64)m =												2163.0769 (64)
Heat gains from water heating, kWh/month	92.9722	82.3833	87.5507	79.9122	79.3462	72.3856	70.9330	75.8857	75.1407	82.7944	85.7502	91.2174 (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	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5917	23.6185	19.2078	14.5416	10.8700	9.1769	9.9160	12.8892	17.2998	21.9661	25.6376	27.3307 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.1946	293.2059	285.6175	269.4627	249.0701	229.9040	217.0998	214.0885	221.6769	237.8317	258.2243	277.3904 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859 (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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869 (71)
Water heating gains (Table 5)	124.9626	122.5941	117.6757	110.9892	106.6481	100.5355	95.3400	101.9968	104.3620	111.2828	119.0975	122.6040 (72)
Total internal gains	510.9065	508.5761	491.6586	464.1510	435.7457	408.7740	391.5134	398.1321	412.4963	440.2382	472.1170	496.4828 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
				5.5000	11.2829		0.7200	0.7000		0.7700		21.6745 (75)
Northeast				5.5000	11.2829		0.7200	0.7000		0.7700		21.6745 (75)
Southeast				2.2700	36.7938		0.7200	0.7000		0.7700		29.1719 (77)
Southwest				7.6400	36.7938		0.7200	0.7000		0.7700		98.1821 (79)
Northwest				1.5500	11.2829		0.7200	0.7000		0.7700		6.1083 (81)
Northeast				4.5100	11.2829		0.7200	0.7000		0.7700		17.7731 (75)
Solar gains	172.9098	309.6611	463.8847	642.1448	780.7472	802.1494	762.1014	654.5626	524.9650	353.0785	209.8617	146.1916 (83)
Total gains	683.8162	818.2372	955.5433	1106.2958	1216.4930	1210.9233	1153.6148	1052.6947	937.4613	793.3167	681.9787	642.6744 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	
util living area	0.9595	0.9395	0.9046	0.8393	0.7385	0.6102	0.4908	0.5402	0.7262	0.8786	0.9433	0.9645 (86)	
MIT	18.0280	18.3508	18.8870	19.5655	20.1905	20.6344	20.8409	20.7969	20.4220	19.6067	18.6804	17.9464 (87)	
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)	
util rest of house	0.9540	0.9313	0.8912	0.8154	0.6969	0.5410	0.3924	0.4426	0.6671	0.8553	0.9341	0.9596 (89)	
MIT 2	15.9314	16.3969	17.1672	18.1282	18.9862	19.5585	19.7919	19.7524	19.3138	18.2069	16.8803	15.8135 (90)	
Living area fraction									fLA = Living area / (4) =			0.1434 (91)	
MIT	16.2322	16.6772	17.4139	18.3343	19.1590	19.7128	19.9424	19.9022	19.4728	18.4077	17.1385	16.1194 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	16.0822	16.5272	17.2639	18.1843	19.0090	19.5628	19.7924	19.7522	19.3228	18.2577	16.9885	15.9694 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9233	0.8935	0.8462	0.7675	0.6566	0.5168	0.3816	0.4277	0.6294	0.8075	0.8970	0.9312 (94)
Useful gains	631.3883	731.1086	808.6191	849.1122	798.7125	625.7938	440.2257	450.2500	590.0386	640.6133	611.7484	598.4389 (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	1784.5723	1761.0997	1630.3395	1406.2419	1107.0422	751.6906	483.5281	507.7383	791.0628	1159.8618	1497.7479	1782.6460 (97)

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Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	857.9689	692.1540	611.3600	401.1334	229.3973	0.0000	0.0000	0.0000	0.0000	386.3209	637.9196	881.0501 (98)
Space heating												4697.3041 (98)
Space heating per m2										(98) / (4) =		37.9151 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5196.1329 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	857.9689	692.1540	611.3600	401.1334	229.3973	0.0000	0.0000	0.0000	0.0000	386.3209	637.9196	881.0501 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	949.0806	765.6571	676.2832	443.7316	253.7580	0.0000	0.0000	0.0000	0.0000	427.3461	705.6633	974.6130 (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	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
Efficiency of water heater (217)m	88.0408	87.8752	87.5291	86.8337	85.4673	79.7000	79.7000	79.7000	79.7000	86.6557	87.6520	79.7000 (216)
Fuel for water heating, kWh/month	243.0203	214.4686	225.8128	203.6039	202.3889	193.4257	185.2868	203.9760	203.8223	211.5811	221.7344	236.7747 (219)
Water heating fuel used												2545.8957 (219)
Annual totals kWh/year												
Space heating fuel - main system												5196.1329 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.3957 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.3957 (231)
Electricity for lighting (calculated in Appendix L)												469.6171 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100		-530.1100 (233)
Total delivered energy for all uses												7843.9313 (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	5196.1329	0.2160	1122.3647 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2545.8957	0.2160	549.9135 (264)
Space and water heating			1672.2782 (265)
Pumps and fans	162.3957	0.5190	84.2833 (267)
Energy for lighting	469.6171	0.5190	243.7313 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total CO2, kg/year			1725.1657 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9200 (273)

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

DER			13.9200 ZC1
Total Floor Area		TFA	123.8900
Assumed number of occupants		N	2.8772
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.8803 ZC2
CO2 emissions from cooking, equation (L16)			1.5179 ZC3
Total CO2 emissions			29.3182 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			29.3182 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1281 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3781 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3781 (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	0.4821	0.4726	0.4632	0.4159	0.4065	0.3592	0.3592	0.3498	0.3781	0.4065	0.4254	0.4443 (22b)
Effective ac	0.6162	0.6117	0.6073	0.5865	0.5826	0.5645	0.5645	0.5612	0.5715	0.5826	0.5905	0.5987 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			21.4700	1.3258	28.4640		(27)
150mm EPS B&B			51.3600	0.1300	6.6768		(28a)
140mm Timber Frame	174.6400	23.5900	151.0500	0.1800	27.1890		(29a)
400mm Mineral Wool	72.5300		72.5300	0.1300	9.4289		(30)
Bay Flat	1.2200		1.2200	0.1300	0.1586		(31)
Total net area of external elements Aum(A, m ²)			299.7500				(32)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.0373		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.1786 (36)
Total fabric heat loss						(33) + (36) =	93.2159 (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	63.4914	63.0265	62.5707	60.4302	60.0297	58.1653	58.1653	57.8200	58.8834	60.0297	60.8399	61.6869 (38)
Heat transfer coeff	156.7073	156.2424	155.7866	153.6461	153.2456	151.3812	151.3812	151.0360	152.0993	153.2456	154.0558	154.9028 (39)
Average = Sum(39)m / 12 =												153.6442 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2649	1.2611	1.2575	1.2402	1.2369	1.2219	1.2219	1.2191	1.2277	1.2369	1.2435	1.2503 (40)
HLP (average)												1.2402 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum(45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
216.5012	190.7627	200.1961	179.2591	175.5207	156.6225	150.2178	165.1132	164.9085	185.8913	196.8169	211.2237	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												(63)
Output from w/h												
216.5012	190.7627	200.1961	179.2591	175.5207	156.6225	150.2178	165.1132	164.9085	185.8913	196.8169	211.2237	(64)
Heat gains from water heating, kWh/month												
95.0076	84.2217	89.5862	81.8820	81.3816	74.3553	72.9684	77.9211	77.1104	84.8298	87.7199	93.2528	(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	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
26.5917	23.6185	19.2078	14.5416	10.8700	9.1769	9.9160	12.8892	17.2998	21.9661	25.6376	27.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
290.1946	293.2059	285.6175	269.4627	249.0701	229.9040	217.0998	214.0885	221.6769	237.8317	258.2243	277.3904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	(71)
Water heating gains (Table 5)												
127.6984	125.3299	120.4115	113.7250	109.3838	103.2713	98.0758	104.7326	107.0978	114.0186	121.8333	125.3398	(72)
Total internal gains												
513.6422	511.3119	494.3944	466.8868	438.4815	411.5097	394.2491	400.8679	415.2321	442.9739	474.8528	499.2185	(73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					10.0100	11.2829	0.6300	0.7000	0.7700		34.5166 (75)	
Southeast					2.2700	36.7938	0.6300	0.7000	0.7700		25.5254 (77)	
Southwest					7.6400	36.7938	0.6300	0.7000	0.7700		85.9093 (79)	
Northwest					1.5500	11.2829	0.6300	0.7000	0.7700		5.3447 (81)	
Solar gains	151.2961	270.9535	405.8991	561.8767	683.1538	701.8807	666.8387	572.7423	459.3443	308.9437	183.6290	127.9177 (83)
Total gains	664.9383	782.2653	900.2935	1028.7635	1121.6353	1113.3904	1061.0879	973.6102	874.5764	751.9176	658.4818	627.1362 (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	54.9015	55.0649	55.2260	55.9954	56.1417	56.8332	56.8332	56.9631	56.5648	56.1417	55.8465	55.5411
alpha	4.6601	4.6710	4.6817	4.7330	4.7428	4.7889	4.7889	4.7975	4.7710	4.7428	4.7231	4.7027
util living area												
0.9987	0.9971	0.9919	0.9719	0.9085	0.7652	0.6008	0.6664	0.8927	0.9848	0.9974	0.9991	(86)
MIT	19.5499	19.7105	19.9844	20.3592	20.6969	20.9125	20.9786	20.9656	20.7991	20.3633	19.8934	19.5291 (87)
Th 2	19.8684	19.8714	19.8743	19.8880	19.8906	19.9025	19.9025	19.9047	19.8979	19.8906	19.8854	19.8800 (88)
util rest of house												
0.9983	0.9960	0.9887	0.9602	0.8689	0.6715	0.4643	0.5300	0.8301	0.9766	0.9962	0.9987	(89)
MIT 2	17.9371	18.1737	18.5747	19.1229	19.5838	19.8422	19.8945	19.8901	19.7273	19.1370	18.4512	17.9145 (90)
Living area fraction												
MIT	18.1684	18.3941	18.7769	19.3002	19.7435	19.9957	20.0500	20.0443	19.8810	19.3129	18.6581	18.1461 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1684	18.3941	18.7769	19.3002	19.7435	19.9957	20.0500	20.0443	19.8810	19.3129	18.6581	18.1461 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9972	0.9938	0.9842	0.9518	0.8624	0.6804	0.4837	0.5488	0.8289	0.9702	0.9942	0.9979 (94)
Useful gains	663.0854	777.4539	886.1002	979.2093	967.3201	757.5950	513.2213	534.3292	724.9658	729.5245	654.6886	625.8096 (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												
2173.2863	2108.3514	1912.5816	1597.9504	1232.6285	816.8128	522.2688	550.4274	879.2896	1335.2117	1780.5915	2160.2923	(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												
1123.5895	894.3631	763.7022	445.4936	197.3894	0.0000	0.0000	0.0000	0.0000	450.6312	810.6501	1141.6551	(98)
Space heating												5827.4743 (98)
Space heating per m2												(98) / (4) = 47.0375 (99)

8c. Space cooling requirement

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6232.5929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1123.5895	894.3631	763.7022	445.4936	197.3894	0.0000	0.0000	0.0000	0.0000	450.6312	810.6501	1141.6551	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1201.7000	956.5381	816.7938	476.4638	211.1117	0.0000	0.0000	0.0000	0.0000	481.9585	867.0055	1221.0215	(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	216.5012	190.7627	200.1961	179.2591	175.5207	156.6225	150.2178	165.1132	164.9085	185.8913	196.8169	211.2237	(64)
Efficiency of water heater (217)m	88.5811	88.4159	88.0480	87.1472	85.1275	79.8000	79.8000	79.8000	79.8000	87.0897	88.1899	79.8000	(216)
Fuel for water heating, kWh/month	244.4102	215.7561	227.3716	205.6969	206.1856	196.2688	188.2429	206.9087	206.6523	213.4481	223.1739	238.2824	(219)
Water heating fuel used												2572.3975	(219)
Annual totals kWh/year													
Space heating fuel - main system												6232.5929	(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)												469.6171	(232)
Total delivered energy for all uses												9349.6074	(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	6232.5929	0.2160	1346.2401 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2572.3975	0.2160	555.6379 (264)
Space and water heating			1901.8779 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	469.6171	0.5190	243.7313 (268)
Total CO2, kg/m2/year			2184.5342 (272)
Emissions per m2 for space and water heating			15.3513 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9673 (272b)
Emissions per m2 for pumps and fans			0.3142 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3513 * 1.00) + 1.9673 + 0.3142, rounded to 2 d.p.			17.6300 (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	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1281 (8)
Pressure test					Yes
Measured/design AP50					3.5500
Infiltration rate					0.3056 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3056 (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	0.3897	0.3820	0.3744	0.3362	0.3285	0.2903	0.2903	0.2827	0.3056	0.3285	0.3438	0.3591 (22b)
Effective ac	0.5759	0.5730	0.5701	0.5565	0.5540	0.5421	0.5421	0.5400	0.5467	0.5540	0.5591	0.5645 (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)			16.9600	1.3258	22.4848		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)
Total net area of external elements Aum(A, m ²)			299.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)
Timber GF			69.5000			9.0000	625.5000 (32c)
Timber FF			143.0400			9.0000	1287.3600 (32c)
Internal Floor			72.5300			18.0000	1305.5400 (32d)
Internal Ceiling			50.1400			9.0000	451.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9544.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							77.0430 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)
Total fabric heat loss						(33) + (36) =	99.9459 (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	59.3400	59.0362	58.7385	57.3401	57.0785	55.8605	55.8605	55.6350	56.3297	57.0785	57.6078	58.1611 (38)
Heat transfer coeff	159.2859	158.9821	158.6844	157.2860	157.0244	155.8064	155.8064	155.5809	156.2756	157.0244	157.5536	158.1070 (39)
Average = Sum(39)m / 12 =												157.2847 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2857	1.2833	1.2808	1.2696	1.2674	1.2576	1.2576	1.2558	1.2614	1.2674	1.2717	1.2762 (40)
HLP (average)												1.2696 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (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 = 1613.2409 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5424	31.0857	32.0776	27.9660	26.8341	23.1558	21.4572	24.6225	24.9165	29.0378	31.6971	34.4210 (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	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5917	23.6185	19.2078	14.5416	10.8700	9.1769	9.9160	12.8892	17.2998	21.9661	25.6376	27.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.1946	293.2059	285.6175	269.4627	249.0701	229.9040	217.0998	214.0885	221.6769	237.8317	258.2243	277.3904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	(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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	(71)
Water heating gains (Table 5)	47.7721	46.2584	43.1151	38.8417	36.0673	32.1608	28.8404	33.0947	34.6063	39.0293	44.0237	46.2647	(72)
Total internal gains	430.7159	429.2404	414.0980	389.0035	362.1650	337.3992	322.0137	326.2300	339.7406	364.9847	394.0432	417.1435	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.5000	11.2829	0.7200	0.7000			0.7700			21.6745 (75)
Southeast					2.2700	36.7938	0.7200	0.7000			0.7700			29.1719 (77)
Southwest					7.6400	36.7938	0.7200	0.7000			0.7700			98.1821 (79)
Northwest					1.5500	11.2829	0.7200	0.7000			0.7700			6.1083 (81)
Northeast					4.5100	11.2829	0.7200	0.7000			0.7700			17.7731 (75)
Solar gains	172.9098	309.6611	463.8847	642.1448	780.7472	802.1494	762.1014	654.5626	524.9650	353.0785	209.8617	146.1916	(83)	
Total gains	603.6257	738.9015	877.9826	1031.1484	1142.9122	1139.5486	1084.1151	980.7926	864.7056	718.0633	603.9049	563.3351	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.6452	16.6770	16.7083	16.8569	16.8850	17.0170	17.0170	17.0416	16.9659	16.8850	16.8282	16.7693	
alpha	2.1097	2.1118	2.1139	2.1238	2.1257	2.1345	2.1345	2.1361	2.1311	2.1257	2.1219	2.1180	
util living area	0.9658	0.9473	0.9151	0.8538	0.7588	0.6345	0.5177	0.5694	0.7520	0.8942	0.9521	0.9702	(86)
MIT	17.7046	18.0468	18.6197	19.3672	20.0524	20.5604	20.8006	20.7477	20.3146	19.4167	18.4239	17.6408	(87)
Th 2	19.8520	19.8540	19.8559	19.8648	19.8664	19.8742	19.8742	19.8756	19.8712	19.8664	19.8631	19.8595	(88)
util rest of house	0.9611	0.9400	0.9028	0.8313	0.7183	0.5650	0.4155	0.4693	0.6948	0.8732	0.9442	0.9661	(89)
MIT 2	16.8422	17.1815	17.7471	18.4800	19.1292	19.5889	19.7785	19.7465	19.3891	18.5434	17.5651	16.7837	(90)
Living area fraction	16.9659	17.3056	17.8722	18.6073	19.2616	19.7283	19.9251	19.8901	19.5218	18.6687	17.6883	16.9066	(91)
MIT	16.9659	17.3056	17.8722	18.6073	19.2616	19.7283	19.9251	19.8901	19.5218	18.6687	17.6883	16.9066	(92)
Temperature adjustment	16.9659	17.3056	17.8722	18.6073	19.2616	19.7283	19.9251	19.8901	19.5218	18.6687	17.6883	16.9066	(93)
adjusted MIT	16.9659	17.3056	17.8722	18.6073	19.2616	19.7283	19.9251	19.8901	19.5218	18.6687	17.6883	16.9066	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	569.6547	677.9138	768.0091	825.3059	791.9763	632.3109	456.0068	461.7276	582.5273	606.0271	557.3436	535.3704	(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	2017.4946	1972.2754	1804.5970	1526.8166	1187.3629	799.0153	518.0744	542.9990	847.2953	1266.9836	1668.2233	2009.0058	(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	1077.1929	869.8110	771.2214	505.0877	294.1676	0.0000	0.0000	0.0000	0.0000	491.7516	799.8334	1096.3847	(98)
Space heating												5905.4504	(98)
Space heating per m2												47.6669	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

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Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1464.5803	1152.9675	1182.4146	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6772	0.7400	0.7032	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	991.8143	853.2031	831.4593	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1448.5041	1381.1114	1262.6095	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	328.8167	392.7638	320.7758	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1042.3563	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.2042	98.1909	80.1939	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												260.5891	(107)
Space cooling per m2												2.1034	(108)
Energy for space heating												47.6669	(99)
Energy for space cooling												2.1034	(108)
Total												49.7703	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1281 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3781 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3781 (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	0.4821	0.4726	0.4632	0.4159	0.4065	0.3592	0.3592	0.3498	0.3781	0.4065	0.4254	0.4443 (22b)					
Effective ac	0.6162	0.6117	0.6073	0.5865	0.5826	0.5645	0.5645	0.5612	0.5715	0.5826	0.5905	0.5987 (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)			21.4700	1.3258	28.4640			(27)					
150mm EPS B&B			51.3600	0.1300	6.6768			(28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1800	27.1890			(29a)					
400mm Mineral Wool	72.5300		72.5300	0.1300	9.4289			(30)					
Bay Flat	1.2200		1.2200	0.1300	0.1586			(30)					
Total net area of external elements Aum(A, m2)			299.7500					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	74.0373		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								19.1786 (36)					
Total fabric heat loss						(33) + (36) =		93.2159 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.4914	Feb 63.0265	Mar 62.5707	Apr 60.4302	May 60.0297	Jun 58.1653	Jul 58.1653	Aug 57.8200	Sep 58.8834	Oct 60.0297	Nov 60.8399	Dec 61.6869	(38)
Heat transfer coeff	156.7073	156.2424	155.7866	153.6461	153.2456	151.3812	151.3812	151.0360	152.0993	153.2456	154.0558	154.9028	(39)
Average = Sum(39)m / 12 =												153.6442	(39)
HLP	Jan 1.2649	Feb 1.2611	Mar 1.2575	Apr 1.2402	May 1.2369	Jun 1.2219	Jul 1.2219	Aug 1.2191	Sep 1.2277	Oct 1.2369	Nov 1.2435	Dec 1.2503	(40)
HLP (average)												1.2402	(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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (43)
Daily hot water use	Jan 112.7861	Feb 108.6848	Mar 104.5835	Apr 100.4822	May 96.3809	Jun 92.2796	Jul 92.2796	Aug 96.3809	Sep 100.4822	Oct 104.5835	Nov 108.6848	Dec 112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum(45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Built)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5424	31.0857	32.0776	27.9660	26.8341	23.1558	21.4572	24.6225	24.9165	29.0378	31.6971	34.4210 (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	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	143.8586	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5917	23.6185	19.2078	14.5416	10.8700	9.1769	9.9160	12.8892	17.2998	21.9661	25.6376	27.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.1946	293.2059	285.6175	269.4627	249.0701	229.9040	217.0998	214.0885	221.6769	237.8317	258.2243	277.3904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	37.3859	(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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	(71)
Water heating gains (Table 5)	47.7721	46.2584	43.1151	38.8417	36.0673	32.1608	28.8404	33.0947	34.6063	39.0293	44.0237	46.2647	(72)
Total internal gains	430.7159	429.2404	414.0980	389.0035	362.1650	337.3992	322.0137	326.2300	339.7406	364.9847	394.0432	417.1435	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					10.0100	11.2829	0.6300	0.7000	0.7700		34.5166 (75)	
Southeast					2.2700	36.7938	0.6300	0.7000	0.7700		25.5254 (77)	
Southwest					7.6400	36.7938	0.6300	0.7000	0.7700		85.9093 (79)	
Northwest					1.5500	11.2829	0.6300	0.7000	0.7700		5.3447 (81)	
Solar gains	151.2961	270.9535	405.8991	561.8767	683.1538	701.8807	666.8387	572.7423	459.3443	308.9437	183.6290	127.9177 (83)
Total gains	582.0120	700.1938	819.9970	950.8802	1045.3188	1039.2799	988.8525	898.9723	799.0849	673.9284	577.6722	545.0611 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9015	55.0649	55.2260	55.9954	56.1417	56.8332	56.8332	56.9631	56.5648	56.1417	55.8465	55.5411	
alpha	4.6601	4.6710	4.6817	4.7330	4.7428	4.7889	4.7889	4.7975	4.7710	4.7428	4.7231	4.7027	
util living area	0.9993	0.9982	0.9944	0.9791	0.9263	0.7970	0.6367	0.7071	0.9180	0.9902	0.9985	0.9995	(86)
MIT	19.4887	19.6502	19.9268	20.3078	20.6590	20.8948	20.9727	20.9557	20.7639	20.3087	19.8338	19.4682	(87)
Th 2	19.8684	19.8714	19.8743	19.8880	19.8906	19.9025	19.9025	19.9047	19.8979	19.8906	19.8854	19.8800	(88)
util rest of house	0.9990	0.9975	0.9923	0.9700	0.8920	0.7066	0.4959	0.5688	0.8648	0.9846	0.9978	0.9993	(89)
MIT 2	18.4887	18.6523	18.9301	19.3168	19.6497	19.8514	19.8953	19.8913	19.7553	19.3233	18.8469	18.4773	(90)
Living area fraction									fLA = Living area / (4) =			0.1434	(91)
MIT	18.6321	18.7954	19.0731	19.4589	19.7945	20.0010	20.0499	20.0440	19.8999	19.4646	18.9885	18.6194	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6321	18.7954	19.0731	19.4589	19.7945	20.0010	20.0499	20.0440	19.8999	19.4646	18.9885	18.6194	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9966	0.9901	0.9654	0.8884	0.7158	0.5161	0.5883	0.8649	0.9815	0.9971	0.9990	(94)
Ext temp.	581.2142	697.7881	811.8517	917.9448	928.6246	743.9638	510.3626	528.8436	691.1498	661.4856	575.9706	544.5187	(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	2245.9440	2171.0573	1958.7188	1622.3387	1240.4474	817.6153	522.2437	550.3684	882.1676	1358.4635	1831.4851	2233.6049	(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 per m2	1238.5590	990.0370	853.2691	507.1636	231.9962	0.0000	0.0000	0.0000	0.0000	518.5516	903.9704	1256.6802	(98)
												6500.2270	(98)
												52.4677	(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	1422.9834	1120.2210	1147.8733	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7986	0.8747	0.8343	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1136.4001	979.8722	957.6359	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1331.3070	1269.7654	1166.9754	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	140.3329	215.6805	155.7486	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			511.7620 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	35.0832	53.9201	38.9371	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												127.9405 (107)
Energy for space heating												1.0327 (108)
Energy for space cooling												52.4677 (99)
Total												1.0327 (108)
Target Fabric Energy Efficiency (TFEE)												53.5004 (109)
												61.5 (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	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (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												3.5500
Infiltration rate												0.1775 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1775 (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	0.1953	0.1819	0.1819	0.1731	0.1731	0.1642	0.1642	0.1553	0.1553	0.1686	0.1642	0.1731 (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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (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	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum (45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
RHI water heating demand												2163.0769 (64)
Heat gains from water heating, kWh/month	92.9722	82.3833	87.5507	79.9122	79.3462	72.3856	70.9330	75.8857	75.1407	82.7944	85.7502	91.2174 (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	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4792	59.0462	48.0196	36.3539	27.1750	22.9423	24.7899	32.2229	43.2495	54.9152	64.0941	68.3268 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1262	437.6207	426.2947	402.1831	371.7464	343.1402	324.0296	319.5351	330.8610	354.9727	385.4094	414.0156 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402 (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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869 (71)	
Water heating gains (Table 5)	124.9626	122.5941	117.6757	110.9892	106.6481	100.5355	95.3400	101.9968	104.3620	111.2828	119.0975	122.6040 (72)	
Total internal gains	740.2517	734.9447	707.6737	665.2098	621.2531	582.3017	559.8431	569.4385	594.1562	636.8543	684.2846	720.6301 (73)	

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast					5.5000	14.6176	0.7200	0.7000	0.7700	28.0804 (75)						
Southeast					2.2700	45.1778	0.7200	0.7000	0.7700	35.8191 (77)						
Southwest					7.6400	45.1778	0.7200	0.7000	0.7700	120.5542 (79)						
Northwest					1.5500	14.6176	0.7200	0.7000	0.7700	7.9136 (81)						
Northeast					4.5100	14.6176	0.7200	0.7000	0.7700	23.0260 (75)						
Solar gains					215.3933	329.5626	500.9680	702.3520	810.2379	913.4401	837.0149	748.6050	596.0482	401.2268	260.8363	172.2312 (83)
Total gains					955.6450	1064.5073	1208.6417	1367.5619	1431.4910	1495.7418	1396.8580	1318.0435	1190.2045	1038.0811	945.1210	892.8613 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	
util living area	0.9158	0.8932	0.8425	0.7545	0.6260	0.4512	0.3335	0.3507	0.5740	0.7772	0.8818	0.9243 (86)	
MIT	18.6398	18.8800	19.3956	19.9938	20.5233	20.8451	20.9461	20.9403	20.7141	20.1173	19.2945	18.5847 (87)	
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)	
util rest of house	0.9046	0.8792	0.8215	0.7208	0.5711	0.3710	0.2312	0.2440	0.4957	0.7371	0.8634	0.9140 (89)	
MIT 2	16.8104	17.1521	17.8818	18.7090	19.4082	19.7831	19.8773	19.8744	19.6535	18.9001	17.7526	16.7333 (90)	
Living area fraction	17.0728	17.3999	18.0989	18.8933	19.5681	19.9354	20.0306	20.0273	19.8057	19.0747	17.9738	16.9989 (92)	
MIT	16.9228	17.2499	17.9489	18.7433	19.4181	19.7854	19.8806	19.8773	19.6557	18.9247	17.8238	16.8489 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	823.2309	886.8665	934.9255	927.8811	778.6017	541.2453	319.9507	318.2666	566.5656	719.5974	771.3408	778.9723 (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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1745.2913	1719.1054	1567.4857	1324.2946	956.9670	588.4999	330.2843	329.7772	659.7250	1048.8472	1427.3626	1718.9440 (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	686.0129	559.2645	470.6247	285.4178	132.7038	0.0000	0.0000	0.0000	0.0000	244.9619	472.3357	699.3389 (98)
RHI space heating demand												3550.6602 (98)
												3551 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											3.5500	
Infiltration rate											0.1775	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1775 (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												
	0.2263	0.2219	0.2174	0.1953	0.1908	0.1686	0.1686	0.1642	0.1775	0.1908	0.1997	0.2086 (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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (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	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)												Total = Sum (45)m = 1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
Heat gains from water heating, kWh/month	92.9722	82.3833	87.5507	79.9122	79.3462	72.3856	70.9330	75.8857	75.1407	82.7944	85.7502	91.2174 (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	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4792	59.0462	48.0196	36.3539	27.1750	22.9423	24.7899	32.2229	43.2495	54.9152	64.0941	68.3268 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1262	437.6207	426.2947	402.1831	371.7464	343.1402	324.0296	319.5351	330.8610	354.9727	385.4094	414.0156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402 (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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869 (71)
Water heating gains (Table 5)	124.9626	122.5941	117.6757	110.9892	106.6481	100.5355	95.3400	101.9968	104.3620	111.2828	119.0975	122.6040 (72)
Total internal gains	740.2517	734.9447	707.6737	665.2098	621.2531	582.3017	559.8431	569.4385	594.1562	636.8543	684.2846	720.6301 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.5000	11.2829		0.7200	0.7000	0.7700		21.6745 (75)
Southeast					2.2700	36.7938		0.7200	0.7000	0.7700		29.1719 (77)
Southwest					7.6400	36.7938		0.7200	0.7000	0.7700		98.1821 (79)
Northwest					1.5500	11.2829		0.7200	0.7000	0.7700		6.1083 (81)
Northeast					4.5100	11.2829		0.7200	0.7000	0.7700		17.7731 (75)
Solar gains	172.9098	309.6611	463.8847	642.1448	780.7472	802.1494	762.1014	654.5626	524.9650	353.0785	209.8617	146.1916 (83)
Total gains	913.1615	1044.6058	1171.5584	1307.3547	1402.0004	1384.4510	1321.9446	1224.0011	1119.1212	989.9329	894.1463	866.8217 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222
util living area	0.9310	0.9071	0.8670	0.7960	0.6913	0.5609	0.4428	0.4855	0.6657	0.8295	0.9084	0.9378 (86)
MIT	18.3358	18.6345	19.1271	19.7433	20.3028	20.6942	20.8714	20.8374	20.5240	19.8036	18.9485	18.2527 (87)
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)
util rest of house	0.9222	0.8954	0.8498	0.7684	0.6470	0.4923	0.3500	0.3923	0.6031	0.8002	0.8948	0.9298 (89)
MIT 2	16.3719	16.7991	17.5014	18.3658	19.1241	19.6199	19.8150	19.7853	19.4290	18.4705	17.2587	16.2529 (90)
Living area fraction	16.6536	17.0623	17.7346	18.5634	19.2932	19.7740	19.9665	19.9362	19.5860	18.6617	17.5011	16.5397 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.5036	16.9123	17.5846	18.4134	19.1432	19.6240	19.8165	19.7862	19.4360	18.5117	17.3511	16.3897 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	805.6654	888.9267	939.6702	944.5312	857.7928	654.8883	452.3122	466.9793	640.5208	744.9743	760.2756	772.9177 (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	1848.3989	1819.4351	1678.9122	1440.9380	1127.3749	760.9478	487.1828	512.8897	808.2170	1198.3372	1552.6654	1846.3027 (97)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	775.7937	625.3017	549.9960	357.4129	200.5691	0.0000	0.0000	0.0000	0.0000	337.3020	570.5207	798.5985 (98)
Space heating												4215.4946 (98)
Space heating per m2										(98) / (4) =		34.0261 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4663.1577 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	775.7937	625.3017	549.9960	357.4129	200.5691	0.0000	0.0000	0.0000	0.0000	337.3020	570.5207	798.5985 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	858.1789	691.7054	608.4027	395.3682	221.8685	0.0000	0.0000	0.0000	0.0000	373.1217	631.1069	883.4054 (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	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
Efficiency of water heater (217)m	87.8504	87.6740	87.3015	86.5543	85.1089	79.7000	79.7000	79.7000	79.7000	86.3191	87.4178	79.7000 (216)
Fuel for water heating, kWh/month	243.5469	214.9607	226.4014	204.2613	203.2412	193.4257	185.2868	203.9760	203.8223	212.4062	222.3284	237.2605 (219)
Water heating fuel used												2550.9174 (219)
Annual totals kWh/year												
Space heating fuel - main system												4663.1577 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.3957 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.3957 (231)
Electricity for lighting (calculated in Appendix L)												469.6171 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =										-530.1100		-530.1100 (233)
Total delivered energy for all uses												7315.9778 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4663.1577	3.4800	162.2779 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2550.9174	3.4800	88.7719 (247)
Mechanical ventilation fans	87.3957	13.1900	11.5275 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	469.6171	13.1900	61.9425 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-530.1100	13.1900	-69.9215 (252)
Total energy cost			384.4908 (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] =	0.9562 (257)
SAP value		86.6615
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4663.1577	0.2160	1007.2421 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2550.9174	0.2160	550.9982 (264)
Space and water heating			1558.2402 (265)
Pumps and fans	162.3957	0.5190	84.2833 (267)
Energy for lighting	469.6171	0.5190	243.7313 (268)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1611.1277 (272)
CO2 emissions per m2			13.0000 (273)
EI value			87.2171
EI rating			87 (274)
EI band			B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8458 = 4.114$, stars = 4
Water heating environmental impact	$0.216 / 0.8458 = 0.2554$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (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															3.5500		
Infiltration rate															0.1775	(18)	
Number of sides sheltered															0	(19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1775	(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	0.1953	0.1819	0.1819	0.1731	0.1731	0.1642	0.1642	0.1553	0.1553	0.1686	0.1642	0.1731	(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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (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 09 Jan 2014

Daily hot water use	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum (45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794 (64)
Heat gains from water heating, kWh/month	92.9722	82.3833	87.5507	79.9122	79.3462	72.3856	70.9330	75.8857	75.1407	82.7944	85.7502	91.2174 (65)
Total per year (kWh/year) = Sum (64)m =												2163.0769 (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	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4792	59.0462	48.0196	36.3539	27.1750	22.9423	24.7899	32.2229	43.2495	54.9152	64.0941	68.3268 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1262	437.6207	426.2947	402.1831	371.7464	343.1402	324.0296	319.5351	330.8610	354.9727	385.4094	414.0156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402 (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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869 (71)
Water heating gains (Table 5)	124.9626	122.5941	117.6757	110.9892	106.6481	100.5355	95.3400	101.9968	104.3620	111.2828	119.0975	122.6040 (72)
Total internal gains	740.2517	734.9447	707.6737	665.2098	621.2531	582.3017	559.8431	569.4385	594.1562	636.8543	684.2846	720.6301 (73)

6. Solar gains

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

Northeast					5.5000	14.6176	0.7200	0.7000	0.7700			28.0804	(75)		
Southeast					2.2700	45.1778	0.7200	0.7000	0.7700			35.8191	(77)		
Southwest					7.6400	45.1778	0.7200	0.7000	0.7700			120.5542	(79)		
Northwest					1.5500	14.6176	0.7200	0.7000	0.7700			7.9136	(81)		
Northeast					4.5100	14.6176	0.7200	0.7000	0.7700			23.0260	(75)		

Solar gains	215.3933	329.5626	500.9680	702.3520	810.2379	913.4401	837.0149	748.6050	596.0482	401.2268	260.8363	172.2312	(83)		
Total gains	955.6450	1064.5073	1208.6417	1367.5619	1431.4910	1495.7418	1396.8580	1318.0435	1190.2045	1038.0811	945.1210	892.8613	(84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	
util living area	0.9158	0.8932	0.8425	0.7545	0.6260	0.4512	0.3335	0.3507	0.5740	0.7772	0.8818	0.9243 (86)	
MIT	18.6398	18.8800	19.3956	19.9938	20.5233	20.8451	20.9461	20.9403	20.7141	20.1173	19.2945	18.5847 (87)	
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)	
util rest of house	0.9046	0.8792	0.8215	0.7208	0.5711	0.3710	0.2312	0.2440	0.4957	0.7371	0.8634	0.9140 (89)	
MIT 2	16.8104	17.1521	17.8818	18.7090	19.4082	19.7831	19.8773	19.8744	19.6535	18.9001	17.7526	16.7333 (90)	
Living area fraction									fLA = Living area / (4) =				0.1434 (91)
MIT	17.0728	17.3999	18.0989	18.8933	19.5681	19.9354	20.0306	20.0273	19.8057	19.0747	17.9738	16.9989 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	16.9228	17.2499	17.9489	18.7433	19.4181	19.7854	19.8806	19.8773	19.6557	18.9247	17.8238	16.8489 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8614	0.8331	0.7735	0.6785	0.5439	0.3619	0.2291	0.2415	0.4760	0.6932	0.8161	0.8724 (94)
Ext temp.	823.2309	886.8665	934.9255	927.8811	778.6017	541.2453	319.9507	318.2666	566.5656	719.5974	771.3408	778.9723 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1745.2913	1719.1054	1567.4857	1324.2946	956.9670	588.4999	330.2843	329.7772	659.7250	1048.8472	1427.3626	1718.9440 (97)

FULL SAP CALCULATION PRINTOUT

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

Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	686.0129	559.2645	470.6247	285.4178	132.7038	0.0000	0.0000	0.0000	0.0000	244.9619	472.3357	699.3389	(98)
Space heating												3550.6602	(98)
Space heating per m2												28.6598	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3927.7215	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	686.0129	559.2645	470.6247	285.4178	132.7038	0.0000	0.0000	0.0000	0.0000	244.9619	472.3357	699.3389	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	758.8639	618.6554	520.6026	315.7276	146.7962	0.0000	0.0000	0.0000	0.0000	270.9755	522.4952	773.6050	(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	213.9570	188.4646	197.6518	176.7969	172.9764	154.1603	147.6736	162.5689	162.4463	183.3470	194.3547	208.6794	(64)	
Efficiency of water heater	87.6039	87.4411	86.9475	85.9845	84.0172	79.7000	79.7000	79.7000	79.7000	85.4870	86.9952	79.7000	(216)	
Fuel for water heating, kWh/month	244.2322	215.5332	227.3231	205.6147	205.8822	193.4257	185.2868	203.9760	203.8223	214.4735	223.4085	237.9624	(219)	
Water heating fuel used												2560.9405	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3927.7215	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)													87.3957	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													162.3957	(231)
Electricity for lighting (calculated in Appendix L)													469.6171	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =										-588.6659		-588.6659	(233)	
Total delivered energy for all uses												6532.0087	(238)	

10a. Fuel costs - using BEDF prices (535)

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	3927.7215	7.6100	298.8996	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2560.9405	7.6100	194.8876	(247)
Mechanical ventilation fans	87.3957	31.0800	27.1626	(249)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Energy for lighting	469.6171	31.0800	145.9570	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.6659	31.0800	-182.9574	(252)
Total energy cost			612.2594	(255)

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

	Energy	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	3927.7215	0.2160	848.3878	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2560.9405	0.2160	553.1631	(264)
Space and water heating			1401.5510	(265)
Pumps and fans	162.3957	0.5190	84.2833	(267)
Energy for lighting	469.6171	0.5190	243.7313	(268)
Energy saving/generation technologies				
PV Unit	-588.6659	0.5190	-305.5176	(269)
Total kg/year			1424.0480	(272)

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

	Energy	Primary energy factor	Primary energy	
	kWh/year	kg CO2/kWh	kWh/year	

FULL SAP CALCULATION PRINTOUT

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Space heating - main system 1	3927.7215	1.2200	4791.8202 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2560.9405	1.2200	3124.3474 (264)
Space and water heating			7916.1675 (265)
Pumps and fans	162.3957	3.0700	498.5547 (267)
Energy for lighting	469.6171	3.0700	1441.7244 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			8049.2422 (272)
Primary energy kWh/m2/year			64.9709 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 89	-269 kg (18.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£89 2.17 kg/m²	B 88	B 89
Total Savings	£89 2.17 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£196	£212	-£16
Mains gas	£599	£495	£104
Space heating	£454	£456	-£2
Water heating	£195	£105	£90
Lighting	£146	£146	£0
Generated (PV)	-£183	-£183	£0
Total cost of fuels	£612	£524	£88
Total cost of uses	£612	£524	£88
Delivered energy	53 kWh/m²	42 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	65 kWh/m²	53 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											3.5500	
Infiltration rate											0.1775	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1775 (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												
	0.2263	0.2219	0.2174	0.1953	0.1908	0.1686	0.1686	0.1642	0.1775	0.1908	0.1997	0.2086 (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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (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	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte (annual)	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum(45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)	
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)	
If cylinder contains dedicated solar storage												
14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
205.2265	180.5791	187.5257	161.5945	151.4517	133.1048	125.9162	141.7420	148.5947	173.2209	185.9059	199.9490 (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												1.1242 (H8)
Utilisation factor												0.5891 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5328 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-939.5079 (H17)
Solar input	-27.2439	-45.4622	-77.4273	-103.7678	-128.1964	-126.0375	-124.3718	-108.6643	-85.1059	-58.1173	-32.3151	-22.7985 (63)
										Solar input (sum of months) = Sum(63)m =		-939.5079 (63)
Output from w/h	177.9827	135.1169	110.0984	57.8267	23.2553	7.0673	1.5444	33.0777	63.4887	115.1035	153.5907	177.1505 (64)
										Total per year (kWh/year) = Sum(64)m =		1055.3028 (64)
Heat gains from water heating, kWh/month	85.9879	76.0748	79.4498	67.7503	62.1264	55.5411	53.5271	59.2242	64.0593	74.6934	78.9911	84.2331 (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	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4792	59.0462	48.0196	36.3539	27.1750	22.9423	24.7899	32.2229	43.2495	54.9152	64.0941	68.3268 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1262	437.6207	426.2947	402.1831	371.7464	343.1402	324.0296	319.5351	330.8610	354.9727	385.4094	414.0156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402 (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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869 (71)
Water heating gains (Table 5)	115.5751	113.2066	106.7874	94.0976	83.5032	77.1405	71.9450	79.6024	88.9713	100.3944	109.7099	113.2165 (72)
Total internal gains	730.8641	725.5572	696.7854	648.3183	598.1082	558.9066	536.4481	547.0440	578.7655	625.9660	674.8971	711.2425 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.5000	11.2829		0.7200	0.7000	0.7700		21.6745 (75)
Southeast					2.2700	36.7938		0.7200	0.7000	0.7700		29.1719 (77)
Southwest					7.6400	36.7938		0.7200	0.7000	0.7700		98.1821 (79)
Northwest					1.5500	11.2829		0.7200	0.7000	0.7700		6.1083 (81)
Northeast					4.5100	11.2829		0.7200	0.7000	0.7700		17.7731 (75)
Solar gains	172.9098	309.6611	463.8847	642.1448	780.7472	802.1494	762.1014	654.5626	524.9650	353.0785	209.8617	146.1916 (83)
Total gains	903.7739	1035.2183	1160.6700	1290.4631	1378.8555	1361.0560	1298.5495	1201.6066	1103.7304	979.0445	884.7588	857.4341 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222
util living area	0.9323	0.9085	0.8689	0.7996	0.6970	0.5672	0.4490	0.4921	0.6706	0.8322	0.9100	0.9390 (86)
MIT	18.3237	18.6233	19.1157	19.7294	20.2899	20.6869	20.8677	20.8328	20.5163	19.7935	18.9373	18.2404 (87)
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9236	0.8969	0.8519	0.7723	0.6530	0.4984	0.3554	0.3983	0.6082	0.8032	0.8967	0.9312 (89)
Living area fraction	16.3547	16.7833	17.4856	18.3474	19.1085	19.6125	19.8122	19.7816	19.4204	18.4572	17.2429	16.2353 (90)
MIT	16.6371	17.0472	17.7194	18.5456	19.2779	19.7666	19.9636	19.9324	fLA = Living area / (4) =			0.1434 (91)
Temperature adjustment									19.5776	18.6488	17.4860	16.5229 (92)
adjusted MIT	16.4871	16.8972	17.5694	18.3956	19.1279	19.6166	19.8136	19.7824	19.4276	18.4988	17.3360	-0.1500
												16.3729 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8840	0.8527	0.8042	0.7261	0.6172	0.4786	0.3472	0.3870	0.5769	0.7555	0.8523	0.8934 (94)
Useful gains	798.9194	882.7539	933.4656	937.0452	850.9822	651.3519	450.8425	465.0767	636.7009	739.6498	754.1120	765.9919 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	1845.9103	1817.1465	1676.6186	1438.2404	1125.0605	759.8365	486.7423	512.3105	806.9411	1196.3902	1550.3782	1843.7549 (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	778.9612	627.9119	552.9059	360.8606	203.9143	0.0000	0.0000	0.0000	0.0000	339.8148	573.3117	801.8556 (98)
Space heating per m2												4239.5359 (98)
												(98) / (4) = 34.2202 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.4000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4689.7521 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	778.9612	627.9119	552.9059	360.8606	203.9143	0.0000	0.0000	0.0000	0.0000	339.8148	573.3117	801.8556 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	861.6828	694.5928	611.6215	399.1820	225.5689	0.0000	0.0000	0.0000	0.0000	375.9013	634.1943	887.0085 (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												
Efficiency of water heater (217)m	177.9827	135.1169	110.0984	57.8267	23.2553	7.0673	1.5444	33.0777	63.4887	115.1035	153.5907	177.1505 (64)
Fuel for water heating, kWh/month	88.1977	88.3008	88.4286	88.7543	89.1744	79.7000	79.7000	79.7000	79.7000	87.4301	87.9064	79.7000 (216)
Annual totals kWh/year	201.7997	153.0189	124.5055	65.1537	26.0784	8.8674	1.9377	41.5028	79.6596	131.6520	174.7208	200.7235 (219)
Space heating fuel - main system												4689.7521 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)	
mechanical ventilation fans (SFP = 0.2294)	87.3957 (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	212.3957 (231)
Electricity for lighting (calculated in Appendix L)	469.6171 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.66 * 1004 * 1.00) =	-530.1100
Total delivered energy for all uses	6051.2749 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4689.7521	3.4800	163.2034 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1209.6201	3.4800	42.0948 (247)
Mechanical ventilation fans	87.3957	13.1900	11.5275 (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	469.6171	13.1900	61.9425 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-530.1100	13.1900	-69.9215 (252)
Total energy cost			345.3341 (255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8588 (257)
SAP value		88.0199
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4689.7521	0.2160	1012.9864 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1209.6201	0.2160	261.2779 (264)
Space and water heating			1274.2644 (265)
Pumps and fans	212.3957	0.5190	110.2333 (267)
Energy for lighting	469.6171	0.5190	243.7313 (268)
Energy saving/generation technologies			
PV Unit	-530.1100	0.5190	-275.1271 (269)
Total kg/year			1353.1019 (272)
CO2 emissions per m2			10.9200 (273)
EI value			89.2643
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.3600 (1b)	x 2.6900 (2b)	= 138.1584 (1b) - (3b)
First floor	72.5300 (1c)	x 2.4000 (2c)	= 174.0720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 312.2304 (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												3.5500
Infiltration rate												0.1775 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1775 (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												
	0.1953	0.1819	0.1819	0.1731	0.1731	0.1642	0.1642	0.1553	0.1553	0.1686	0.1642	0.1731 (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)			16.9600	1.3258	22.4848		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			51.3600	0.1800	9.2448	75.0000	3852.0000 (28a)					
140mm Timber Frame	174.6400	23.5900	151.0500	0.1900	28.6995	9.0000	1359.4500 (29a)					
400mm Mineral Wool	72.5300		72.5300	0.1100	7.9783	9.0000	652.7700 (30)					
Bay Flat	1.2200		1.2200	0.2500	0.3050	9.0000	10.9800 (30)					
Total net area of external elements Aum(A, m2)			299.7500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4476		(33)					
Timber GF			69.5000			9.0000	625.5000 (32c)					
Timber FF			143.0400			9.0000	1287.3600 (32c)					
Internal Floor			72.5300			18.0000	1305.5400 (32d)					
Internal Ceiling			50.1400			18.0000	902.5200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9996.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							80.6854 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4983 (36)					
Total fabric heat loss						(33) + (36) =	99.9459 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.5180	Feb 51.5180	Mar 51.5180	Apr 51.5180	May 51.5180	Jun 51.5180	Jul 51.5180	Aug 51.5180	Sep 51.5180	Oct 51.5180	Nov 51.5180	Dec 51.5180 (38)
Heat transfer coeff	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639	151.4639 (39)
Average = Sum(39)m / 12 =												151.4639 (39)
HLP	Jan 1.2226	Feb 1.2226	Mar 1.2226	Apr 1.2226	May 1.2226	Jun 1.2226	Jul 1.2226	Aug 1.2226	Sep 1.2226	Oct 1.2226	Nov 1.2226	Dec 1.2226 (40)
HLP (average)												1.2226 (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												2.8772 (42)
Average daily hot water use (litres/day)												102.5328 (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	112.7861	108.6848	104.5835	100.4822	96.3809	92.2796	92.2796	96.3809	100.4822	104.5835	108.6848	112.7861 (44)
Energy conte	167.2586	146.2854	150.9534	131.6049	126.2780	108.9683	100.9752	115.8705	117.2543	136.6486	149.1627	161.9810 (45)
Energy content (annual)										Total = Sum(45)m =		1613.2409 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0888	21.9428	22.6430	19.7407	18.9417	16.3452	15.1463	17.3806	17.5882	20.4973	22.3744	24.2971 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage												
	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	205.2265	180.5791	187.5257	161.5945	151.4517	133.1048	125.9162	141.7420	148.5947	173.2209	185.9059	199.9490 (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												1.2503 (H8)
Utilisation factor												0.5506 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5328 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-976.4916 (H17)
Solar input	-32.0561	-45.5817	-78.3440	-105.7042	-123.5413	-133.1998	-126.7957	-115.5660	-90.3035	-62.1024	-37.9139	-25.3831 (63)
								Solar input (sum of months) = Sum(63)m =				-976.4916 (63)
Output from w/h												
	173.1705	134.9974	109.1817	55.8903	27.9104	0.0000	0.0000	26.1760	58.2912	111.1184	147.9920	174.5658 (64)
								Total per year (kWh/year) = Sum(64)m =				1019.2936 (64)
Heat gains from water heating, kWh/month												
	85.9879	76.0748	79.4498	67.7503	62.1264	55.5411	53.5271	59.2242	64.0593	74.6934	78.9911	84.2331 (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	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	172.6303	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4792	59.0462	48.0196	36.3539	27.1750	22.9423	24.7899	32.2229	43.2495	54.9152	64.0941	68.3268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.1262	437.6207	426.2947	402.1831	371.7464	343.1402	324.0296	319.5351	330.8610	354.9727	385.4094	414.0156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	55.1402	(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)	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	-115.0869	(71)
Water heating gains (Table 5)	115.5751	113.2066	106.7874	94.0976	83.5032	77.1405	71.9450	79.6024	88.9713	100.3944	109.7099	113.2165	(72)
Total internal gains	730.8641	725.5572	696.7854	648.3183	598.1082	558.9066	536.4481	547.0440	578.7655	625.9660	674.8971	711.2425	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					5.5000	14.6176		0.7200	0.7000	0.7700		28.0804 (75)				
Southeast					2.2700	45.1778		0.7200	0.7000	0.7700		35.8191 (77)				
Southwest					7.6400	45.1778		0.7200	0.7000	0.7700		120.5542 (79)				
Northwest					1.5500	14.6176		0.7200	0.7000	0.7700		7.9136 (81)				
Northeast					4.5100	14.6176		0.7200	0.7000	0.7700		23.0260 (75)				
Solar gains					215.3933	329.5626	500.9680	702.3520	810.2379	913.4401	837.0149	748.6050	596.0482	401.2268	260.8363	172.2312 (83)
Total gains					946.2574	1055.1198	1197.7533	1350.6703	1408.3461	1472.3468	1373.4630	1295.6490	1174.8137	1027.1927	935.7334	883.4737 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324	18.3324
alpha	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222	2.2222
util living area	0.9172	0.8948	0.8446	0.7584	0.6319	0.4567	0.3384	0.3558	0.5788	0.7803	0.8837	0.9257 (86)
MIT	18.6283	18.8693	19.3850	19.9818	20.5135	20.8412	20.9445	20.9385	20.7090	20.1090	19.2842	18.5729 (87)
Th 2	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020	19.9020 (88)
util rest of house												

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	0.9062	0.8809	0.8238	0.7249	0.5771	0.3759	0.2348	0.2479	0.5004	0.7405	0.8655	0.9156 (89)
MIT 2	16.7942	17.1371	17.8675	18.6936	19.3971	19.7798	19.8765	19.8735	19.6486	18.8896	17.7384	16.7166 (90)
Living area fraction									fLA = Living area / (4) =			0.1434 (91)
MIT	17.0573	17.3856	18.0851	18.8784	19.5573	19.9320	20.0297	20.0262	19.8007	19.0645	17.9601	16.9828 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9073	17.2356	17.9351	18.7284	19.4073	19.7820	19.8797	19.8762	19.6507	18.9145	17.8101	16.8328 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8633	0.8350	0.7758	0.6822	0.5493	0.3664	0.2326	0.2452	0.4803	0.6963	0.8184	0.8743 (94)	
Useful gains	816.8698	881.0036	929.2410	921.4647	773.5610	539.5384	319.4774	317.7383	564.2048	715.2392	765.7605	772.4094 (95)	
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)	
Heat loss rate W													
Month fracti	1742.9347	1716.9306	1565.3982	1322.0319	955.3218	587.9902	330.1420	329.6178	658.9775	1047.2925	1425.2929	1716.5168 (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	688.9923	561.7430	473.3009	288.4084	135.2300	0.0000	0.0000	0.0000	0.0000	247.0477	474.8633	702.4159 (98)	
Space heating per m2												3572.0015 (98)	
										(98) / (4) =		28.8320 (99)	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.4000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3951.3291 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	688.9923	561.7430	473.3009	288.4084	135.2300	0.0000	0.0000	0.0000	0.0000	247.0477	474.8633	702.4159 (98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)	
Space heating fuel (main heating system)	762.1596	621.3971	523.5630	319.0358	149.5907	0.0000	0.0000	0.0000	0.0000	273.2829	525.2913	777.0088 (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	173.1705	134.9974	109.1817	55.8903	27.9104	0.0000	0.0000	26.1760	58.2912	111.1184	147.9920	174.5658 (64)	
Efficiency of water heater (217)m	88.0263	88.1081	88.1810	88.4719	88.3703	79.7000	79.7000	79.7000	79.7000	86.7853	87.6055	79.7000 (216)	
Fuel for water heating, kWh/month	196.7258	153.2179	123.8155	63.1729	31.5835	0.0000	0.0000	32.8431	73.1383	128.0383	168.9300	198.2642 (219)	
Water heating fuel used												1169.7296 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3951.3291 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)	
mechanical ventilation fans (SFP = 0.2294)	87.3957 (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	212.3957 (231)
Electricity for lighting (calculated in Appendix L)	469.6171 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.66 * 1115 * 1.00) =	-588.6659	-588.6659 (233)
Total delivered energy for all uses		5214.4054 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3951.3291	7.6100	300.6961 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1169.7296	7.6100	89.0164 (247)	
Mechanical ventilation fans	87.3957	31.0800	27.1626 (249)	
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)	
Pump for solar water heating	50.0000	31.0800	15.5400 (249)	
Energy for lighting	469.6171	31.0800	145.9570 (250)	
Additional standing charges			105.0000 (251)	
Energy saving/generation technologies				
PV Unit	-588.6659	31.0800	-182.9574 (252)	
Total energy cost			523.7247 (255)	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3951.3291	0.2160	853.4871 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1169.7296	0.2160	252.6616 (264)
Space and water heating			1106.1487 (265)
Pumps and fans	212.3957	0.5190	110.2333 (267)
Energy for lighting	469.6171	0.5190	243.7313 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	0.5190	-305.5176 (269)
Total kg/year			1154.5956 (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	3951.3291	1.2200	4820.6215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1169.7296	1.2200	1427.0701 (264)
Space and water heating			6247.6915 (265)
Pumps and fans	212.3957	3.0700	652.0547 (267)
Energy for lighting	469.6171	3.0700	1441.7244 (268)
Energy saving/generation technologies			
PV Unit	-588.6659	3.0700	-1807.2044 (269)
Primary energy kWh/year			6534.2662 (272)
Primary energy kWh/m2/year			52.7425 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	80.7 (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	412.14 (P1)
Transmission heat loss coefficient	99.95 (37)
Summer heat loss coefficient	512.09 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.5000	106.0502	0.7200	0.7000	0.9000	238.1167
South East	2.2700	127.3119	0.7200	0.7000	0.9000	117.9805
South West	7.6400	127.3119	0.7200	0.7000	0.9000	397.0798
North West	1.5500	106.0502	0.7200	0.7000	0.9000	67.1056
North East	4.5100	106.0502	0.7200	0.7000	0.9000	195.2557
total:						1015.5382

Solar gains	Jun 1095	Jul 1016	Aug 889	(P3)
Internal gains	579	557	566	
Total summer gains	1675	1572	1455	(P5)
Summer gain/loss ratio	3.27	3.07	2.84	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 80.7)	1.44	1.44	1.44	
Threshold temperature	20.11	21.81	21.58	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Assessment of likelihood of high internal temperature:

Slight