

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-150			Issued on Date	09/06/2023
Assessment Reference	As Built	Prop Type Ref	H Det As		
Property	5, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR				
SAP Rating	88 B	DER	12.78	TER	17.01
Environmental	88 B	% DER<TER	24.85		
CO ₂ Emissions (t/year)	1.23	DFEE	50.43	TFEE	59.18
General Requirements Compliance	Pass	% DFEE<TFEE	14.78		
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) 17.01 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.4 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.70 (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: 1.11 kWh/day
Permitted by DBSCG 1.66 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Southern England): Medium OK

Based on:

Overshading:
Average
Windows facing North East: 8.08 m², No overhang
Windows facing South East: 7.06 m², No overhang
Windows facing South West: 5.62 m², No overhang
Windows facing North West: 4.40 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.7000	
Infiltration rate											0.2350	(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) =	0.2350 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	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)
	0.2996	0.2938	0.2879	0.2585	0.2526	0.2233	0.2233	0.2174	0.2350	0.2526	0.2644	0.2761 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5496	0.5438	0.5379	0.5085	0.5026	0.5000	0.5000	0.5000	0.5000	0.5026	0.5144	0.5261 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.9137	Feb 56.3053	Mar 55.6970	Apr 52.6552	May 52.0468	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 52.0468	Nov 53.2636	Dec 54.4803 (38)
Heat transfer coeff	157.9462	157.3379	156.7295	153.6877	153.0794	152.8075	152.8075	152.8075	152.8075	153.0794	154.2961	155.5128 (39)
Average = Sum(39)m / 12 =												154.4083 (39)
HLP	Jan 1.2779	Feb 1.2730	Mar 1.2680	Apr 1.2434	May 1.2385	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2385	Nov 1.2484	Dec 1.2582 (40)
HLP (average)												1.2493 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum (45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage												
Primary loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (57)
Total heat required for water heating calculated for each month	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)
Solar input	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (62)
Solar input (sum of months) = Sum (63)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 (63)
Output from w/h	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Heat gains from water heating, kWh/month	89.0762	78.8646	83.6559	76.1441	75.4532	68.6191	67.0418	71.9934	71.3736	78.9006	81.9808	87.3218 (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	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9752	23.0710	18.7626	14.2045	10.6180	8.9642	9.6861	12.5904	16.8988	21.4569	25.0433	26.6972 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	289.8287	292.8362	285.2574	269.1229	248.7561	229.6141	216.8261	213.8186	221.3974	237.5319	257.8987	277.0407 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811 (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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486 (71)
Water heating gains (Table 5)	119.7261	117.3581	112.4408	105.7557	101.4155	95.3043	90.1100	96.7654	99.1300	106.0492	113.8622	117.3680 (72)
Total internal gains	504.6732	502.4085	485.6039	458.2263	429.9328	403.0258	385.7654	392.3175	406.5694	434.1812	465.9475	490.2491 (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				8.0800	11.2829		0.7200		0.7000		0.7700		31.8418 (75)
Southeast				7.0600	36.7938		0.7200		0.7000		0.7700		90.7285 (77)
Southwest				2.2900	36.7938		0.7200		0.7000		0.7700		29.4289 (79)
Northwest				0.6000	11.2829		0.7200		0.7000		0.7700		2.3645 (81)
Southwest				3.3300	36.7938		0.7200		0.7000		0.7700		42.7940 (79)
Northwest				3.8000	11.2829		0.7200		0.7000		0.7700		14.9751 (81)
Solar gains	212.1328	377.6766	560.1452	766.7778	925.2404	947.7502	901.5803	778.8959	630.9994	429.1126	257.0611	179.6164	83)
Total gains	716.8060	880.0851	1045.7491	1225.0042	1355.1732	1350.7760	1287.3458	1171.2134	1037.5688	863.2938	723.0086	669.8655	84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.0552	19.1289	19.2031	19.5832	19.6610	19.6960	19.6960	19.6960	19.6960	19.6610	19.5060	19.3534
alpha	2.2703	2.2753	2.2802	2.3055	2.3107	2.3131	2.3131	2.3131	2.3131	2.3107	2.3004	2.2902
util living area	0.9616	0.9392	0.9002	0.8258	0.7150	0.5799	0.4594	0.5099	0.7038	0.8718	0.9441	0.9667 (86)
MIT	18.0969	18.4527	19.0095	19.7207	20.3128	20.7056	20.8776	20.8400	20.5097	19.7314	18.7982	18.0513 (87)
Th 2	19.8582	19.8621	19.8660	19.8854	19.8893	19.8911	19.8911	19.8911	19.8911	19.8893	19.8815	19.8737 (88)
util rest of house	0.9560	0.9305	0.8856	0.7996	0.6703	0.5089	0.3623	0.4120	0.6410	0.8466	0.9346	0.9618 (89)
MIT 2	15.9924	16.5069	17.3070	18.3194	19.1253	19.6227	19.8103	19.7784	19.4040	18.3596	17.0225	15.9334 (90)
Living area fraction	16.2989	16.7903	17.5549	18.5235	19.2982	19.7804	19.9657	19.9330	19.5650	18.5594	17.2811	16.2418 (92)
MIT	16.2989	16.7903	17.5549	18.5235	19.2982	19.7804	19.9657	19.9330	19.5650	18.5594	17.2811	16.2418 (91)
Temperature adjustment												-0.1500
adjusted MIT	16.1489	16.6403	17.4049	18.3735	19.1482	19.6304	19.8157	19.7830	19.4150	18.4094	17.1311	16.0918 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9270	0.8937	0.8418	0.7551	0.6358	0.4903	0.3552	0.4015	0.6091	0.8015	0.8993	0.9354 (94)
Useful gains	664.4849	786.5496	880.3106	925.0337	861.5570	662.3419	457.2394	470.2912	632.0242	691.9005	650.2180	626.5884 (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												

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Month fraction	1871.4842	1847.1926	1709.1247	1455.9624	1140.1679	768.6843	491.3881	516.9463	812.1757	1195.4511	1547.7577	1849.3270 (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 requirement	898.0074	712.7521	616.6377	382.2687	207.2865	0.0000	0.0000	0.0000	0.0000	374.6416	646.2285	909.7175 (98)
Space heating requirement												4747.5400 (98)
Space heating per m2											(98) / (4) =	38.4105 (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												5251.7035 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	898.0074	712.7521	616.6377	382.2687	207.2865	0.0000	0.0000	0.0000	0.0000	374.6416	646.2285	909.7175 (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)	993.3711	788.4426	682.1213	422.8636	229.2992	0.0000	0.0000	0.0000	0.0000	414.4265	714.8546	1006.3247 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Efficiency of water heater	88.1647	87.9760	87.5992	86.7835	85.2735	79.7000	79.7000	79.7000	79.7000	86.6467	87.7281	79.7000 (216)
Fuel for water heating, kWh/month	237.1302	209.2017	220.0521	198.2747	197.1231	187.5008	179.1676	197.8527	197.8950	205.9654	216.1493	230.9691 (219)
Water heating fuel used												2477.2817 (219)
Annual totals kWh/year												
Space heating fuel - main system												5251.7035 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.8316 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.8316 (231)
Electricity for lighting (calculated in Appendix L)												458.7310 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =									-795.1650			-795.1650 (233)
Total delivered energy for all uses												7555.3829 (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	5251.7035	0.2160	1134.3680 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2477.2817	0.2160	535.0928 (264)
Space and water heating			1669.4608 (265)
Pumps and fans	162.8316	0.5190	84.5096 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total CO2, kg/year			1579.3612 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7800 (273)

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

DER			12.7800 ZC1
Total Floor Area		TFA	123.6000
Assumed number of occupants		N	2.8762
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.8953 ZC2
CO2 emissions from cooking, equation (L16)			1.5213 ZC3
Total CO2 emissions			28.1966 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			28.1966 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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour				
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans																4 * 10 =	40.0000 (7a)	
Number of passive vents																0 * 10 =	0.0000 (7b)	
Number of flueless gas fires																0 * 40 =	0.0000 (7c)	
										Air changes per hour								
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =								0.1275 (8)
Pressure test										Yes								
Measured/design AP50																		5.0000
Infiltration rate																		0.3775 (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) =								0.3775 (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	0.4813	0.4718	0.4624	0.4152	0.4058	0.3586	0.3586	0.3492	0.3775	0.4058	0.4247	0.4435	(22b)					
Effective ac	0.6158	0.6113	0.6069	0.5862	0.5823	0.5643	0.5643	0.5610	0.5712	0.5823	0.5902	0.5984	(25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			25.1600	1.3258	33.3561			(27)					
150mm EPS B&B			62.4000	0.1300	8.1120			(28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1800	26.9676			(29a)					
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560			(30)					
Bay Plane	1.3000		1.3000	0.1300	0.1690			(30)					
Total net area of external elements Aum(A, m2)			302.0000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.6807			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7894	(36)					
Total fabric heat loss						(33) + (36) =	92.4701	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.7677	Feb 63.3020	Mar 62.8455	Apr 60.7015	May 60.3004	Jun 58.4330	Jul 58.4330	Aug 58.0872	Sep 59.1523	Oct 60.3004	Nov 61.1119	Dec 61.9603	(38)
Heat transfer coeff	156.2378	155.7721	155.3156	153.1716	152.7704	150.9031	150.9031	150.5573	151.6224	152.7704	153.5819	154.4303	(39)
Average = Sum(39)m / 12 =												153.1697	(39)
HLP	Jan 1.2641	Feb 1.2603	Mar 1.2566	Apr 1.2393	May 1.2360	Jun 1.2209	Jul 1.2209	Aug 1.2181	Sep 1.2267	Oct 1.2360	Nov 1.2426	Dec 1.2494	(40)
HLP (average)												1.2392	(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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (43)
Daily hot water use	Jan 112.7611	Feb 108.6607	Mar 104.5603	Apr 100.4599	May 96.3595	Jun 92.2591	Jul 92.2591	Aug 96.3595	Sep 100.4599	Oct 104.5603	Nov 108.6607	Dec 112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum(45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												120.0000 (47)
Store volume												1.2247 (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)												0.6613 (55)
Total storage loss	20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007 (56)
If cylinder contains dedicated solar storage	20.5007	18.5168	20.5007	19.8394	20.5007	19.8394	20.5007	20.5007	19.8394	20.5007	19.8394	20.5007 (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	210.9846	185.7809	194.6831	173.9271	170.0131	151.2955	144.7159	159.6079	159.5797	180.3814	191.4810	205.7082 (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	210.9846	185.7809	194.6831	173.9271	170.0131	151.2955	144.7159	159.6079	159.5797	180.3814	191.4810	205.7082 (64)
Heat gains from water heating, kWh/month	90.6116	80.2515	85.1914	77.6300	76.9886	70.1050	68.5773	73.5289	72.8595	80.4361	83.4667	88.8572 (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	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9752	23.0710	18.7626	14.2045	10.6180	8.9642	9.6861	12.5904	16.8988	21.4569	25.0433	26.6972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	289.8287	292.8362	285.2574	269.1229	248.7561	229.6141	216.8261	213.8186	221.3974	237.5319	257.8987	277.0407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	(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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	(71)
Water heating gains (Table 5)	121.7898	119.4219	114.5045	107.8195	103.4793	97.3681	92.1738	98.8291	101.1938	108.1130	115.9260	119.4317	(72)
Total internal gains	506.7370	504.4723	487.6677	460.2901	431.9966	405.0896	387.8292	394.3813	408.6332	436.2450	468.0112	492.3128	(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				8.0800	11.2829		0.6300		0.7000		0.7700		27.8616 (75)
Southeast				7.0600	36.7938		0.6300		0.7000		0.7700		79.3874 (77)
Southwest				5.6200	36.7938		0.6300		0.7000		0.7700		63.1951 (79)
Northwest				4.4000	11.2829		0.6300		0.7000		0.7700		15.1721 (81)
Solar gains	185.6162	330.4670	490.1270	670.9306	809.5853	829.2814	788.8828	681.5339	552.1245	375.4735	224.9285		157.1644 (83)
Total gains	692.3531	834.9393	977.7947	1131.2207	1241.5819	1234.3710	1176.7120	1075.9152	960.7577	811.7185	692.9397		649.4772 (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	54.9376	55.1019	55.2638	56.0374	56.1845	56.8798	56.8798	57.0104	56.6099	56.1845	55.8876	55.5806
alpha	4.6625	4.6735	4.6843	4.7358	4.7456	4.7920	4.7920	4.8007	4.7740	4.7456	4.7258	4.7054
util living area	0.9985	0.9961	0.9885	0.9600	0.8766	0.7132	0.5478	0.6137	0.8601	0.9794	0.9967	0.9989 (86)
MIT	19.5724	19.7514	20.0418	20.4263	20.7513	20.9359	20.9855	20.9758	20.8352	20.4061	19.9209	19.5479 (87)
Th 2	19.8691	19.8721	19.8750	19.8887	19.8913	19.9033	19.9033	19.9055	19.8987	19.8913	19.8861	19.8807 (88)
util rest of house	0.9980	0.9947	0.9843	0.9444	0.8292	0.6172	0.4196	0.4822	0.7882	0.9685	0.9953	0.9985 (89)
MIT 2	17.9704	18.2337	18.6578	19.2154	19.6482	19.8611	19.8981	19.8957	19.7649	19.1974	18.4917	17.9425 (90)
Living area fraction	18.2037	18.4548	18.8594	19.3917	19.8088	20.0176	20.0565	20.0530	19.9207	19.3735	18.6999	18.1763 (91)
MIT	18.2037	18.4548	18.8594	19.3917	19.8088	20.0176	20.0565	20.0530	19.9207	19.3735	18.6999	18.1763 (92)
Temperature adjustment	18.2037	18.4548	18.8594	19.3917	19.8088	20.0176	20.0565	20.0530	19.9207	19.3735	18.6999	18.1763 (93)
adjusted MIT	18.2037	18.4548	18.8594	19.3917	19.8088	20.0176	20.0565	20.0530	19.9207	19.3735	18.6999	18.1763 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	690.0677	828.2974	956.9896	1057.9260	1024.3346	775.3253	515.6553	539.0364	758.9485	780.3309	688.0344	647.8798	(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	2172.2811	2111.4518	1919.6038	1607.0335	1238.7899	817.5391	521.5943	549.9861	882.5554	1340.3247	1781.5280	2158.3672	(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	1102.7668	862.2798	716.1850	395.3574	159.5547	0.0000	0.0000	0.0000	0.0000	416.6353	787.3154	1123.8026	(98)
Space heating												5563.8971	(98)
Space heating per m2												(98) / (4) =	45.0153 (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													5950.6920 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1102.7668	862.2798	716.1850	395.3574	159.5547	0.0000	0.0000	0.0000	0.0000	416.6353	787.3154	1123.8026	(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)	1179.4297	922.2244	765.9733	422.8421	170.6468	0.0000	0.0000	0.0000	0.0000	445.5993	842.0486	1201.9279	(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	210.9846	185.7809	194.6831	173.9271	170.0131	151.2955	144.7159	159.6079	159.5797	180.3814	191.4810	205.7082	(64)
Efficiency of water heater (217)m	88.5923	88.3989	87.9787	86.9385	84.6451	79.8000	79.8000	79.8000	79.8000	86.9764	88.1868	79.8000	(216)
Fuel for water heating, kWh/month	238.1523	210.1620	221.2844	200.0576	200.8541	189.5934	181.3482	200.0099	199.9746	207.3913	217.1312	232.0175	(219)
Water heating fuel used												2497.9765	(219)
Annual totals kWh/year													
Space heating fuel - main system												5950.6920	(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)												458.7310	(232)
Total delivered energy for all uses												8982.3995	(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	5950.6920	0.2160	1285.3495 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2497.9765	0.2160	539.5629 (264)
Space and water heating			1824.9124 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)
Total CO2, kg/m2/year			2101.9188 (272)
Emissions per m2 for space and water heating			14.7647 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9262 (272b)
Emissions per m2 for pumps and fans			0.3149 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7647 * 1.00) + 1.9262 + 0.3149, rounded to 2 d.p.			17.0100 (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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1275 (8)
Pressure test					Yes
Measured/design AP50					4.7000
Infiltration rate					0.3625 (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) =		0.3625 (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	0.4622	0.4531	0.4440	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259 (22b)
Effective ac	0.6068	0.6026	0.5986	0.5795	0.5759	0.5593	0.5593	0.5562	0.5657	0.5759	0.5831	0.5907 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			18.0300	1.3258	23.9034		(27)
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)
Total net area of external elements Aum(A, m ²)			302.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8019		(33)
Timber GF			96.0600			9.0000	864.5400 (32c)
Timber FF			130.7000			9.0000	1176.3000 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			9.0000	550.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10284.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.2049 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)
Total fabric heat loss						(33) + (36) =	101.0325 (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	62.8335	62.4041	61.9832	60.0062	59.6363	57.9144	57.9144	57.5955	58.5776	59.6363	60.3846	61.1669 (38)
Heat transfer coeff	163.8660	163.4366	163.0157	161.0387	160.6688	158.9469	158.9469	158.6280	159.6101	160.6688	161.4171	162.1994 (39)
Average = Sum(39)m / 12 =												161.0369 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3258	1.3223	1.3189	1.3029	1.2999	1.2860	1.2860	1.2834	1.2913	1.2999	1.3060	1.3123 (40)
HLP (average)												1.3029 (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	2.8762 (42)
Average daily hot water use (litres/day)	102.5101 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (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 = 1612.8832 (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	35.5346	31.0788	32.0705	27.9598	26.8281	23.1506	21.4525	24.6170	24.9110	29.0314	31.6900	34.4133 (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	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9752	23.0710	18.7626	14.2045	10.6180	8.9642	9.6861	12.5904	16.8988	21.4569	25.0433	26.6972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	289.8287	292.8362	285.2574	269.1229	248.7561	229.6141	216.8261	213.8186	221.3974	237.5319	257.8987	277.0407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	(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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	(71)
Water heating gains (Table 5)	47.7615	46.2482	43.1055	38.8331	36.0593	32.1537	28.8340	33.0874	34.5986	39.0207	44.0139	46.2545	(72)
Total internal gains	429.7087	428.2986	413.2687	388.3037	361.5766	336.8751	321.4894	325.6396	339.0380	364.1526	393.0992	416.1356	(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				8.0800	11.2829	0.7200	0.7000	0.7700	31.8418 (75)			
Southeast				7.0600	36.7938	0.7200	0.7000	0.7700	90.7285 (77)			
Southwest				2.2900	36.7938	0.7200	0.7000	0.7700	29.4289 (79)			
Northwest				0.6000	11.2829	0.7200	0.7000	0.7700	2.3645 (81)			
Southwest				3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (79)			
Northwest				3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)			
Solar gains	212.1328	377.6766	560.1452	766.7778	925.2404	947.7502	901.5803	778.8959	630.9994	429.1126	257.0611	179.6164 (83)
Total gains	641.8414	805.9752	973.4138	1155.0815	1286.8170	1284.6254	1223.0697	1104.5355	970.0374	793.2653	650.1603	595.7520 (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	17.4331	17.4789	17.5241	17.7392	17.7801	17.9727	17.9727	18.0088	17.8980	17.7801	17.6976	17.6123	
alpha	2.1622	2.1653	2.1683	2.1826	2.1853	2.1982	2.1982	2.2006	2.1932	2.1853	2.1798	2.1742	
util living area	0.9664	0.9452	0.9086	0.8396	0.7356	0.6042	0.4857	0.5381	0.7292	0.8863	0.9513	0.9711	(86)
MIT	17.8131	18.1812	18.7668	19.5138	20.1676	20.6317	20.8392	20.7930	20.3993	19.5287	18.5351	17.7520	(87)
Th 2	19.8207	19.8234	19.8261	19.8386	19.8409	19.8518	19.8518	19.8539	19.8476	19.8409	19.8362	19.8312	(88)
util rest of house	0.9614	0.9372	0.8949	0.8145	0.6916	0.5319	0.3834	0.4363	0.6675	0.8630	0.9429	0.9668	(89)
MIT 2	16.9200	17.2849	17.8617	18.5924	19.2056	19.6204	19.7785	19.7529	19.4361	18.6247	17.6479	16.8662	(90)
Living area fraction	17.0501	17.4154	17.9935	18.7266	19.3457	19.7677	19.9330	19.9044	19.5763	18.7564	17.7771	16.9952	(92)
MIT	17.0501	17.4154	17.9935	18.7266	19.3457	19.7677	19.9330	19.9044	19.5763	18.7564	17.7771	16.9952	(93)
Temperature adjustment	17.0501	17.4154	17.9935	18.7266	19.3457	19.7677	19.9330	19.9044	19.5763	18.7564	17.7771	16.9952	(93)
adjusted MIT	17.0501	17.4154	17.9935	18.7266	19.3457	19.7677	19.9330	19.9044	19.5763	18.7564	17.7771	16.9952	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	606.3385	737.3660	844.1059	907.1114	862.1544	675.7137	478.5054	487.3348	630.9066	662.2617	599.5247	567.0437	(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	2089.3074	2045.4738	1873.6245	1582.4656	1228.4186	821.3844	529.7670	555.8901	874.0774	1310.4710	1723.4633	2075.3755	(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	1103.3288	879.0485	765.9618	486.2550	272.5006	0.0000	0.0000	0.0000	0.0000	482.2678	809.2358	1122.1989	(98)
Space heating												5920.7972	(98)
Space heating per m2												47.9029	(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
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1494.1008	1176.2070	1205.5730	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7142	0.7744	0.7388	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1067.0419	910.8972	890.6219	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1617.6895	1543.1233	1406.7511	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	396.4663	470.3762	384.0001	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1250.8426	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	99.1166	117.5940	96.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												312.7106	(107)
Energy for space heating												2.5300	(108)
Energy for space cooling												47.9029	(99)
Total												2.5300	(108)
Dwelling Fabric Energy Efficiency (DFEE)												50.4329	(109)
												50.4	(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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (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) = 0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3775 (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	0.4813	0.4718	0.4624	0.4152	0.4058	0.3586	0.3586	0.3492	0.3775	0.4058	0.4247	0.4435 (22b)
Effective ac	0.6158	0.6113	0.6069	0.5862	0.5823	0.5643	0.5643	0.5610	0.5712	0.5823	0.5902	0.5984 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			25.1600	1.3258	33.3561		(27)
150mm EPS B&B			62.4000	0.1300	8.1120		(28a)
140mm Timber Frame	177.1000	27.2800	149.8200	0.1800	26.9676		(29a)
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560		(30)
Bay Plane	1.3000		1.3000	0.1300	0.1690		(31)
Total net area of external elements Aum(A, m ²)			302.0000				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	78.6807	(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)							13.7894 (36)
Total fabric heat loss						(33) + (36) =	92.4701 (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	63.7677	63.3020	62.8455	60.7015	60.3004	58.4330	58.4330	58.0872	59.1523	60.3004	61.1119	61.9603 (38)
Heat transfer coeff	156.2378	155.7721	155.3156	153.1716	152.7704	150.9031	150.9031	150.5573	151.6224	152.7704	153.5819	154.4303 (39)
Average = Sum(39)m / 12 =												153.1697 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2641	1.2603	1.2566	1.2393	1.2360	1.2209	1.2209	1.2181	1.2267	1.2360	1.2426	1.2494 (40)
HLP (average)												1.2392 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum(45)m =		1612.8832 (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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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	35.5346	31.0788	32.0705	27.9598	26.8281	23.1506	21.4525	24.6170	24.9110	29.0314	31.6900	34.4133 (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	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	143.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9752	23.0710	18.7626	14.2045	10.6180	8.9642	9.6861	12.5904	16.8988	21.4569	25.0433	26.6972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	289.8287	292.8362	285.2574	269.1229	248.7561	229.6141	216.8261	213.8186	221.3974	237.5319	257.8987	277.0407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	37.3811	(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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	(71)
Water heating gains (Table 5)	47.7615	46.2482	43.1055	38.8331	36.0593	32.1537	28.8340	33.0874	34.5986	39.0207	44.0139	46.2545	(72)
Total internal gains	429.7087	428.2986	413.2687	388.3037	361.5766	336.8751	321.4894	325.6396	339.0380	364.1526	393.0992	416.1356	(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	8.0800	11.2829	0.6300	0.7000	0.7700	27.8616	(75)
Southeast	7.0600	36.7938	0.6300	0.7000	0.7700	79.3874	(77)
Southwest	5.6200	36.7938	0.6300	0.7000	0.7700	63.1951	(79)
Northwest	4.4000	11.2829	0.6300	0.7000	0.7700	15.1721	(81)

Solar gains	185.6162	330.4670	490.1270	670.9306	809.5853	829.2814	788.8828	681.5339	552.1245	375.4735	224.9285	157.1644	(83)
Total gains	615.3248	758.7656	903.3957	1059.2343	1171.1619	1166.1566	1110.3722	1007.1735	891.1625	739.6262	618.0277	573.2999	(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	54.9376	55.1019	55.2638	56.0374	56.1845	56.8798	56.8798	57.0104	56.6099	56.1845	55.8876	55.5806	
alpha	4.6625	4.6735	4.6843	4.7358	4.7456	4.7920	4.7920	4.8007	4.7740	4.7456	4.7258	4.7054	
util living area	0.9991	0.9974	0.9917	0.9684	0.8952	0.7414	0.5764	0.6475	0.8859	0.9856	0.9980	0.9994	(86)
MIT	19.5154	19.6956	19.9891	20.3812	20.7215	20.9241	20.9820	20.9696	20.8076	20.3568	19.8657	19.4913	(87)
Th 2	19.8691	19.8721	19.8750	19.8887	19.8913	19.9033	19.9033	19.9055	19.8987	19.8913	19.8861	19.8807	(88)
util rest of house	0.9988	0.9964	0.9885	0.9555	0.8521	0.6463	0.4436	0.5125	0.8212	0.9778	0.9971	0.9991	(89)
MIT 2	18.5159	18.6980	18.9922	19.3870	19.7017	19.8684	19.8988	19.8969	19.7882	19.3704	18.8792	18.5009	(90)
Living area fraction									fLA = Living area / (4) =			0.1456	(91)
MIT	18.6614	18.8433	19.1374	19.5318	19.8502	20.0221	20.0566	20.0531	19.9367	19.5141	19.0229	18.6451	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6614	18.8433	19.1374	19.5318	19.8502	20.0221	20.0566	20.0531	19.9367	19.5141	19.0229	18.6451	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9952	0.9856	0.9502	0.8502	0.6577	0.4630	0.5321	0.8239	0.9740	0.9961	0.9988	(94)
Ext temp.	614.2523	755.1350	890.3700	1006.4630	995.7702	766.9417	514.1112	535.9013	734.2422	720.3974	615.6077	572.5870	(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	2243.8000	2171.9776	1962.7825	1628.4892	1245.1161	818.2132	521.6093	550.0004	884.9713	1361.8047	1831.1364	2230.7644	(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	1212.3840	952.1183	797.8749	447.8588	185.5134	0.0000	0.0000	0.0000	0.0000	477.2070	875.1807	1233.6840	(98)
												6181.8211	(98)
												50.0147	(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	1418.4888	1116.6827	1144.2352	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8442	0.9085	0.8740	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1197.5150	1014.4550	1000.0658	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1479.2195	1411.3989	1292.9514	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	202.8272	295.3262	217.9069	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			716.0603 (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	50.7068	73.8316	54.4767	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												179.0151 (107)
Energy for space heating												1.4483 (108)
Energy for space cooling												50.0147 (99)
Total												1.4483 (108)
Target Fabric Energy Efficiency (TFEE)												51.4631 (109)
												59.2 (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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.7000	
Infiltration rate											0.2350 (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) =	0.2350 (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	0.2585	0.2409	0.2409	0.2291	0.2291	0.2174	0.2174	0.2056	0.2056	0.2233	0.2174	0.2291 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5085	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)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.6552	Feb 51.7750	Mar 51.7750	Apr 51.7750	May 51.7750	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 51.7750	Nov 51.7750	Dec 51.7750 (38)
Heat transfer coeff	153.6877	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075 (39)
Average = Sum(39)m / 12 =												152.8809 (39)
HLP	Jan 1.2434	Feb 1.2363	Mar 1.2363	Apr 1.2363	May 1.2363	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2363	Nov 1.2363	Dec 1.2363 (40)
HLP (average)												1.2369 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (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	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum (45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
RHI water heating demand												2105.5602 (64)
Heat gains from water heating, kWh/month	89.0762	78.8646	83.6559	76.1441	75.4532	68.6191	67.0418	71.9934	71.3736	78.9006	81.9808	87.3218 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.9381	57.6775	46.9065	35.5112	26.5450	22.4104	24.2153	31.4759	42.2469	53.6422	62.6083	66.7429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.5801	437.0690	425.7573	401.6760	371.2777	342.7076	323.6210	319.1322	330.4439	354.5252	384.9234	413.4935 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335 (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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486 (71)
Water heating gains (Table 5)	119.7261	117.3581	112.4408	105.7557	101.4155	95.3043	90.1100	96.7654	99.1300	106.0492	113.8622	117.3680 (72)
Total internal gains	732.9021	727.7623	700.7623	658.6007	614.8961	576.0802	553.6041	563.0313	587.4787	629.8744	677.0518	713.2623 (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					8.0800	14.6176	0.7200	0.7000	0.7700			41.2527 (75)
Southeast					7.0600	45.1778	0.7200	0.7000	0.7700			111.4022 (77)
Southwest					2.2900	45.1778	0.7200	0.7000	0.7700			36.1347 (79)
Northwest					0.6000	14.6176	0.7200	0.7000	0.7700			3.0633 (81)
Southwest					3.3300	45.1778	0.7200	0.7000	0.7700			52.5452 (79)
Northwest					3.8000	14.6176	0.7200	0.7000	0.7700			19.4010 (81)

Solar gains	263.7992	401.0986	603.4522	836.7813	958.4604	1077.5812	988.5649	888.9486	714.7016	486.5178	318.9121	211.2722 (83)
Total gains	996.7013	1128.8609	1304.2145	1495.3821	1573.3565	1653.6614	1542.1690	1451.9799	1302.1803	1116.3922	995.9639	924.5345 (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)												
tau	19.5832	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960
alpha	2.3055	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131
util living area	0.9183	0.8922	0.8351	0.7378	0.6017	0.4236	0.3100	0.3271	0.5502	0.7671	0.8816	0.9276 (86)
MIT	18.7639	19.0334	19.5504	20.1265	20.6059	20.8808	20.9603	20.9555	20.7663	20.2152	19.4159	18.7148 (87)
Th 2	19.8854	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911 (88)
util rest of house	0.9069	0.8775	0.8125	0.7019	0.5449	0.3447	0.2121	0.2246	0.4705	0.7246	0.8624	0.9172 (89)
MIT 2	16.9638	17.3494	18.0781	18.8680	19.4916	19.8030	19.8740	19.8717	19.6943	19.0119	17.9040	16.8982 (90)
Living area fraction									fLA = Living area / (4) =			0.1456 (91)
MIT	17.2260	17.5947	18.2925	19.0513	19.6539	19.9599	20.0322	20.0296	19.8504	19.1871	18.1242	17.1628 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0760	17.4447	18.1425	18.9013	19.5039	19.8099	19.8822	19.8796	19.7004	19.0371	17.9742	17.0128 (93)

8. Space heating requirement

Utilisation	0.8663	0.8339	0.7679	0.6645	0.5231	0.3386	0.2113	0.2235	0.4554	0.6850	0.8179	0.8784 (94)
Useful gains	863.3956	941.4112	1001.5242	993.6181	822.9630	559.9615	325.8433	324.4742	593.0212	764.7032	814.5975	812.1476 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1794.4522	1764.1141	1610.9754	1360.1820	978.5614	597.4657	333.4562	333.0565	672.4135	1075.3229	1463.0097	1759.2372 (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												
Space heating	692.7061	552.8564	453.4317	263.9260	115.7652	0.0000	0.0000	0.0000	0.0000	231.1011	466.8568	704.6346 (98)
RHI space heating demand												3481.2778 (98)
												3481 (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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.7000	
Infiltration rate											0.2350	(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) =	0.2350 (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												
	0.2996	0.2938	0.2879	0.2585	0.2526	0.2233	0.2233	0.2174	0.2350	0.2526	0.2644	0.2761 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5496	0.5438	0.5379	0.5085	0.5026	0.5000	0.5000	0.5000	0.5000	0.5026	0.5144	0.5261 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.9137	Feb 56.3053	Mar 55.6970	Apr 52.6552	May 52.0468	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 52.0468	Nov 53.2636	Dec 54.4803 (38)
Heat transfer coeff	157.9462	157.3379	156.7295	153.6877	153.0794	152.8075	152.8075	152.8075	152.8075	153.0794	154.2961	155.5128 (39)
Average = Sum(39)m / 12 =												154.4083 (39)
HLP	Jan 1.2779	Feb 1.2730	Mar 1.2680	Apr 1.2434	May 1.2385	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2385	Nov 1.2484	Dec 1.2582 (40)
HLP (average)												1.2493 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (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	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum (45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Heat gains from water heating, kWh/month	89.0762	78.8646	83.6559	76.1441	75.4532	68.6191	67.0418	71.9934	71.3736	78.9006	81.9808	87.3218 (65)
Total per year (kWh/year) = Sum (64)m =												2105.5602 (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	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.9381	57.6775	46.9065	35.5112	26.5450	22.4104	24.2153	31.4759	42.2469	53.6422	62.6083	66.7429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.5801	437.0690	425.7573	401.6760	371.2777	342.7076	323.6210	319.1322	330.4439	354.5252	384.9234	413.4935 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335 (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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486 (71)
Water heating gains (Table 5)	119.7261	117.3581	112.4408	105.7557	101.4155	95.3043	90.1100	96.7654	99.1300	106.0492	113.8622	117.3680 (72)
Total internal gains	732.9021	727.7623	700.7623	658.6007	614.8961	576.0802	553.6041	563.0313	587.4787	629.8744	677.0518	713.2623 (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					8.0800	11.2829	0.7200	0.7000	0.7700		31.8418 (75)	
Southeast					7.0600	36.7938	0.7200	0.7200	0.7700		90.7285 (77)	
Southwest					2.2900	36.7938	0.7200	0.7000	0.7700		29.4289 (79)	
Northwest					0.6000	11.2829	0.7200	0.7000	0.7700		2.3645 (81)	
Southwest					3.3300	36.7938	0.7200	0.7000	0.7700		42.7940 (79)	
Northwest					3.8000	11.2829	0.7200	0.7000	0.7700		14.9751 (81)	
Solar gains	212.1328	377.6766	560.1452	766.7778	925.2404	947.7502	901.5803	778.8959	630.9994	429.1126	257.0611	179.6164 (83)
Total gains	945.0349	1105.4389	1260.9075	1425.3785	1540.1365	1523.8304	1455.1844	1341.9272	1218.4780	1058.9870	934.1129	892.8787 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.0552	19.1289	19.2031	19.5832	19.6610	19.6960	19.6960	19.6960	19.6960	19.6610	19.5060	19.3534
alpha	2.2703	2.2753	2.2802	2.3055	2.3107	2.3131	2.3131	2.3131	2.3131	2.3107	2.3004	2.2902
util living area	0.9353	0.9085	0.8641	0.7837	0.6701	0.5347	0.4169	0.4605	0.6463	0.8238	0.9108	0.9420 (86)
MIT	18.3868	18.7180	19.2311	19.8799	20.4081	20.7533	20.9006	20.8715	20.5963	19.9124	19.0515	18.3417 (87)
Th 2	19.8582	19.8621	19.8660	19.8854	19.8893	19.8911	19.8911	19.8911	19.8911	19.8893	19.8815	19.8737 (88)
util rest of house	0.9265	0.8963	0.8457	0.7540	0.6235	0.4651	0.3256	0.3678	0.5811	0.7927	0.8969	0.9340 (89)
MIT 2	16.4075	16.8826	17.6142	18.5299	19.2401	19.6699	19.8267	19.8026	19.4992	18.5999	17.3799	16.3502 (90)
Living area fraction	16.6957	17.1499	17.8496	18.7265	19.4102	19.8277	19.9831	19.9583	fLA = Living area / (4) =	17.6233	17.6233	16.6403 (92)
MIT	16.6957	17.1499	17.8496	18.7265	19.4102	19.8277	19.9831	19.9583	19.6590	18.7910	17.6233	16.6403 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.5457	16.9999	17.6996	18.5765	19.2602	19.6777	19.8331	19.8083	19.5090	18.6410	17.4733	16.4903 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	839.8604	943.5809	1008.6428	1015.0596	914.3511	686.4127	466.4550	483.4958	676.8087	792.6651	798.4883	802.2161 (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												

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Month fracti	1934.1654	1903.7703	1755.3138	1487.1576	1157.3077	775.9061	494.0446	520.8095	826.5327	1230.9146	1600.5645	1911.2913 (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	814.1629	645.2472	555.5232	339.9106	180.7597	0.0000	0.0000	0.0000	0.0000	326.0576	577.4948	825.1519 (98)
Space heating												4264.3080 (98)
Space heating per m2												(98) / (4) = 34.5009 (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												4717.1549 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	814.1629	645.2472	555.5232	339.9106	180.7597	0.0000	0.0000	0.0000	0.0000	326.0576	577.4948	825.1519 (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)	900.6227	713.7691	614.5168	376.0073	199.9554	0.0000	0.0000	0.0000	0.0000	360.6832	638.8217	912.7786 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Efficiency of water heater	87.9865	87.7844	87.3781	86.4972	84.9074	79.7000	79.7000	79.7000	79.7000	86.3016	87.4963	79.7000 (216)
(217)m	87.9865	87.7844	87.3781	86.4972	84.9074	79.7000	79.7000	79.7000	79.7000	86.3016	87.4963	88.0585 (217)
Fuel for water heating, kWh/month	237.6107	209.6583	220.6089	198.9310	197.9731	187.5008	179.1676	197.8527	197.8950	206.7889	216.7217	231.4243 (219)
Water heating fuel used												2482.1330 (219)
Annual totals kWh/year												
Space heating fuel - main system												4717.1549 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.8316 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.8316 (231)
Electricity for lighting (calculated in Appendix L)												458.7310 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =									-795.1650			-795.1650 (233)
Total delivered energy for all uses												7025.6855 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	4717.1549	3.4800	164.1570 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2482.1330	3.4800	86.3782 (247)
Mechanical ventilation fans	87.8316	13.1900	11.5850 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	458.7310	13.1900	60.5066 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-795.1650	13.1900	-104.8823 (252)
Total energy cost			347.6371 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8660 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.9193
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4717.1549	0.2160	1018.9055 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.1330	0.2160	536.1407 (264)
Space and water heating			1555.0462 (265)
Pumps and fans	162.8316	0.5190	84.5096 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)

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Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1464.9465 (272)
CO2 emissions per m2			11.8500 (273)
EI value			88.3569
EI rating			88 (274)
EI band			B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$	stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$	stars = 4
Water heating energy efficiency	$3.48 / 0.8460 = 4.113$	stars = 4
Water heating environmental impact	$0.216 / 0.8460 = 0.2553$	stars = 4

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7000
Infiltration rate												0.2350 (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) =	0.2350 (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	0.2585	0.2409	0.2409	0.2291	0.2291	0.2174	0.2174	0.2056	0.2056	0.2233	0.2174	0.2291 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5085	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)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.6552	Feb 51.7750	Mar 51.7750	Apr 51.7750	May 51.7750	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 51.7750	Nov 51.7750	Dec 51.7750 (38)
Heat transfer coeff	153.6877	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075 (39)
Average = Sum(39)m / 12 =												152.8809 (39)
HLP	Jan 1.2434	Feb 1.2363	Mar 1.2363	Apr 1.2363	May 1.2363	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2363	Nov 1.2363	Dec 1.2363 (40)
HLP (average)												1.2369 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum (45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												120.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Heat gains from water heating, kWh/month	89.0762	78.8646	83.6559	76.1441	75.4532	68.6191	67.0418	71.9934	71.3736	78.9006	81.9808	87.3218 (65)
Total per year (kWh/year) = Sum (64)m =												2105.5602 (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	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.9381	57.6775	46.9065	35.5112	26.5450	22.4104	24.2153	31.4759	42.2469	53.6422	62.6083	66.7429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.5801	437.0690	425.7573	401.6760	371.2777	342.7076	323.6210	319.1322	330.4439	354.5252	384.9234	413.4935 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335 (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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486 (71)
Water heating gains (Table 5)	119.7261	117.3581	112.4408	105.7557	101.4155	95.3043	90.1100	96.7654	99.1300	106.0492	113.8622	117.3680 (72)
Total internal gains	732.9021	727.7623	700.7623	658.6007	614.8961	576.0802	553.6041	563.0313	587.4787	629.8744	677.0518	713.2623 (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					8.0800	14.6176	0.7200	0.7000	0.7700	41.2527 (75)		
Southeast					7.0600	45.1778	0.7200	0.7000	0.7700	111.4022 (77)		
Southwest					2.2900	45.1778	0.7200	0.7000	0.7700	36.1347 (79)		
Northwest					0.6000	14.6176	0.7200	0.7000	0.7700	3.0633 (81)		
Southwest					3.3300	45.1778	0.7200	0.7000	0.7700	52.5452 (79)		
Northwest					3.8000	14.6176	0.7200	0.7000	0.7700	19.4010 (81)		

Solar gains	263.7992	401.0986	603.4522	836.7813	958.4604	1077.5812	988.5649	888.9486	714.7016	486.5178	318.9121	211.2722 (83)
Total gains	996.7013	1128.8609	1304.2145	1495.3821	1573.3565	1653.6614	1542.1690	1451.9799	1302.1803	1116.3922	995.9639	924.5345 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.5832	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960
alpha	2.3055	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131
util living area	0.9183	0.8922	0.8351	0.7378	0.6017	0.4236	0.3100	0.3271	0.5502	0.7671	0.8816	0.9276 (86)
MIT	18.7639	19.0334	19.5504	20.1265	20.6059	20.8808	20.9603	20.9555	20.7663	20.2152	19.4159	18.7148 (87)
Th 2	19.8854	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911 (88)
util rest of house	0.9069	0.8775	0.8125	0.7019	0.5449	0.3447	0.2121	0.2246	0.4705	0.7246	0.8624	0.9172 (89)
MIT 2	16.9638	17.3494	18.0781	18.8680	19.4916	19.8030	19.8740	19.8717	19.6943	19.0119	17.9040	16.8982 (90)
Living area fraction	17.2260	17.5947	18.2925	19.0513	19.6539	19.9599	20.0322	20.0296	fLA = Living area / (4) =	19.8504	19.1871	18.1242
MIT	17.2260	17.5947	18.2925	19.0513	19.6539	19.9599	20.0322	20.0296	19.8504	19.1871	18.1242	17.1628 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0760	17.4447	18.1425	18.9013	19.5039	19.8099	19.8822	19.8796	19.7004	19.0371	17.9742	17.0128 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8663	0.8339	0.7679	0.6645	0.5231	0.3386	0.2113	0.2235	0.4554	0.6850	0.8179	0.8784 (94)
Ext temp.	863.3956	941.4112	1001.5242	993.6181	822.9630	559.9615	325.8433	324.4742	593.0212	764.7032	814.5975	812.1476 (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)

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Month fracti	1794.4522	1764.1141	1610.9754	1360.1820	978.5614	597.4657	333.4562	333.0565	672.4135	1075.3229	1463.0097	1759.2372 (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	692.7061	552.8564	453.4317	263.9260	115.7652	0.0000	0.0000	0.0000	0.0000	231.1011	466.8568	704.6346 (98)
Space heating												3481.2778 (98)
Space heating per m2											(98) / (4) =	28.1657 (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												3850.9711 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	692.7061	552.8564	453.4317	263.9260	115.7652	0.0000	0.0000	0.0000	0.0000	231.1011	466.8568	704.6346 (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)	766.2678	611.5668	501.5837	291.9535	128.0588	0.0000	0.0000	0.0000	0.0000	255.6428	516.4345	779.4631 (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	209.0653	184.0474	192.7638	172.0697	168.0938	149.4382	142.7966	157.6886	157.7223	178.4621	189.6236	203.7889 (64)
Efficiency of water heater	87.6712	87.4672	86.9190	85.8512	83.7424	79.7000	79.7000	79.7000	79.7000	85.4039	87.0253	79.7000 (216)
(217)m	87.6712	87.4672	86.9190	85.8512	83.7424	79.7000	79.7000	79.7000	79.7000	85.4039	87.0253	87.7570 (217)
Fuel for water heating, kWh/month	238.4651	210.4188	221.7740	200.4278	200.7273	187.5008	179.1676	197.8527	197.8950	208.9624	217.8949	232.2195 (219)
Water heating fuel used												2493.3060 (219)
Annual totals kWh/year												
Space heating fuel - main system												3850.9711 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.8316 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.8316 (231)
Electricity for lighting (calculated in Appendix L)												458.7310 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1115 * 1.00) =									-882.9989			-882.9989 (233)
Total delivered energy for all uses												6082.8408 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3850.9711	9.7400	375.0846 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2493.3060	9.7400	242.8480 (247)
Mechanical ventilation fans	87.8316	36.8500	32.3660 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	458.7310	36.8500	169.0424 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-882.9989	36.8500	-325.3851 (252)
Total energy cost			625.5933 (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	3850.9711	0.2160	831.8097 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2493.3060	0.2160	538.5541 (264)
Space and water heating			1370.3638 (265)
Pumps and fans	162.8316	0.5190	84.5096 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			1234.6784 (272)

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

Energy Primary energy factor Primary energy

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	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	3850.9711	1.2200	4698.1847 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2493.3060	1.2200	3041.8333 (264)
Space and water heating			7740.0180 (265)
Pumps and fans	162.8316	3.0700	499.8931 (267)
Energy for lighting	458.7310	3.0700	1408.3041 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			6937.4086 (272)
Primary energy kWh/m2/year			56.1279 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 109	-256 kg (20.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£109 2.07 kg/m²	B 89	B 90
Total Savings	£109 2.07 kg/m²		

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

Fuel prices for cost data on this page from database revision number 519 TEST (31 May 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£229	£247	-£18
Mains gas	£722	£595	£127
Space heating	£539	£540	-£1
Water heating	£243	£133	£110
Lighting	£169	£169	£0
Generated (PV)	-£325	-£325	£0
Total cost of fuels	£626	£517	£109
Total cost of uses	£626	£517	£109
Delivered energy	49 kWh/m²	39 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	44 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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.7000	
Infiltration rate											0.2350	(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) =	0.2350 (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												
	0.2996	0.2938	0.2879	0.2585	0.2526	0.2233	0.2233	0.2174	0.2350	0.2526	0.2644	0.2761 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5496	0.5438	0.5379	0.5085	0.5026	0.5000	0.5000	0.5000	0.5000	0.5026	0.5144	0.5261 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.9137	Feb 56.3053	Mar 55.6970	Apr 52.6552	May 52.0468	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 52.0468	Nov 53.2636	Dec 54.4803 (38)
Heat transfer coeff	157.9462	157.3379	156.7295	153.6877	153.0794	152.8075	152.8075	152.8075	152.8075	153.0794	154.2961	155.5128 (39)
Average = Sum(39)m / 12 =												154.4083 (39)
HLP	Jan 1.2779	Feb 1.2730	Mar 1.2680	Apr 1.2434	May 1.2385	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2385	Nov 1.2484	Dec 1.2582 (40)
HLP (average)												1.2493 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (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	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)										Total = Sum (45)m =		1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5079 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8143 (55)
Total storage loss	25.2422	22.7994	25.2422	24.4279	25.2422	24.4279	25.2422	25.2422	24.4279	25.2422	24.4279	25.2422 (56)
If cylinder contains dedicated solar storage	15.2782	13.7996	15.2782	14.7853	15.2782	14.7853	15.2782	15.2782	14.7853	15.2782	14.7853	15.2782 (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	205.7620	181.0638	188.0648	162.1194	151.9962	133.6347	126.4664	142.2889	149.1228	173.7631	186.4269	200.4856 (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												1.1244 (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												102.5101 (H14)
Volume ratio Veff/V												1.0682 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-939.3787 (H17)
Solar input	-27.2401	-45.4559	-77.4166	-103.7535	-128.1787	-126.0201	-124.3547	-108.6493	-85.0942	-58.1093	-32.3107	-22.7953 (63)
Solar input (sum of months) = Sum (63)m =												-939.3787 (63)
Output from w/h	178.5219	135.6079	110.6482	58.3659	23.8175	7.6146	2.1117	33.6396	64.0285	115.6538	154.1162	177.6903 (64)
Total per year (kWh/year) = Sum (64)m =												1061.8161 (64)
Heat gains from water heating, kWh/month	86.4336	76.4778	79.8967	68.1839	62.5751	55.9764	53.9777	59.6737	64.4940	75.1414	79.4234	84.6792 (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	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.9381	57.6775	46.9065	35.5112	26.5450	22.4104	24.2153	31.4759	42.2469	53.6422	62.6083	66.7429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.5801	437.0690	425.7573	401.6760	371.2777	342.7076	323.6210	319.1322	330.4439	354.5252	384.9234	413.4935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	(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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	(71)
Water heating gains (Table 5)	116.1742	113.8062	107.3881	94.6998	84.1063	77.7450	72.5507	80.2066	89.5750	100.9966	110.3103	113.8161	(72)
Total internal gains	729.3502	724.2104	695.7096	647.5448	597.5869	558.5209	536.0448	546.4725	577.9236	624.8217	673.4999	709.7104	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	8.0800	11.2829	0.7200	0.7000	0.7700	31.8418 (75)
Southeast	7.0600	36.7938	0.7200	0.7000	0.7700	90.7285 (77)
Southwest	2.2900	36.7938	0.7200	0.7000	0.7700	29.4289 (79)
Northwest	0.6000	11.2829	0.7200	0.7000	0.7700	2.3645 (81)
Southwest	3.3300	36.7938	0.7200	0.7000	0.7700	42.7940 (79)
Northwest	3.8000	11.2829	0.7200	0.7000	0.7700	14.9751 (81)

Solar gains	212.1328	377.6766	560.1452	766.7778	925.2404	947.7502	901.5803	778.8959	630.9994	429.1126	257.0611	179.6164 (83)
Total gains	941.4830	1101.8870	1255.8548	1414.3227	1522.8273	1506.2711	1437.6251	1325.3684	1208.9230	1053.9343	930.5610	889.3268 (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)													
tau	19.0552	19.1289	19.2031	19.5832	19.6610	19.6960	19.6960	19.6960	19.6960	19.6610	19.5060	19.3534	
alpha	2.2703	2.2753	2.2802	2.3055	2.3107	2.3131	2.3131	2.3131	2.3131	2.3107	2.3004	2.2902	
util living area	0.9358	0.9090	0.8650	0.7860	0.6741	0.5391	0.4210	0.4649	0.6492	0.8250	0.9114	0.9424 (86)	
MIT	18.3825	18.7140	19.2262	19.8717	20.3999	20.7489	20.8985	20.8688	20.5923	19.9081	19.0475	18.3373 (87)	
Th 2	19.8582	19.8621	19.8660	19.8854	19.8893	19.8911	19.8911	19.8911	19.8911	19.8893	19.8815	19.8737 (88)	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9270	0.8969	0.8467	0.7565	0.6277	0.4692	0.3291	0.3717	0.5840	0.7941	0.8976	0.9345 (89)
MIT 2	16.4013	16.8770	17.6074	18.5192	19.2303	19.6656	19.8252	19.8006	19.4948	18.5942	17.3742	16.3439 (90)
Living area fraction									fLA = Living area / (4) =			0.1456 (91)
MIT	16.6898	17.1445	17.8432	18.7162	19.4006	19.8234	19.9815	19.9562	19.6546	18.7856	17.6179	16.6342 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.5398	16.9945	17.6932	18.5662	19.2506	19.6734	19.8315	19.8062	19.5046	18.6356	17.4679	16.4842 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8893	0.8542	0.8009	0.7144	0.5974	0.4542	0.3239	0.3640	0.5581	0.7498	0.8556	0.8991 (94)	
Useful gains	837.2747	941.2440	1005.8110	1010.4299	909.8007	684.2180	465.6128	482.3845	674.7058	790.2736	796.1483	799.5617 (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	1933.2345	1902.9261	1754.2981	1485.5691	1155.8486	775.2548	493.8035	520.4874	825.8694	1230.0807	1599.7284	1910.3470 (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	815.3941	646.2504	556.8744	342.1002	183.0596	0.0000	0.0000	0.0000	0.0000	327.2165	578.5777	826.4243 (98)	
Space heating												4275.8971 (98)	
Space heating per m2										(98) / (4) =		34.5946 (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													4729.9746 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	815.3941	646.2504	556.8744	342.1002	183.0596	0.0000	0.0000	0.0000	0.0000	327.2165	578.5777	826.4243 (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)	901.9846	714.8787	616.0115	378.4294	202.4996	0.0000	0.0000	0.0000	0.0000	361.9651	640.0196	914.1861 (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	178.5219	135.6079	110.6482	58.3659	23.8175	7.6146	2.1117	33.6396	64.0285	115.6538	154.1162	177.6903 (64)	
Efficiency of water heater (217)m	88.2714	88.3429	88.4321	88.6651	89.0240	79.7000	79.7000	79.7000	79.7000	87.3380	87.9173	79.7000 (216)	
Fuel for water heating, kWh/month	202.2420	153.5017	125.1222	65.8273	26.7540	9.5541	2.6495	42.2077	80.3369	132.4210	175.2968	201.2299 (219)	
Water heating fuel used												1217.1434 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4729.9746 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													87.8316 (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													212.8316 (231)
Electricity for lighting (calculated in Appendix L)													458.7310 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1004 * 1.00) =										-795.1650			-795.1650 (233)
Total delivered energy for all uses													5823.5156 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4729.9746	3.4800	164.6031 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1217.1434	3.4800	42.3566 (247)	
Mechanical ventilation fans	87.8316	13.1900	11.5850 (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	458.7310	13.1900	60.5066 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-795.1650	13.1900	-104.8823 (252)	
Total energy cost			310.6566 (255)	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7739 (257)
SAP value		89.2044
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4729.9746	0.2160	1021.6745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1217.1434	0.2160	262.9030 (264)
Space and water heating			1284.5775 (265)
Pumps and fans	212.8316	0.5190	110.4596 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)
Energy saving/generation technologies			
PV Unit	-795.1650	0.5190	-412.6906 (269)
Total kg/year			1220.4278 (272)
CO2 emissions per m2			9.8700 (273)
EI value			90.3003
EI rating			90 (274)
EI band			B

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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	62.4000 (1b)	x 2.4100 (2b)	= 150.3840 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.7880 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.7000	
Infiltration rate											0.2350	(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) =	0.2350 (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	0.2585	0.2409	0.2409	0.2291	0.2291	0.2174	0.2174	0.2056	0.2056	0.2233	0.2174	0.2291 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5085	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)			18.0300	1.3258	23.9034		(27)					
French Door (Uw = 1.40)			7.1300	1.3258	9.4527		(27)					
150mm EPS B&B			62.4000	0.1800	11.2320	75.0000	4680.0000 (28a)					
140mm Timber Frame	177.1000	27.2800	149.8200	0.1900	28.4658	9.0000	1348.3800 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.3000		1.3000	0.2000	0.2600	9.0000	11.7000 (30)					
Total net area of external elements Aum(A, m2)			302.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8019		(33)					
Timber GF			96.0600			9.0000	864.5400 (32c)					
Timber FF			130.7000			9.0000	1176.3000 (32c)					
Internal Floor			61.2000			18.0000	1101.6000 (32d)					
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10834.9200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.6612 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2307 (36)					
Total fabric heat loss						(33) + (36) =	101.0325 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.6552	Feb 51.7750	Mar 51.7750	Apr 51.7750	May 51.7750	Jun 51.7750	Jul 51.7750	Aug 51.7750	Sep 51.7750	Oct 51.7750	Nov 51.7750	Dec 51.7750 (38)
Heat transfer coeff	153.6877	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075	152.8075 (39)
Average = Sum(39)m / 12 =												152.8809 (39)
HLP	Jan 1.2434	Feb 1.2363	Mar 1.2363	Apr 1.2363	May 1.2363	Jun 1.2363	Jul 1.2363	Aug 1.2363	Sep 1.2363	Oct 1.2363	Nov 1.2363	Dec 1.2363 (40)
HLP (average)												1.2369 (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												2.8762 (42)
Average daily hot water use (litres/day)												102.5101 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	112.7611	108.6607	104.5603	100.4599	96.3595	92.2591	92.2591	96.3595	100.4599	104.5603	108.6607	112.7611 (44)
Energy conte	167.2215	146.2530	150.9200	131.5757	126.2500	108.9442	100.9528	115.8448	117.2283	136.6183	149.1296	161.9451 (45)
Energy content (annual)												1612.8832 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0832	21.9379	22.6380	19.7364	18.9375	16.3416	15.1429	17.3767	17.5843	20.4927	22.3694	24.2918 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5079 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8143 (55)
Total storage loss												
	25.2422	22.7994	25.2422	24.4279	25.2422	24.4279	25.2422	25.2422	24.4279	25.2422	24.4279	25.2422 (56)
If cylinder contains dedicated solar storage												
	15.2782	13.7996	15.2782	14.7853	15.2782	14.7853	15.2782	15.2782	14.7853	15.2782	14.7853	15.2782 (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												
	205.7620	181.0638	188.0648	162.1194	151.9962	133.6347	126.4664	142.2889	149.1228	173.7631	186.4269	200.4856 (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												1.2506 (H8)
Utilisation factor												0.5505 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5101 (H14)
Volume ratio Veff/V												1.0682 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-976.3502 (H17)
Solar input	-32.0514	-45.5751	-78.3326	-105.6889	-123.5234	-133.1805	-126.7774	-115.5493	-90.2904	-62.0935	-37.9084	-25.3795 (63)
Solar input (sum of months) = Sum(63)m =												-976.3502 (63)
Output from w/h												
	173.7106	135.4887	109.7321	56.4305	28.4729	0.4543	0.0000	26.7396	58.8324	111.6697	148.5185	175.1062 (64)
Total per year (kWh/year) = Sum(64)m =												1025.1555 (64)
Heat gains from water heating, kWh/month												
	86.4336	76.4778	79.8967	68.1839	62.5751	55.9764	53.9777	59.6737	64.4940	75.1414	79.4234	84.6792 (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	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	172.5729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.9381	57.6775	46.9065	35.5112	26.5450	22.4104	24.2153	31.4759	42.2469	53.6422	62.6083	66.7429	(67)
Appliances gains (calculated in Appendix L3, equation L13 or L13a), also see Table 5	432.5801	437.0690	425.7573	401.6760	371.2777	342.7076	323.6210	319.1322	330.4439	354.5252	384.9234	413.4935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	55.1335	(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)	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	-115.0486	(71)
Water heating gains (Table 5)	116.1742	113.8062	107.3881	94.6998	84.1063	77.7450	72.5507	80.2066	89.5750	100.9966	110.3103	113.8161	(72)
Total internal gains	729.3502	724.2104	695.7096	647.5448	597.5869	558.5209	536.0448	546.4725	577.9236	624.8217	673.4999	709.7104	(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				8.0800	14.6176		0.7200		0.7000		0.7700		41.2527 (75)
Southeast				7.0600	45.1778		0.7200		0.7000		0.7700		111.4022 (77)
Southwest				2.2900	45.1778		0.7200		0.7000		0.7700		36.1347 (79)
Northwest				0.6000	14.6176		0.7200		0.7000		0.7700		3.0633 (81)
Southwest				3.3300	45.1778		0.7200		0.7000		0.7700		52.5452 (79)
Northwest				3.8000	14.6176		0.7200		0.7000		0.7700		19.4010 (81)
Solar gains	263.7992	401.0986	603.4522	836.7813	958.4604	1077.5812	988.5649	888.9486	714.7016	486.5178	318.9121	211.2722	(83)
Total gains	993.1495	1125.3090	1299.1618	1484.3262	1556.0473	1636.1021	1524.6096	1435.4211	1292.6252	1111.3395	992.4121	920.9826	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.5832	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960	19.6960
alpha	2.3055	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131	2.3131
util living area	0.9188	0.8927	0.8361	0.7403	0.6058	0.4273	0.3132	0.3304	0.5530	0.7685	0.8823	0.9281 (86)
MIT	18.7597	19.0296	19.5459	20.1196	20.5999	20.8786	20.9595	20.9546	20.7637	20.2117	19.4122	18.7105 (87)
Th 2	19.8854	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911	19.8911 (88)

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util rest of house	0.9074	0.8781	0.8136	0.7045	0.5491	0.3480	0.2144	0.2270	0.4732	0.7261	0.8632	0.9178 (89)
MIT 2	16.9580	17.3441	18.0720	18.8593	19.4850	19.8012	19.8736	19.8713	19.6919	19.0075	17.8990	16.8922 (90)
Living area fraction									fLA = Living area / (4) =			0.1456 (91)
MIT	17.2204	17.5896	18.2867	19.0428	19.6473	19.9581	20.0317	20.0291	19.8480	19.1829	18.1193	17.1570 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0704	17.4396	18.1367	18.8928	19.4973	19.8081	19.8817	19.8791	19.6980	19.0329	17.9693	17.0070 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8669	0.8346	0.7689	0.6668	0.5268	0.3417	0.2136	0.2259	0.4578	0.6864	0.8187	0.8791	(94)
Useful gains	860.9779	939.2144	998.9780	989.7420	819.7151	558.9806	325.5945	324.1964	591.7934	762.7910	812.5039	809.6448	(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													
	1793.5918	1763.3346	1610.0847	1358.8897	977.5626	597.1869	333.3836	332.9753	672.0458	1074.6756	1462.2672	1758.3511	(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													
	693.8647	553.8088	454.6634	265.7863	117.4385	0.0000	0.0000	0.0000	0.0000	232.0422	467.8296	705.8375	(98)
Space heating													3491.2709 (98)
Space heating per m2													28.2465 (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													3862.0254 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	693.8647	553.8088	454.6634	265.7863	117.4385	0.0000	0.0000	0.0000	0.0000	232.0422	467.8296	705.8375 (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)	767.5495	612.6204	502.9462	294.0114	129.9098	0.0000	0.0000	0.0000	0.0000	256.6838	517.5106	780.7937 (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	173.7106	135.4887	109.7321	56.4305	28.4729	0.4543	0.0000	26.7396	58.8324	111.6697	148.5185	175.1062 (64)	
Efficiency of water heater (217)m	88.0336	88.0758	88.1004	88.3233	88.0922	79.7000	79.7000	79.7000	79.7000	86.6217	87.5672	88.0503 (217)	
Fuel for water heating, kWh/month	197.3231	153.8320	124.5535	63.8909	32.3217	0.5700	0.0000	33.5503	73.8173	128.9165	169.6052	198.8706 (219)	
Water heating fuel used												1177.2511 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3862.0254 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													87.8316 (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													212.8316 (231)
Electricity for lighting (calculated in Appendix L)													458.7310 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.99 + 1115 + 1.00) =										-882.9989			-882.9989 (233)
Total delivered energy for all uses													4827.8401 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3862.0254	9.7400	376.1613 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1177.2511	9.7400	114.6643 (247)	
Mechanical ventilation fans	87.8316	36.8500	32.3660 (249)	
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)	
Pump for solar water heating	50.0000	36.8500	18.4250 (249)	
Energy for lighting	458.7310	36.8500	169.0424 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-882.9989	36.8500	-325.3851 (252)	
Total energy cost			516.9113 (255)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3862.0254	0.2160	834.1975 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1177.2511	0.2160	254.2862 (264)
Space and water heating			1088.4837 (265)
Pumps and fans	212.8316	0.5190	110.4596 (267)
Energy for lighting	458.7310	0.5190	238.0814 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	0.5190	-458.2764 (269)
Total kg/year			978.7483 (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	3862.0254	1.2200	4711.6710 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1177.2511	1.2200	1436.2463 (264)
Space and water heating			6147.9172 (265)
Pumps and fans	212.8316	3.0700	653.3931 (267)
Energy for lighting	458.7310	3.0700	1408.3041 (268)
Energy saving/generation technologies			
PV Unit	-882.9989	3.0700	-2710.8066 (269)
Primary energy kWh/year			5498.8078 (272)
Primary energy kWh/m2/year			44.4887 (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	North East
Overshading	Average or unknown
Thermal mass parameter	87.7 (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	414.20 (P1)
Transmission heat loss coefficient	101.03 (P3)
Summer heat loss coefficient	515.23 (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	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
North East	8.0800	106.0502	0.7200	0.7000	0.9000	349.8150
South East	7.0600	127.3119	0.7200	0.7000	0.9000	366.9350
South West	2.2900	127.3119	0.7200	0.7000	0.9000	119.0200
North West	0.6000	106.0502	0.7200	0.7000	0.9000	25.9764
South West	3.3300	127.3119	0.7200	0.7000	0.9000	173.0727
North West	3.8000	106.0502	0.7200	0.7000	0.9000	164.5170
total:						1199.3361

Solar gains	Jun 1292	Jul 1199	Aug 1056	(P3)
Internal gains	573	551	560	
Total summer gains	1865	1750	1616	(P5)
Summer gain/loss ratio	3.62	3.40	3.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 87.7)	1.39	1.39	1.39	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Threshold temperature	20.41	22.08	21.82	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			