

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-649				Issued on Date	06/07/2023
Assessment Reference	As Built	Prop Type Ref	Islington-As-DET			
Property	3, Fulmar Drive, BOTLEY, SO32 2TP					
SAP Rating	90 B	DER	11.37	TER	19.00	
Environmental	91 B	% DER<TER	40.15			
CO ₂ Emissions (t/year)	0.77	DFEE	53.18	TFEE	60.78	
General Requirements Compliance	Pass	% DFEE<TFEE	12.50			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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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 101 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) 19.00 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.37 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (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: 4.72 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing South East: 6.36 m², No overhang
Windows facing North West: 8.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 1.48 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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 260.5163 (5)
Dwelling volume			

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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (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	0.5456	0.5349	0.5242	0.4707	0.4600	0.4065	0.4065	0.3958	0.4279	0.4600	0.4814	0.5028 (22b)
Effective ac	0.6488	0.6431	0.6374	0.6108	0.6058	0.5826	0.5826	0.5783	0.5916	0.6058	0.6159	0.6264 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.0619	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	55.7813	55.2844	54.7974	52.5097	52.0817	50.0892	50.0892	49.7202	50.8567	52.0817	52.9476	53.8528 (38)
Heat transfer coeff	133.7403	133.2435	132.7564	130.4688	130.0407	128.0483	128.0483	127.6793	128.8157	130.0407	130.9066	131.8118 (39)
Average = Sum(39)m / 12 =												130.4667 (39)
HLP	1.3271	1.3221	1.3173	1.2946	1.2903	1.2706	1.2706	1.2669	1.2782	1.2903	1.2989	1.3079 (40)
HLP (average)												1.2946 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	24.4153	21.6855	17.6358	13.3515	9.9804	8.4258	9.1044	11.8343	15.8839	20.1683	23.5394	25.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	426.4397	424.0818	408.5182	383.3957	357.7026	333.1946	317.4614	323.9879	337.0745	362.4242	391.4883	413.4617 (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		
Southeast				6.3600	36.7938	0.4600	0.0000	0.7700		82.8859 (77)		
Northwest				5.0200	11.2829	0.4600	0.0000	0.7700		20.0620 (81)		
Northwest				3.3300	11.2829	0.4600	0.0000	0.7700		13.3081 (81)		
Solar gains	116.2560	209.1111	315.5566	440.3386	538.2591	554.1796	526.0430	449.9609	358.2915	239.0506	141.2664	98.1848 (83)
Total gains	542.6957	633.1929	724.0748	823.7343	895.9616	887.3742	843.5044	773.9488	695.3660	601.4748	532.7547	511.6465 (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	33.4379	33.5626	33.6857	34.2764	34.3892	34.9243	34.9243	35.0252	34.7162	34.3892	34.1617	33.9271
alpha	3.2292	3.2375	3.2457	3.2851	3.2926	3.3283	3.3283	3.3350	3.3144	3.2926	3.2774	3.2618
util living area												
	0.9921	0.9864	0.9735	0.9399	0.8667	0.7375	0.5978	0.6544	0.8523	0.9602	0.9873	0.9935 (86)
MIT	18.8850	19.1003	19.4740	19.9882	20.4550	20.7911	20.9252	20.8976	20.6260	20.0244	19.3747	18.8612 (87)
Th 2	19.8197	19.8235	19.8273	19.8451	19.8484	19.8640	19.8640	19.8668	19.8580	19.8484	19.8417	19.8346 (88)
util rest of house												
	0.9903	0.9831	0.9667	0.9233	0.8268	0.6545	0.4701	0.5302	0.7924	0.9462	0.9837	0.9920 (89)
MIT 2	17.0086	17.3242	17.8685	18.6156	19.2605	19.6912	19.8243	19.8070	19.5052	18.6801	17.7367	16.9827 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.3350	17.6331	18.1477	18.8543	19.4683	19.8825	20.0158	19.9967	19.7001	18.9139	18.0217	17.3094 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1850	17.4831	17.9977	18.7043	19.3183	19.7325	19.8658	19.8467	19.5501	18.7639	17.8717	17.1594 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9835	0.9730	0.9512	0.9011	0.8040	0.6434	0.4704	0.5277	0.7719	0.9269	0.9740	0.9862 (94)
Useful gains	533.7172	616.0733	688.7619	742.2978	720.3584	570.9368	396.7443	408.4509	536.7441	557.4891	518.8929	504.5811 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1723.2423	1676.6191	1526.3999	1279.1612	990.6853	657.2062	418.1802	440.0732	702.0637	1061.6450	1410.0821	1708.2051 (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												
	885.0067	712.6868	623.2027	386.5417	201.1232	0.0000	0.0000	0.0000	0.0000	375.0919	641.6562	895.4963 (98)
Space heating												4720.8054 (98)
Space heating per m2										(98) / (4) =		46.8427 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5216.3595 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	885.0067	712.6868	623.2027	386.5417	201.1232	0.0000	0.0000	0.0000	0.0000	375.0919	641.6562	895.4963	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	977.9079	787.4992	688.6217	427.1179	222.2356	0.0000	0.0000	0.0000	0.0000	414.4662	709.0124	989.4987	(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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.9522	89.9124	89.8257	89.6209	89.1785	87.3000	87.3000	87.3000	87.3000	89.5774	89.8482	87.3000	(216)
Fuel for water heating, kWh/month	196.0452	171.9760	178.6758	157.5935	153.0536	136.5557	128.1658	144.7599	145.8047	163.6477	176.1996	190.3027	(219)
Water heating fuel used												1942.7803	(219)
Annual totals kWh/year													
Space heating fuel - main system												5216.3595	(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)												431.1826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1080 * 1.00) =										-1278.1572		-1278.1572	(233)
Total delivered energy for all uses												6387.1652	(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	5216.3595	0.2160	1126.7337	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1942.7803	0.2160	419.6405	(264)
Space and water heating			1546.3742	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1826	0.5190	223.7837	(268)
Energy saving/generation technologies				
PV Unit	-1278.1572	0.5190	-663.3636	(269)
Total CO2, kg/year			1145.7194	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.3700	(273)

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

DER			11.3700	ZC1
Total Floor Area		TFA	100.7800	
Assumed number of occupants		N	2.7466	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.1457	ZC2
CO2 emissions from cooking, equation (L16)			1.8349	ZC3
Total CO2 emissions			28.3505	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			28.3505	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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.5163 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1535 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4035 (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) =					0.4035	(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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742	(22b)				
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124	(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			2.1300	1.0000	2.1300			(26)					
TER Semi-glazed door			2.1300	1.2000	2.5560			(26a)					
TER Opening Type (Uw = 1.40)			14.7100	1.3258	19.5019			(27)					
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507			(28a)					
EW Brick AAC015	149.0500	18.9700	130.0800	0.1800	23.4144			(29a)					
Plane Ceiling	50.3900		50.3900	0.1300	6.5507			(30)					
Total net area of external elements Aum(A, m2)			249.8300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.7037			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9168	(36)					
Total fabric heat loss						(33) + (36) =	71.6205	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 54.3645	Feb 53.9226	Mar 53.4895	Apr 51.4551	May 51.0745	Jun 49.3026	Jul 49.3026	Aug 48.9745	Sep 49.9851	Oct 51.0745	Nov 51.8445	Dec 52.6495	(38)
Heat transfer coeff	125.9850	125.5431	125.1100	123.0756	122.6950	120.9231	120.9231	120.5950	121.6056	122.6950	123.4650	124.2700	(39)
Average = Sum(39)m / 12 =												123.0738	(39)
HLP	Jan 1.2501	Feb 1.2457	Mar 1.2414	Apr 1.2212	May 1.2175	Jun 1.1999	Jul 1.1999	Aug 1.1966	Sep 1.2066	Oct 1.2175	Nov 1.2251	Dec 1.2331	(40)
HLP (average)												1.2212	(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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan 109.3757	Feb 105.3984	Mar 101.4211	Apr 97.4438	May 93.4665	Jun 89.4892	Jul 89.4892	Aug 93.4665	Sep 97.4438	Oct 101.4211	Nov 105.3984	Dec 109.3757 (44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total = Sum(45)m =		1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)

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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)
Combi loss	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Heat gains from water heating, kWh/month	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4153	21.6855	17.6358	13.3515	9.9804	8.4258	9.1044	11.8343	15.8839	20.1683	23.5394	25.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250 (72)
Total internal gains	438.8097	436.4559	420.9009	395.3552	368.9923	343.8168	328.0917	335.2853	349.0453	374.8182	403.8685	425.8358 (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			
Southeast				6.3600	36.7938	0.6300	0.7000	0.7700	71.5161 (77)			
Northwest				8.3500	11.2829	0.6300	0.7000	0.7700	28.7926 (81)			
Solar gains	100.3087	180.4266	272.2705	379.9356	464.4240	478.1606	453.8837	388.2380	309.1432	206.2591	121.8884	84.7164 (83)
Total gains	539.1184	616.8825	693.1714	775.2908	833.4163	821.9774	781.9754	723.5233	658.1885	581.0773	525.7569	510.5522 (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	55.5512	55.7467	55.9397	56.8643	57.0407	57.8765	57.8765	58.0340	57.5517	57.0407	56.6850	56.3178
alpha	4.7034	4.7164	4.7293	4.7910	4.8027	4.8584	4.8584	4.8689	4.8368	4.8027	4.7790	4.7545
util living area	0.9988	0.9974	0.9934	0.9785	0.9289	0.8034	0.6430	0.7046	0.9121	0.9874	0.9976	0.9991 (86)
MIT	19.5673	19.7123	19.9684	20.3279	20.6622	20.8951	20.9730	20.9585	20.7798	20.3535	19.9045	19.5517 (87)
Th 2	19.8801	19.8836	19.8870	19.9031	19.9061	19.9201	19.9201	19.9227	19.9147	19.9061	19.9000	19.8936 (88)
util rest of house	0.9983	0.9965	0.9909	0.9692	0.8957	0.7148	0.5034	0.5682	0.8570	0.9805	0.9965	0.9987 (89)
MIT 2	17.9705	18.1848	18.5606	19.0909	19.5550	19.8446	19.9095	19.9041	19.7214	19.1347	18.4775	17.9570 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	18.2482	18.4505	18.8055	19.3060	19.7476	20.0274	20.0945	20.0875	19.9055	19.3467	18.7257	18.2344 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2482	18.4505	18.8055	19.3060	19.7476	20.0274	20.0945	20.0875	19.9055	19.3467	18.7257	18.2344 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	537.6747	613.5855	684.3288	746.0702	741.4647	595.7993	412.5302	427.6983	563.6486	566.6719	523.0059	509.5018 (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	1757.2657	1701.1671	1539.5380	1280.7310	987.4014	656.2952	422.5673	444.6968	705.9830	1073.1773	1435.3719	1744.0559 (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	907.3757	730.8549	636.2756	384.9558	182.9769	0.0000	0.0000	0.0000	0.0000	376.8400	656.9035	918.5083 (98)
Space heating												4794.6907 (98)
Space heating per m2												47.5758 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5133.5018 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	907.3757	730.8549	636.2756	384.9558	182.9769	0.0000	0.0000	0.0000	0.0000	376.8400	656.9035	918.5083 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	971.4943	782.4998	681.2373	412.1582	195.9068	0.0000	0.0000	0.0000	0.0000	403.4689	703.3228	983.4136 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Efficiency of water heater (217)m	88.2876	88.1330	87.7861	86.9721	85.2353	80.3000	80.3000	80.3000	80.3000	86.8241	87.8802	80.3000 (216)
Fuel for water heating, kWh/month	241.4382	213.1885	224.8054	201.9957	199.5525	186.5567	178.7355	199.2482	201.4487	211.3188	220.7179	235.4804 (219)
Water heating fuel used												2514.4865 (219)
Annual totals kWh/year												
Space heating fuel - main system												5133.5018 (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)												431.1826 (232)
Total delivered energy for all uses												8154.1709 (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	5133.5018	0.2160	1108.8364 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2514.4865	0.2160	543.1291 (264)
Space and water heating			1651.9655 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	431.1826	0.5190	223.7837 (268)
Total CO2, kg/m2/year			1914.6742 (272)
Emissions per m2 for space and water heating			16.3918 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2205 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3918 * 1.00) + 2.2205 + 0.3862, rounded to 2 d.p.			19.0000 (273)

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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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.3895 (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) =	0.3895 (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	0.4967	0.4869	0.4772	0.4285	0.4188	0.3701	0.3701	0.3603	0.3895	0.4188	0.4382	0.4577 (22b)
Effective ac	0.6233	0.6185	0.6139	0.5918	0.5877	0.5685	0.5685	0.5649	0.5759	0.5877	0.5960	0.6047 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.0619	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	53.5886	53.1769	52.7733	50.8776	50.5230	48.8719	48.8719	48.5662	49.5079	50.5230	51.2405	51.9906 (38)
Heat transfer coeff	131.5477	131.1359	130.7323	128.8367	128.4820	126.8310	126.8310	126.5252	127.4669	128.4820	129.1995	129.9496 (39)
Average = Sum(39)m / 12 =												128.8350 (39)
HLP	1.3053	1.3012	1.2972	1.2784	1.2749	1.2585	1.2585	1.2555	1.2648	1.2749	1.2820	1.2894 (40)
HLP (average)												1.2784 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801 (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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4153	21.6855	17.6358	13.3515	9.9804	8.4258	9.1044	11.8343	15.8839	20.1683	23.5394	25.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658 (72)
Total internal gains	392.5250	391.0001	377.1665	354.3987	330.2362	307.8810	293.9744	298.1570	310.4082	333.3212	359.6365	380.3765 (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			
Southeast				6.3600	36.7938	0.4600	0.0000	0.7700	82.8859 (77)			
Northwest				5.0200	11.2829	0.4600	0.0000	0.7700	20.0620 (81)			
Northwest				3.3300	11.2829	0.4600	0.0000	0.7700	13.3081 (81)			
Solar gains	116.2560	209.1111	315.5566	440.3386	538.2591	554.1796	526.0430	449.9609	358.2915	239.0506	141.2664	98.1848 (83)
Total gains	508.7810	600.1113	692.7231	794.7373	868.4953	862.0607	820.0174	748.1180	668.6997	572.3718	500.9029	478.5613 (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	33.9953	34.1020	34.2073	34.7106	34.8064	35.2595	35.2595	35.3447	35.0836	34.8064	34.6131	34.4133
alpha	3.2664	3.2735	3.2805	3.3140	3.3204	3.3506	3.3506	3.3563	3.3389	3.3204	3.3075	3.2942
util living area	0.9935	0.9883	0.9763	0.9444	0.8734	0.7465	0.6069	0.6661	0.8620	0.9649	0.9894	0.9947 (86)
MIT	18.8783	19.0936	19.4675	19.9792	20.4485	20.7865	20.9233	20.8938	20.6159	20.0092	19.3595	18.8502 (87)
Th 2	19.8367	19.8399	19.8430	19.8578	19.8606	19.8735	19.8735	19.8759	19.8685	19.8606	19.8550	19.8491 (88)
util rest of house	0.9920	0.9855	0.9703	0.9289	0.8350	0.6647	0.4794	0.5427	0.8046	0.9523	0.9864	0.9935 (89)
MIT 2	17.9060	18.1224	18.4953	19.0073	19.4520	19.7519	19.8454	19.8329	19.6186	19.0457	18.3992	17.8869 (90)
Living area fraction	18.0751	18.2914	18.6644	19.1764	19.6253	19.9319	20.0329	20.0175	19.7921	19.2133	18.5663	0.1739 (91)
Temperature adjustment	18.0751	18.2914	18.6644	19.1764	19.6253	19.9319	20.0329	20.0175	19.7921	19.2133	18.5663	18.0545 (92)
adjusted MIT	18.0751	18.2914	18.6644	19.1764	19.6253	19.9319	20.0329	20.0175	19.7921	19.2133	18.5663	18.0545 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9886	0.9802	0.9620	0.9172	0.8255	0.6695	0.4991	0.5601	0.7999	0.9426	0.9815	0.9906 (94)
Ext temp.	502.9807	588.2370	666.3758	728.9229	716.9742	577.1666	409.2532	418.9955	534.8724	539.5165	491.6346	474.0777 (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	1812.0858	1756.0887	1590.2844	1323.9763	1018.2648	676.2454	435.4027	457.7008	725.5516	1106.6530	1481.4356	1800.3828 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	973.9742	784.7964	687.3880	428.4384	224.1603	0.0000	0.0000	0.0000	0.0000	421.9495	712.6567	986.7710 (98)
												5220.1345 (98)
												51.7973 (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												

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1192.2110	938.5491	961.5916	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7433	0.8154	0.7779	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	886.1273	765.2566	747.9740	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1113.7326	1062.3591	980.3929	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	163.8759	221.0443	172.9196	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			557.8398 (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	40.9690	55.2611	43.2299	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												139.4599 (107)
Energy for space heating												1.3838 (108)
Energy for space cooling												51.7973 (99)
Total												1.3838 (108)
Dwelling Fabric Energy Efficiency (DFEE)												53.1811 (109)
												53.2 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (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) =	0.4035 (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	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (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			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			14.7100	1.3258	19.5019		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.1800	23.4144		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.7037		(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)							10.9168 (36)
Total fabric heat loss						(33) + (36) =	71.6205 (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	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	125.9850	125.5431	125.1100	123.0756	122.6950	120.9231	120.9231	120.5950	121.6056	122.6950	123.4650	124.2700 (39)
Average = Sum(39)m / 12 =												123.0738 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2501	1.2457	1.2414	1.2212	1.2175	1.1999	1.1999	1.1966	1.2066	1.2175	1.2251	1.2331 (40)
HLP (average)												1.2212 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total = Sum(45)m =		1564.4598 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(59)
Heat gains from water heating, kWh/month	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	(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	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4153	21.6855	17.6358	13.3515	9.9804	8.4258	9.1044	11.8343	15.8839	20.1683	23.5394	25.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains	392.5250	391.0001	377.1665	354.3987	330.2362	307.8810	293.9744	298.1570	310.4082	333.3212	359.6365	380.3765	(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	
Southeast				6.3600	36.7938	0.6300	0.7000		0.7700		71.5161 (77)	
Northwest				8.3500	11.2829	0.6300	0.7000		0.7700		28.7926 (81)	
Solar gains	100.3087	180.4266	272.2705	379.9356	464.4240	478.1606	453.8837	388.2380	309.1432	206.2591	121.8884	84.7164 (83)
Total gains	492.8337	571.4267	649.4370	734.3343	794.6602	786.0417	747.8580	686.3951	619.5514	539.5803	481.5249	465.0929 (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	55.5512	55.7467	55.9397	56.8643	57.0407	57.8765	57.8765	58.0340	57.5517	57.0407	56.6850	56.3178		
alpha	4.7034	4.7164	4.7293	4.7910	4.8027	4.8584	4.8584	4.8689	4.8368	4.8027	4.7790	4.7545		
util living area	0.9992	0.9981	0.9950	0.9826	0.9391	0.8228	0.6660	0.7312	0.9273	0.9907	0.9983	0.9994	(86)	
MIT	19.5251	19.6711	19.9295	20.2938	20.6366	20.8826	20.9686	20.9511	20.7560	20.3174	19.8642	19.5102	(87)	
Th 2	19.8801	19.8836	19.8870	19.9031	19.9061	19.9201	19.9201	19.9227	19.9147	19.9061	19.9000	19.8936	(88)	
util rest of house	0.9989	0.9975	0.9930	0.9749	0.9094	0.7372	0.5244	0.5947	0.8785	0.9854	0.9976	0.9992	(89)	
MIT 2	18.5342	18.6827	18.9429	19.3158	19.6445	19.8611	19.9115	19.9073	19.7645	19.3444	18.8888	18.5299	(90)	
Living area fraction									fLA = Living area / (4) =			0.1739	(91)	
MIT	18.7066	18.8547	19.1145	19.4859	19.8170	20.0388	20.0954	20.0889	19.9370	19.5137	19.0584	18.7004	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7066	18.8547	19.1145	19.4859	19.8170	20.0388	20.0954	20.0889	19.9370	19.5137	19.0584	18.7004	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	492.0532	569.4704	643.6664	713.0159	720.2874	587.9912	410.7625	424.2999	545.0681	530.2390	479.9888	464.5416	(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	1815.0152	1751.9102	1578.2048	1302.8707	995.9211	657.6752	422.6736	444.8611	709.8069	1093.6613	1476.4482	1801.9653	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)	
Space heating kWh	984.2838	794.5996	695.2966	424.6954	205.0714	0.0000	0.0000	0.0000	0.0000	419.1862	717.4507	995.0433	(98)	
Space heating												5235.6270	(98)	
Space heating per m2												51.9511	(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	1136.6775	894.8312	916.5221	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7837	0.8640	0.8258	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	890.8440	773.0934	756.8898	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1024.8793	978.0170	908.2493	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	96.5054	152.4631	112.6114	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												361.5799	(104)	

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.1264	38.1158	28.1529	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												90.3950 (107)
Space cooling per m2												0.8970 (108)
Energy for space heating												51.9511 (99)
Energy for space cooling												0.8970 (108)
Total												52.8480 (109)
Target Fabric Energy Efficiency (TFEE)												60.8 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4493	0.4172	0.4279	0.4065	0.4065	0.3958	0.3851	0.3744	0.3637	0.3958	0.3744	0.3958 (22b)
Effective ac	0.6009	0.5870	0.5916	0.5826	0.5826	0.5783	0.5742	0.5701	0.5662	0.5783	0.5701	0.5783 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.0619	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	51.6635	50.4680	50.8567	50.0892	50.0892	49.7202	49.3611	49.0118	48.6723	49.7202	49.0118	49.7202 (38)
Heat transfer coeff	129.6226	128.4271	128.8157	128.0483	128.0483	127.6793	127.3202	126.9709	126.6314	127.6793	126.9709	127.6793 (39)
Average = Sum(39)m / 12 =												127.8244 (39)
HLP	1.2862	1.2743	1.2782	1.2706	1.2706	1.2669	1.2633	1.2599	1.2565	1.2669	1.2599	1.2669 (40)
HLP (average)												1.2684 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
RHI water heating demand	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.0384	54.2137	44.0896	33.3786	24.9509	21.0646	22.7611	29.5857	39.7099	50.4208	58.8485	62.7348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains	634.8914	629.7551	604.7995	566.1878	526.5227	491.3037	470.9906	480.2954	502.7741	541.6130	584.6490	617.3334 (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			
Southeast				6.3600	45.1778	0.4600	0.0000	0.7700	101.7726 (77)			
Northwest				5.0200	14.6176	0.4600	0.0000	0.7700	25.9914 (81)			
Northwest				3.3300	14.6176	0.4600	0.0000	0.7700	17.2413 (81)			
Solar gains	145.0053	222.8980	341.3836	482.3963	562.0791	628.9866	592.2599	518.1964	410.5577	275.5918	175.8198	120.2655 (83)
Total gains	779.8967	852.6531	946.1831	1048.5841	1088.6018	1120.2903	1063.2506	998.4919	913.3317	817.2048	760.4688	737.5989 (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	34.5002	34.8213	34.7162	34.9243	34.9243	35.0252	35.1240	35.2207	35.3151	35.0252	35.2207	35.0252
alpha	3.3000	3.3214	3.3144	3.3283	3.3283	3.3350	3.3416	3.3480	3.3543	3.3350	3.3480	3.3350
util living area	0.9753	0.9661	0.9403	0.8792	0.7689	0.5858	0.4467	0.4709	0.7158	0.8958	0.9591	0.9784 (86)
MIT	19.3285	19.4926	19.8461	20.3034	20.6819	20.9094	20.9727	20.9682	20.8171	20.3748	19.8153	19.3269 (87)
Th 2	19.8517	19.8610	19.8580	19.8640	19.8640	19.8668	19.8697	19.8724	19.8751	19.8668	19.8724	19.8668 (88)
util rest of house	0.9698	0.9585	0.9264	0.8501	0.7110	0.4904	0.3261	0.3455	0.6304	0.8634	0.9483	0.9734 (89)
MIT 2	17.6702	17.9121	18.4157	19.0566	19.5509	19.8044	19.8586	19.8593	19.7272	19.1704	18.3879	17.6779 (90)
Living area fraction	17.9587	18.1870	18.6645	19.2735	19.7476	19.9966	20.0524	20.0522	19.9168	19.3799	18.6362	17.9647 (92)
MIT	17.9587	18.1870	18.6645	19.2735	19.7476	19.9966	20.0524	20.0522	19.9168	19.3799	18.6362	17.9647 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8087	18.0370	18.5145	19.1235	19.5976	19.8466	19.9024	19.9022	19.7668	19.2299	18.4862	17.8147 (93)

8. Space heating requirement

Utilisation	0.9553	0.9415	0.9047	0.8267	0.6954	0.4886	0.3297	0.3490	0.6211	0.8400	0.9296	0.9602 (94)
Useful gains	745.0566	802.7768	856.0071	866.9067	757.0171	547.3690	350.5777	348.4834	567.2348	686.4803	706.9203	708.2525 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1673.2547	1635.7728	1483.2534	1232.2694	908.8389	580.5092	356.8016	355.8015	641.6099	999.7200	1344.1348	1636.1757 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	690.5794	559.7733	466.6712	263.0611	112.9554	0.0000	0.0000	0.0000	0.0000	233.0504	458.7945	690.3749 (98)
Space heating												3475.2601 (98)
RHI space heating demand												3475 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (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	0.5456	0.5349	0.5242	0.4707	0.4600	0.4065	0.4065	0.3958	0.4279	0.4600	0.4814	0.5028 (22b)
Effective ac	0.6488	0.6431	0.6374	0.6108	0.6058	0.5826	0.5826	0.5783	0.5916	0.6058	0.6159	0.6264 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.0619	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	55.7813	55.2844	54.7974	52.5097	52.0817	50.0892	50.0892	49.7202	50.8567	52.0817	52.9476	53.8528 (38)
Heat transfer coeff	133.7403	133.2435	132.7564	130.4688	130.0407	128.0483	128.0483	127.6793	128.8157	130.0407	130.9066	131.8118 (39)
Average = Sum(39)m / 12 =												130.4667 (39)
HLP	1.3271	1.3221	1.3173	1.2946	1.2903	1.2706	1.2706	1.2669	1.2782	1.2903	1.2989	1.3079 (40)
HLP (average)												1.2946 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	61.0384	54.2137	44.0896	33.3786	24.9509	21.0646	22.7611	29.5857	39.7099	50.4208	58.8485	62.7348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	634.8914	629.7551	604.7995	566.1878	526.5227	491.3037	470.9906	480.2954	502.7741	541.6130	584.6490	617.3334 (73)

6. Solar gains

[Jan]			Area		Solar flux		g		FF		Access		Gains	
			m2		Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast			6.3600		36.7938		0.4600		0.0000		0.7700		82.8859 (77)	
Northwest			5.0200		11.2829		0.4600		0.0000		0.7700		20.0620 (81)	
Northwest			3.3300		11.2829		0.4600		0.0000		0.7700		13.3081 (81)	
Solar gains			116.2560	209.1111	315.5566	440.3386	538.2591	554.1796	526.0430	449.9609	358.2915	239.0506	141.2664	98.1848 (83)
Total gains			751.1474	838.8663	920.3561	1006.5264	1064.7817	1045.4834	997.0337	930.2563	861.0655	780.6636	725.9154	715.5181 (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	33.4379	33.5626	33.6857	34.2764	34.3892	34.9243	34.9243	35.0252	34.7162	34.3892	34.1617	33.9271
alpha	3.2292	3.2375	3.2457	3.2851	3.2926	3.3283	3.3283	3.3350	3.3144	3.2926	3.2774	3.2618
util living area												
	0.9801	0.9703	0.9503	0.9033	0.8133	0.6682	0.5249	0.5732	0.7803	0.9235	0.9698	0.9829 (86)
MIT	19.1318	19.3369	19.6862	20.1580	20.5677	20.8471	20.9493	20.9315	20.7260	20.2050	19.5984	19.1056 (87)
Th 2	19.8197	19.8235	19.8273	19.8451	19.8484	19.8640	19.8640	19.8668	19.8580	19.8484	19.8417	19.8346 (88)
util rest of house												
	0.9757	0.9637	0.9387	0.8795	0.7652	0.5822	0.4054	0.4540	0.7080	0.8997	0.9620	0.9791 (89)
MIT 2	17.3659	17.6644	18.1687	18.8453	19.3968	19.7429	19.8385	19.8292	19.6137	18.9259	18.0573	17.3370 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	17.6730	17.9553	18.4327	19.0737	19.6005	19.9349	20.0317	20.0209	19.8071	19.1484	18.3254	17.6446 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5230	17.8053	18.2827	18.9237	19.4505	19.7849	19.8817	19.8709	19.6571	18.9984	18.1754	17.4946 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9628	0.9473	0.9177	0.8555	0.7456	0.5756	0.4074	0.4545	0.6930	0.8763	0.9454	0.9674 (94)
Useful gains	723.1883	794.6938	844.6558	861.0509	793.8530	601.7530	406.1753	422.7777	596.6818	684.1088	686.3121	692.2108 (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												
	1768.4540	1719.5473	1564.2289	1307.7766	1007.8804	663.9236	420.2145	443.1663	715.8471	1092.1317	1449.8420	1752.3896 (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												
	777.6776	621.5015	535.3624	321.6426	159.2364	0.0000	0.0000	0.0000	0.0000	303.5690	549.7416	788.7730 (98)
Space heating												4057.5041 (98)
Space heating per m2												(98) / (4) = 40.2610 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4483.4300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	777.6776	621.5015	535.3624	321.6426	159.2364	0.0000	0.0000	0.0000	0.0000	303.5690	549.7416	788.7730	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	859.3123	686.7420	591.5607	355.4061	175.9518	0.0000	0.0000	0.0000	0.0000	335.4354	607.4492	871.5724	(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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8909	89.8439	89.7413	89.4990	88.9944	87.3000	87.3000	87.3000	87.3000	89.4325	89.7643	87.3000	(216)
Fuel for water heating, kWh/month	196.1787	172.1072	178.8439	157.8081	153.3702	136.5557	128.1658	144.7599	145.8047	163.9128	176.3643	190.4264	(219)
Water heating fuel used												1944.2978	(219)
Annual totals kWh/year													
Space heating fuel - main system												4483.4300	(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)												431.1826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1080 * 1.00) =										-1278.1572		-1278.1572	(233)
Total delivered energy for all uses												5655.7532	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4483.4300	3.4800	156.0234	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1944.2978	3.4800	67.6616	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	431.1826	13.1900	56.8730	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1278.1572	13.1900	-168.5889	(252)
Total energy cost			241.8615	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6968 (257)
SAP value	90.2794	
SAP rating (Section 12)	90	(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	4483.4300	0.2160	968.4209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1944.2978	0.2160	419.9683	(264)
Space and water heating			1388.3892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1826	0.5190	223.7837	(268)
Energy saving/generation technologies				
PV Unit	-1278.1572	0.5190	-663.3636	(269)
Total kg/year			987.7344	(272)
CO2 emissions per m2			9.8000	(273)
EI value			90.9208	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8886 = 3.916$, stars = 4
Water heating environmental impact	$0.216 / 0.8886 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 260.5163 (5)
Dwelling volume			

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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4493	0.4172	0.4279	0.4065	0.4065	0.3958	0.3851	0.3744	0.3637	0.3958	0.3744	0.3958 (22b)
Effective ac	0.6009	0.5870	0.5916	0.5826	0.5826	0.5783	0.5742	0.5701	0.5662	0.5783	0.5701	0.5783 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 71.0619		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	51.6635	50.4680	50.8567	50.0892	50.0892	49.7202	49.3611	49.0118	48.6723	49.7202	49.0118	49.7202 (38)
Heat transfer coeff	129.6226	128.4271	128.8157	128.0483	128.0483	127.6793	127.3202	126.9709	126.6314	127.6793	126.9709	127.6793 (39)
Average = Sum(39)m / 12 =												127.8244 (39)
HLP	1.2862	1.2743	1.2782	1.2706	1.2706	1.2669	1.2633	1.2599	1.2565	1.2669	1.2599	1.2669 (40)
HLP (average)												1.2684 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	61.0384	54.2137	44.0896	33.3786	24.9509	21.0646	22.7611	29.5857	39.7099	50.4208	58.8485	62.7348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (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)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	634.8914	629.7551	604.7995	566.1878	526.5227	491.3037	470.9906	480.2954	502.7741	541.6130	584.6490	617.3334 (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			
Southeast				6.3600	45.1778	0.4600	0.0000	0.7700	101.7726 (77)			
Northwest				5.0200	14.6176	0.4600	0.0000	0.7700	25.9914 (81)			
Northwest				3.3300	14.6176	0.4600	0.0000	0.7700	17.2413 (81)			
Solar gains	145.0053	222.8980	341.3836	482.3963	562.0791	628.9866	592.2599	518.1964	410.5577	275.5918	175.8198	120.2655 (83)
Total gains	779.8967	852.6531	946.1831	1048.5841	1088.6018	1120.2903	1063.2506	998.4919	913.3317	817.2048	760.4688	737.5989 (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	34.5002	34.8213	34.7162	34.9243	34.9243	35.0252	35.1240	35.2207	35.3151	35.0252	35.2207	35.0252
alpha	3.3000	3.3214	3.3144	3.3283	3.3283	3.3350	3.3416	3.3480	3.3543	3.3350	3.3480	3.3350
util living area												
	0.9753	0.9661	0.9403	0.8792	0.7689	0.5858	0.4467	0.4709	0.7158	0.8958	0.9591	0.9784 (86)
MIT	19.3285	19.4926	19.8461	20.3034	20.6819	20.9094	20.9727	20.9682	20.8171	20.3748	19.8153	19.3269 (87)
Th 2	19.8517	19.8610	19.8580	19.8640	19.8640	19.8668	19.8697	19.8724	19.8751	19.8668	19.8724	19.8668 (88)
util rest of house												
	0.9698	0.9585	0.9264	0.8501	0.7110	0.4904	0.3261	0.3455	0.6304	0.8634	0.9483	0.9734 (89)
MIT 2	17.6702	17.9121	18.4157	19.0566	19.5509	19.8044	19.8586	19.8593	19.7272	19.1704	18.3879	17.6779 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	17.9587	18.1870	18.6645	19.2735	19.7476	19.9966	20.0524	20.0522	19.9168	19.3799	18.6362	17.9647 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8087	18.0370	18.5145	19.1235	19.5976	19.8466	19.9024	19.9022	19.7668	19.2299	18.4862	17.8147 (93)

8. Space heating requirement

Utilisation	0.9553	0.9415	0.9047	0.8267	0.6954	0.4886	0.3297	0.3490	0.6211	0.8400	0.9296	0.9602 (94)
Useful gains	745.0566	802.7768	856.0071	866.9067	757.0171	547.3690	350.5777	348.4834	567.2348	686.4803	706.9203	708.2525 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1673.2547	1635.7728	1483.2534	1232.2694	908.8389	580.5092	356.8016	355.8015	641.6099	999.7200	1344.1348	1636.1757 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	690.5794	559.7733	466.6712	263.0611	112.9554	0.0000	0.0000	0.0000	0.0000	233.0504	458.7945	690.3749 (98)
Space heating												3475.2601 (98)
Space heating per m2										(98) / (4) =		34.4836 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3840.0664 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.5794	559.7733	466.6712	263.0611	112.9554	0.0000	0.0000	0.0000	0.0000	233.0504	458.7945	690.3749	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	763.0711	618.5340	515.6588	290.6752	124.8125	0.0000	0.0000	0.0000	0.0000	257.5142	506.9552	762.8452	(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	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8302	89.7876	89.6590	89.3558	88.7205	87.3000	87.3000	87.3000	87.3000	89.2370	89.6569	87.3000	(216)
Fuel for water heating, kWh/month	196.3113	172.2150	179.0081	158.0610	153.8436	136.5557	128.1658	144.7599	145.8047	164.2719	176.5756	190.5677	(219)
Water heating fuel used												1946.1404	(219)
Annual totals kWh/year													
Space heating fuel - main system												3840.0664	(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)												431.1826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1208 * 1.00) =										-1430.4508		-1430.4508	(233)
Total delivered energy for all uses												4861.9385	(238)

10a. Fuel costs - using BEDF prices (522)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3840.0664	10.2300	392.8388 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.1404	10.2300	199.0902 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	431.1826	36.7200	158.3302 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1430.4508	36.7200	-525.2615 (252)
Total energy cost			355.5377 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3840.0664	0.2160	829.4543 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.1404	0.2160	420.3663 (264)
Space and water heating			1249.8207 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	431.1826	0.5190	223.7837 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	0.5190	-742.4040 (269)
Total kg/year			770.1254 (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	3840.0664	1.2200	4684.8810 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.1404	1.2200	2374.2913 (264)
Space and water heating			7059.1723 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	431.1826	3.0700	1323.7305 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	3.0700	-4391.4840 (269)
Primary energy kWh/year			4221.6687 (272)
Primary energy kWh/m2/year			41.8899 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 90
Current environmental impact rating: B 91

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 85	-193 kg (25.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£85 1.92 kg/m²	B 91	A 93
Total Savings	£85 1.92 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 522 TEST (30 Jun 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£186	£204	-£18
Mains gas	£695	£591	£104
Space heating	£523	£523	£0
Water heating	£199	£114	£85
Lighting	£158	£158	£0
Generated (PV)	-£525	-£525	£0
Total cost of fuels	£356	£270	£86
Total cost of uses	£355	£270	£85
Delivered energy	48 kWh/m²	39 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	8 kg/m²	6 kg/m²	2 kg/m²
Primary energy	42 kWh/m²	31 kWh/m²	11 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 260.5163 (5)
Dwelling volume			

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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (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	0.5456	0.5349	0.5242	0.4707	0.4600	0.4065	0.4065	0.3958	0.4279	0.4600	0.4814	0.5028 (22b)
Effective ac	0.6488	0.6431	0.6374	0.6108	0.6058	0.5826	0.5826	0.5783	0.5916	0.6058	0.6159	0.6264 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.0619	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	55.7813	55.2844	54.7974	52.5097	52.0817	50.0892	50.0892	49.7202	50.8567	52.0817	52.9476	53.8528 (38)
Heat transfer coeff	133.7403	133.2435	132.7564	130.4688	130.0407	128.0483	128.0483	127.6793	128.8157	130.0407	130.9066	131.8118 (39)
Average = Sum(39)m / 12 =												130.4667 (39)
HLP	1.3271	1.3221	1.3173	1.2946	1.2903	1.2706	1.2706	1.2669	1.2782	1.2903	1.2989	1.3079 (40)
HLP (average)												1.2946 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1564.4598 (45)
Water storage loss:	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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												1.1593 (H8)
Utilisation factor												0.5779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-869.6671 (H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037 (63)
Solar input (sum of months) = Sum (63)m =												-869.6671 (63)
Output from w/h	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129 (64)
Total per year (kWh/year) = Sum (64)m =												863.6545 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.0384	54.2137	44.0896	33.3786	24.9509	21.0646	22.7611	29.5857	39.7099	50.4208	58.8485	62.7348	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	634.8914	629.7551	604.7995	566.1878	526.5227	491.3037	470.9906	480.2954	502.7741	541.6130	584.6490	617.3334	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a		Specific data	Specific data		factor		W
					W/m2		or Table 6b	or Table 6c		Table 6d		
Southeast				6.3600	36.7938		0.4600	0.0000		0.7700		82.8859 (77)
Northwest				5.0200	11.2829		0.4600	0.0000		0.7700		20.0620 (81)
Northwest				3.3300	11.2829		0.4600	0.0000		0.7700		13.3081 (81)

Solar gains	116.2560	209.1111	315.5566	440.3386	538.2591	554.1796	526.0430	449.9609	358.2915	239.0506	141.2664	98.1848 (83)
Total gains	751.1474	838.8663	920.3561	1006.5264	1064.7817	1045.4834	997.0337	930.2563	861.0655	780.6636	725.9154	715.5181 (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	33.4379	33.5626	33.6857	34.2764	34.3892	34.9243	34.9243	35.0252	34.7162	34.3892	34.1617	33.9271
alpha	3.2292	3.2375	3.2457	3.2851	3.2926	3.3283	3.3283	3.3350	3.3144	3.2926	3.2774	3.2618
util living area	0.9801	0.9703	0.9503	0.9033	0.8133	0.6682	0.5249	0.5732	0.7803	0.9235	0.9698	0.9829 (86)
MIT	19.1318	19.3369	19.6862	20.1580	20.5677	20.8471	20.9493	20.9315	20.7260	20.2050	19.5984	19.1056 (87)
Th 2	19.8197	19.8235	19.8273	19.8451	19.8484	19.8640	19.8640	19.8668	19.8580	19.8484	19.8417	19.8346 (88)
util rest of house	0.9757	0.9637	0.9387	0.8795	0.7652	0.5822	0.4054	0.4540	0.7080	0.8997	0.9620	0.9791 (89)
MIT 2	17.3659	17.6644	18.1687	18.8453	19.3968	19.7429	19.8385	19.8292	19.6137	18.9259	18.0573	17.3370 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.6730	17.9553	18.4327	19.0737	19.6005	19.9349	20.0317	20.0209	19.8071	19.1484	18.3254	17.6446 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5230	17.8053	18.2827	18.9237	19.4505	19.7849	19.8817	19.8709	19.6571	18.9984	18.1754	17.4946 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9628	0.9473	0.9177	0.8555	0.7456	0.5756	0.4074	0.4545	0.6930	0.8763	0.9454	0.9674	(94)
Useful gains	723.1883	794.6938	844.6558	861.0509	793.8530	601.7530	406.1753	422.7777	596.6818	684.1088	686.3121	692.2108	(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	1768.4540	1719.5473	1564.2289	1307.7766	1007.8804	663.9236	420.2145	443.1663	715.8471	1092.1317	1449.8420	1752.3896	(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	777.6776	621.5015	535.3624	321.6426	159.2364	0.0000	0.0000	0.0000	0.0000	303.5690	549.7416	788.7730	(98)
Space heating												4057.5041	(98)
Space heating per m2											(98) / (4) =	40.2610	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4483.4300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	777.6776	621.5015	535.3624	321.6426	159.2364	0.0000	0.0000	0.0000	0.0000	303.5690	549.7416	788.7730	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	859.3123	686.7420	591.5607	355.4061	175.9518	0.0000	0.0000	0.0000	0.0000	335.4354	607.4492	871.5724	(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	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129	(64)
Efficiency of water heater	(217)m	89.9634	89.9942	90.0304	90.0932	90.1673	87.3000	87.3000	87.3000	89.7300	89.8762	87.3000	(216)
Fuel for water heating, kWh/month	167.9885	125.0582	98.6615	50.1511	19.7681	2.9152	0.0000	29.5406	55.5649	103.4150	142.8624	166.8427	(219)
Water heating fuel used												962.7683	(219)
Annual totals kWh/year													
Space heating fuel - main system												4483.4300	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1080 * 1.00) =									-1278.1572			-1278.1572	(233)
Total delivered energy for all uses												4724.2237	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4483.4300	3.4800	156.0234	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	962.7683	3.4800	33.5043	(247)
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	431.1826	13.1900	56.8730	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1278.1572	13.1900	-168.5889	(252)
Total energy cost			214.2993	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.6174 (257)
SAP value			91.3872
SAP rating (Section 12)			91 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4483.4300	0.2160	968.4209 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.7683	0.2160	207.9579 (264)
Space and water heating			1176.3788 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	431.1826	0.5190	223.7837 (268)
Energy saving/generation technologies			
PV Unit	-1278.1572	0.5190	-663.3636 (269)
Total kg/year			801.6740 (272)
CO2 emissions per m2			7.9500 (273)
EI value			92.6311
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 260.5163 (5)
Dwelling volume			

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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4279 (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) =	0.4279 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.4493	0.4172	0.4279	0.4065	0.4065	0.3958	0.3851	0.3744	0.3637	0.3958	0.3744	0.3958 (22b)
Effective ac	0.6009	0.5870	0.5916	0.5826	0.5826	0.5783	0.5742	0.5701	0.5662	0.5783	0.5701	0.5783 (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			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			11.3800	1.2357	14.0627		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	18.9700	130.0800	0.2500	32.5200	52.3000	6803.1840 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 71.0619		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16099.1940 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.7459 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8972 (36)
Total fabric heat loss							(33) + (36) = 77.9591 (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	51.6635	50.4680	50.8567	50.0892	50.0892	49.7202	49.3611	49.0118	48.6723	49.7202	49.0118	49.7202 (38)
Heat transfer coeff	129.6226	128.4271	128.8157	128.0483	128.0483	127.6793	127.3202	126.9709	126.6314	127.6793	126.9709	127.6793 (39)
Average = Sum(39)m / 12 =												127.8244 (39)
HLP	1.2862	1.2743	1.2782	1.2706	1.2706	1.2669	1.2633	1.2599	1.2565	1.2669	1.2599	1.2669 (40)
HLP (average)												1.2684 (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												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1564.4598 (45)
Water storage loss:	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (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)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (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												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2974 (H8)
Utilisation factor												0.5374 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-904.9218 (H17)
Solar input	-29.5207	-41.9766	-72.1477	-97.3440	-114.3363	-122.1293	-119.5609	-107.0106	-83.7819	-57.9239	-34.9153	-24.2746 (63)
Solar input (sum of months) = Sum (63)m =												-904.9218 (63)
Output from w/h	146.8261	112.6512	88.3491	43.8927	22.1545	0.0000	0.0000	19.3648	43.5056	88.6673	123.3970	146.9419 (64)
Total per year (kWh/year) = Sum (64)m =												835.7504 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (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	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.0384	54.2137	44.0896	33.3786	24.9509	21.0646	22.7611	29.5857	39.7099	50.4208	58.8485	62.7348	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(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)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	634.8914	629.7551	604.7995	566.1878	526.5227	491.3037	470.9906	480.2954	502.7741	541.6130	584.6490	617.3334	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast				6.3600	45.1778	0.4600		0.0000	0.7700	101.7726 (77)		
Northwest				5.0200	14.6176	0.4600		0.0000	0.7700	25.9914 (81)		
Northwest				3.3300	14.6176	0.4600		0.0000	0.7700	17.2413 (81)		
Solar gains	145.0053	222.8980	341.3836	482.3963	562.0791	628.9866	592.2599	518.1964	410.5577	275.5918	175.8198	120.2655 (83)
Total gains	779.8967	852.6531	946.1831	1048.5841	1088.6018	1120.2903	1063.2506	998.4919	913.3317	817.2048	760.4688	737.5989 (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	34.5002	34.8213	34.7162	34.9243	34.9243	35.0252	35.1240	35.2207	35.3151	35.0252	35.2207	35.0252
alpha	3.3000	3.3214	3.3144	3.3283	3.3283	3.3350	3.3416	3.3480	3.3543	3.3350	3.3480	3.3350
util living area	0.9753	0.9661	0.9403	0.8792	0.7689	0.5858	0.4467	0.4709	0.7158	0.8958	0.9591	0.9784 (86)
MIT	19.3285	19.4926	19.8461	20.3034	20.6819	20.9094	20.9727	20.9682	20.8171	20.3748	19.8153	19.3269 (87)
Th 2	19.8517	19.8610	19.8580	19.8640	19.8640	19.8668	19.8697	19.8724	19.8751	19.8668	19.8724	19.8668 (88)
util rest of house	0.9698	0.9585	0.9264	0.8501	0.7110	0.4904	0.3261	0.3455	0.6304	0.8634	0.9483	0.9734 (89)
MIT 2	17.6702	17.9121	18.4157	19.0566	19.5509	19.8044	19.8586	19.8593	19.7272	19.1704	18.3879	17.6779 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.9587	18.1870	18.6645	19.2735	19.7476	19.9966	20.0524	20.0522	19.9168	19.3799	18.6362	17.9647 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8087	18.0370	18.5145	19.1235	19.5976	19.8466	19.9024	19.9022	19.7668	19.2299	18.4862	17.8147 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9553	0.9415	0.9047	0.8267	0.6954	0.4886	0.3297	0.3490	0.6211	0.8400	0.9296	0.9602	(94)
Useful gains	745.0566	802.7768	856.0071	866.9067	757.0171	547.3690	350.5777	348.4834	567.2348	686.4803	706.9203	708.2525	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1673.2547	1635.7728	1483.2534	1232.2694	908.8389	580.5092	356.8016	355.8015	641.6099	999.7200	1344.1348	1636.1757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	690.5794	559.7733	466.6712	263.0611	112.9554	0.0000	0.0000	0.0000	0.0000	233.0504	458.7945	690.3749	(98)
Space heating												3475.2601	(98)
Space heating per m2											(98) / (4) =	34.4836	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3840.0664	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	690.5794	559.7733	466.6712	263.0611	112.9554	0.0000	0.0000	0.0000	0.0000	233.0504	458.7945	690.3749	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	763.0711	618.5340	515.6588	290.6752	124.8125	0.0000	0.0000	0.0000	0.0000	257.5142	506.9552	762.8452	(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	146.8261	112.6512	88.3491	43.8927	22.1545	0.0000	0.0000	19.3648	43.5056	88.6673	123.3970	146.9419	(64)	
Efficiency of water heater	89.9221	89.9476	89.9750	90.0281	89.9593	87.3000	87.3000	87.3000	87.3000	89.5949	89.8023	87.3000	(216)	
Fuel for water heating, kWh/month	163.2815	125.2408	98.1930	48.7545	24.6273	0.0000	0.0000	22.1819	49.8346	98.9647	137.4096	163.4112	(219)	
Water heating fuel used												931.8992	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3840.0664	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													431.1826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1208 * 1.00) =										-1430.4508			-1430.4508	(233)
Total delivered energy for all uses													3897.6973	(238)

10a. Fuel costs - using BEDF prices (522)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3840.0664	10.2300	392.8388	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	931.8992	10.2300	95.3333	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	431.1826	36.7200	158.3302	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1430.4508	36.7200	-525.2615	(252)
Total energy cost			270.1408	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3840.0664	0.2160	829.4543	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	931.8992	0.2160	201.2902	(264)
Space and water heating			1030.7446	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	431.1826	0.5190	223.7837	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-1430.4508	0.5190	-742.4040 (269)
Total kg/year			576.9993 (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	3840.0664	1.2200	4684.8810 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	931.8992	1.2200	1136.9170 (264)
Space and water heating			5821.7980 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	431.1826	3.0700	1323.7305 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	3.0700	-4391.4840 (269)
Primary energy kWh/year			3137.7944 (272)
Primary energy kWh/m2/year			31.1351 (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	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	159.7 (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	343.88 (P1)
Transmission heat loss coefficient	77.96 (37)
Summer heat loss coefficient	421.84 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	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 or Table 6b g	Specific data or Table 6c FF	Shading	Gains W
South East	6.3600	119.9223	0.4600	0.0000	0.9000	315.7603
North West	5.0200	98.8453	0.4600	0.0000	0.9000	205.4281
North West	3.3300	98.8453	0.4600	0.0000	0.9000	136.2701
total:						657.4586

	Jun	Jul	Aug	
Solar gains	700	657	574	(P4)
Internal gains	488	468	477	
Total summer gains	1189	1125	1051	(P5)
Summer gain/loss ratio	2.82	2.67	2.49	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 159.7)	0.88	0.88	0.88	
Threshold temperature	19.70	21.45	21.17	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			