

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-651			Issued on Date	27/06/2023
Assessment Reference	As Built	Prop Type Ref	Coiner-CB-Opp-SEMI		
Property	5, Flycatcher Road , BOTLEY, SO32 2FG				
SAP Rating	91 B	DER	9.82	TER	18.80
Environmental	93 A	% DER<TER	47.77		
CO ₂ Emissions (t/year)	0.48	DFEE	42.46	TFEE	52.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.54		
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

Semi-Detached House, total floor area 80 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) 18.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.30 (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: 4.88 (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 North East: 6.68 m², No overhang
Windows facing South West: 3.53 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 0.64 W/m²K
Thermal bridging y-value 0.030 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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4442 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4108 (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	0.5238	0.5135	0.5033	0.4519	0.4417	0.3903	0.3903	0.3800	0.4108	0.4417	0.4622	0.4827 (22b)
Effective ac	0.6372	0.6319	0.6266	0.6021	0.5975	0.5762	0.5762	0.5722	0.5844	0.5975	0.6068	0.6165 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.0232	41.6719	41.3275	39.7099	39.4073	37.9984	37.9984	37.7375	38.5411	39.4073	40.0195	40.6596 (38)
Average = Sum(39)m / 12 =	89.0494	88.6981	88.3537	86.7361	86.4335	85.0246	85.0246	84.7637	85.5673	86.4335	87.0457	87.6858 (39)
	86.7347 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1140	1.1096	1.1053	1.0850	1.0812	1.0636	1.0636	1.0603	1.0704	1.0812	1.0889	1.0969 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											
Average daily hot water use (litres/day)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use											

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1457.9953 (45)											
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 1623.2284 (64)											
	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	375.9454	373.6816	359.9393	337.9173	315.6170	294.2333	280.4489	286.5947	298.0240	320.2577	345.7036	364.7281 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast				2.1700	11.2829	0.4600	0.0000			0.7700			8.6722 (75)
Southwest				3.5300	36.7938	0.4600	0.0000			0.7700			46.0043 (79)
Northeast				4.5100	11.2829	0.4600	0.0000			0.7700			18.0238 (75)
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)	
Total gains	448.6458	506.3845	565.0626	631.5539	680.5490	672.3767	638.4232	588.9562	533.4174	473.2733	434.3967	425.8995 (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	37.1922	37.3395	37.4851	38.1842	38.3179	38.9528	38.9528	39.0727	38.7058	38.3179	38.0484	37.7706
alpha	3.4795	3.4893	3.4990	3.5456	3.5545	3.5969	3.5969	3.6048	3.5804	3.5545	3.5366	3.5180
util living area	0.9892	0.9825	0.9673	0.9270	0.8403	0.6934	0.5472	0.6025	0.8195	0.9488	0.9827	0.9909 (86)
MIT	19.1828	19.3774	19.7176	20.1853	20.5924	20.8624	20.9563	20.9381	20.7299	20.2095	19.6269	19.1609 (87)
Th 2	19.9895	19.9930	19.9965	20.0131	20.0162	20.0307	20.0307	20.0334	20.0251	20.0162	20.0099	20.0034 (88)
util rest of house	0.9869	0.9788	0.9600	0.9098	0.8013	0.6190	0.4416	0.4975	0.7614	0.9334	0.9784	0.9890 (89)
MIT 2	17.5549	17.8398	18.3345	19.0121	19.5696	19.9129	20.0055	19.9947	19.7648	19.0585	18.2153	17.5316 (90)
Living area fraction	17.9886	18.2495	18.7031	19.3247	19.8422	20.1659	20.2588	20.2460	fLA = Living area / (4) =	19.3652	18.5914	0.2664 (91)
MIT	17.9886	18.2495	18.7031	19.3247	19.8422	20.1659	20.2588	20.2460	20.0219	19.3652	18.5914	17.9657 (92)
Temperature adjustment	17.8386	18.0995	18.5531	19.1747	19.6922	20.0159	20.1088	20.0960	19.8719	19.2152	18.4414	-0.1500
adjusted MIT	17.8386	18.0995	18.5531	19.1747	19.6922	20.0159	20.1088	20.0960	19.8719	19.2152	18.4414	17.8157 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9796	0.9688	0.9458	0.8914	0.7862	0.6178	0.4507	0.5049	0.7506	0.9167	0.9685	0.9827 (94)
Ext temp.	439.4996	490.5882	534.4104	562.9497	535.0678	415.3813	287.7163	297.3513	400.4065	433.8265	420.7263	418.5383 (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	1205.6067	1170.7722	1064.9334	891.1902	690.7911	460.4857	298.3365	313.2893	493.8871	744.6408	987.2239	1193.9021 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	569.9836	457.0837	394.7091	236.3332	115.8582	0.0000	0.0000	0.0000	0.0000	231.2458	407.8783	576.8707 (98)
Space heating per m2	(98) / (4) = 37.4026 (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													3303.8260 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	569.9836	457.0837	394.7091	236.3332	115.8582	0.0000	0.0000	0.0000	0.0000	231.2458	407.8783	576.8707	(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)	629.8162	505.0649	436.1426	261.1416	128.0201	0.0000	0.0000	0.0000	0.0000	255.5203	450.6943	637.4262	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.7604	89.7083	89.5935	89.3237	88.7909	87.3000	87.3000	87.3000	87.3000	89.2795	89.6234	89.7837	(216)
Fuel for water heating, kWh/month	184.1372	161.5737	167.9730	148.3506	144.2954	128.2841	120.5010	135.9628	136.9009	154.0503	165.6252	178.7643	(219)
Water heating fuel used												1826.4184	(219)
Annual totals kWh/year													
Space heating fuel - main system												3303.8260	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												4508.3482	(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	3303.8260	0.2160	713.6264	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.4184	0.2160	394.5064	(264)
Space and water heating			1108.1328	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)
Energy saving/generation technologies				
PV Unit	-1074.8994	0.5190	-557.8728	(269)
Total CO2, kg/year			785.3686	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.8200	(273)

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

DER			9.8200	ZC1
Total Floor Area		TFA	79.9400	
Assumed number of occupants		N	2.4617	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.2574	ZC2
CO2 emissions from cooking, equation (L16)			2.2277	ZC3
Total CO2 emissions			28.3051	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			28.3051	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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1501 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3701	(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	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349	(22b)				
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	0.0000 (57)
Combi loss	50.9589	45.2108	48.1660	44.7843	44.3882	41.1284	42.4994	44.3882	44.7843	48.1660	48.4401	50.9589	(61)
Total heat required for water heating calculated for each month	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(64)
Heat gains from water heating, kWh/month	63.0014	55.2619	57.4034	50.7437	49.0440	43.0274	40.9682	45.9165	46.4313	53.1048	56.9338	61.4155	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	84.6793	82.2349	77.1551	70.4774	65.9193	59.7603	55.0647	61.7157	64.4880	71.3774	79.0748	82.5477	(72)
Total internal gains	388.3243	385.7626	371.3976	348.7549	325.8298	303.8231	290.0457	296.8140	308.8714	331.7259	357.7903	377.1108	(73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		or Table 6b		or Table 6c		factor		W	
					W/m2						Table 6d			
Northeast	6.6800				11.2829		0.6300		0.7000		0.7700		23.0341 (75)	
Southwest	3.5300				36.7938		0.6300		0.7000		0.7700		39.6937 (79)	
Solar gains	62.7278	114.4996	176.9857	253.3573	314.8728	326.2719	308.8696	260.8854	203.1036	132.0259	76.5267	52.7803	(83)	
Total gains	451.0521	500.2622	548.3833	602.1122	640.7026	630.0950	598.9153	557.6994	511.9750	463.7517	434.3170	429.8911	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642	
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976	
util living area	0.9985	0.9971	0.9930	0.9767	0.9207	0.7795	0.6103	0.6705	0.8975	0.9853	0.9970	0.9989	(86)
MIT	19.7701	19.8954	20.1221	20.4428	20.7380	20.9294	20.9846	20.9753	20.8370	20.4662	20.0683	19.7536	(87)
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)
util rest of house	0.9980	0.9961	0.9904	0.9672	0.8866	0.6941	0.4854	0.5460	0.8403	0.9775	0.9958	0.9985	(89)
MIT 2	18.3420	18.5271	18.8595	19.3312	19.7373	19.9702	20.0145	20.0117	19.8746	19.3710	18.7900	18.3259	(90)
Living area fraction	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(91)
MIT	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	449.7229	497.5414	541.4980	579.4666	567.9103	449.7169	310.7922	323.0404	434.3269	451.5981	431.8213	428.9029	(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	1287.5581	1245.1051	1126.2489	937.5351	723.6972	483.8616	315.9035	331.8993	521.3699	789.8314	1054.4608	1278.9838	(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	623.3494	502.3628	435.0546	257.8094	115.9054	0.0000	0.0000	0.0000	0.0000	251.6456	448.3004	632.4602	(98)
Space heating												3266.8877	(98)
Space heating per m2												40.8667	(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												3497.7384 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	623.3494	502.3628	435.0546	257.8094	115.9054	0.0000	0.0000	0.0000	0.0000	251.6456	448.3004	632.4602 (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)	667.3976	537.8616	465.7972	276.0272	124.0957	0.0000	0.0000	0.0000	0.0000	269.4278	479.9790	677.1522 (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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521 (64)
Efficiency of water heater (217)m	87.6991	87.5267	87.1351	86.1894	84.2770	80.3000	80.3000	80.3000	80.3000	86.0128	87.2170	80.3000 (216)
Fuel for water heating, kWh/month	230.4720	202.7025	211.8467	189.9590	188.0873	173.8611	166.5722	185.6890	187.7397	199.5804	210.1065	224.8403 (219)
Water heating fuel used												2371.4566 (219)
Annual totals kWh/year												
Space heating fuel - main system												3497.7384 (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)												378.0032 (232)
Total delivered energy for all uses												6322.1982 (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	3497.7384	0.2160	755.5115 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2371.4566	0.2160	512.2346 (264)
Space and water heating			1267.7461 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/m2/year			1502.8548 (272)
Emissions per m2 for space and water heating			15.8587 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4541 (272b)
Emissions per m2 for pumps and fans			0.4869 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8587 * 1.00) + 2.4541 + 0.4869, rounded to 2 d.p.			18.8000 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1501 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.3941 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3646 (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	0.4648	0.4557	0.4466	0.4010	0.3919	0.3463	0.3463	0.3372	0.3646	0.3919	0.4101	0.4284 (22b)
Effective ac	0.6080	0.6038	0.5997	0.5804	0.5768	0.5600	0.5600	0.5569	0.5664	0.5768	0.5841	0.5917 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	40.0994	39.8228	39.5516	38.2780	38.0397	36.9304	36.9304	36.7249	37.3577	38.0397	38.5217	39.0257 (38)
Average = Sum(39)m / 12 =	87.1256	86.8490	86.5778	85.3042	85.0659	83.9566	83.9566	83.7512	84.3839	85.0659	85.5479	86.0519 (39)
	85.3030 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0899	1.0864	1.0830	1.0671	1.0641	1.0502	1.0502	1.0477	1.0556	1.0641	1.0702	1.0765 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	31.1086 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				2.1700	11.2829	0.4600	0.0000	0.7700		8.6722 (75)		
Southwest				3.5300	36.7938	0.4600	0.0000	0.7700		46.0043 (79)		
Northeast				4.5100	11.2829	0.4600	0.0000	0.7700		18.0238 (75)		
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	416.5203	475.0375	535.3318	604.0180	654.4389	648.2720	616.0203	564.3698	508.0530	445.6376	404.1958	394.5472 (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	38.0135	38.1346	38.2540	38.8251	38.9339	39.4483	39.4483	39.5451	39.2486	38.9339	38.7145	38.4878	
alpha	3.5342	3.5423	3.5503	3.5883	3.5956	3.6299	3.6299	3.6363	3.6166	3.5956	3.5810	3.5659	
util living area	0.9914	0.9855	0.9716	0.9337	0.8498	0.7053	0.5583	0.6175	0.8333	0.9560	0.9861	0.9929	(86)
MIT	19.1732	19.3679	19.7086	20.1740	20.5852	20.8580	20.9548	20.9348	20.7189	20.1902	19.6066	19.1456	(87)
Th 2	20.0091	20.0119	20.0147	20.0278	20.0302	20.0417	20.0417	20.0438	20.0373	20.0302	20.0253	20.0201	(88)
util rest of house	0.9896	0.9824	0.9652	0.9179	0.8124	0.6319	0.4526	0.5126	0.7779	0.9424	0.9826	0.9914	(89)
MIT 2	18.3323	18.5278	18.8672	19.3313	19.7178	19.9580	20.0237	20.0156	19.8500	19.3555	18.7764	18.3130	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5563	18.7516	19.0914	19.5558	19.9489	20.1978	20.2718	20.2605	20.0815	19.5779	18.9976	18.5349	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5563	18.7516	19.0914	19.5558	19.9489	20.1978	20.2718	20.2605	20.0815	19.5779	18.9976	18.5349	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9859	0.9772	0.9576	0.9086	0.8088	0.6449	0.4793	0.5380	0.7808	0.9344	0.9776	0.9883	(94)
Useful gains	410.6554	464.1846	512.6238	548.8029	529.3228	418.0396	295.2662	303.6178	396.6997	416.4258	395.1397	389.9148	(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	1242.0917	1202.9998	1090.1336	908.9872	701.7034	469.9722	308.2724	323.3224	504.7455	763.7126	1017.8135	1233.5421	(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	618.5886	496.4838	429.6673	259.3327	128.2512	0.0000	0.0000	0.0000	0.0000	258.3814	448.3251	627.6587	(98)
Space heating												3266.6889	(98)
Space heating per m2												40.8643	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	789.1919	621.2787	636.5088	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8123	0.8745	0.8445	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	641.0225	543.2947	537.5500	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.3136	810.7828	752.2120	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	150.6896	199.0112	159.7085	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												509.4093	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.6724	49.7528	39.9271	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												127.3523	(107)
Space cooling per m2												1.5931	(108)
Energy for space heating												40.8643	(99)
Energy for space cooling												1.5931	(108)
Total												42.4574	(109)
Dwelling Fabric Energy Efficiency (DFEE)												42.5	(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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1501 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3701 (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	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349	(22b)				
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Built)

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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast												6.6800	11.2829	0.6300	0.7000	0.7700	23.0341
Southwest												3.5300	36.7938	0.6300	0.7000	0.7700	39.6937 (75)
Solar gains	62.7278	114.4996	176.9857	253.3573	314.8728	326.2719	308.8696	260.8854	203.1036	132.0259	76.5267	52.7803	(83)				
Total gains	406.5477	456.8341	507.1942	563.7387	604.3797	596.4006	566.9155	522.8937	475.7631	424.6478	392.0294	386.1560	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642		
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976		
util living area	0.9991	0.9981	0.9951	0.9823	0.9351	0.8058	0.6393	0.7048	0.9192	0.9900	0.9982	0.9993	(86)	
MIT	19.7179	19.8447	20.0750	20.4020	20.7086	20.9168	20.9809	20.9689	20.8106	20.4228	20.0189	19.7021	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)	
util rest of house	0.9988	0.9975	0.9932	0.9748	0.9053	0.7231	0.5111	0.5786	0.8696	0.9845	0.9974	0.9991	(89)	
MIT 2	18.8118	18.9408	19.1725	19.5064	19.7987	19.9789	20.0153	20.0129	19.8998	19.5314	19.1258	18.8050	(90)	
Living area fraction									fLA = Living area / (4) =			0.2664	(91)	
MIT	19.0532	19.1816	19.4130	19.7450	20.0411	20.2288	20.2726	20.2676	20.1425	19.7689	19.3638	19.0440	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0532	19.1816	19.4130	19.7450	20.0411	20.2288	20.2726	20.2676	20.1425	19.7689	19.3638	19.0440	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	405.8835	455.3388	502.9859	548.0728	547.8698	442.8949	309.4174	320.3567	417.3989	417.2899	390.7430	385.6775	(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	1317.0800	1270.9064	1145.5006	947.8198	726.9362	484.1209	315.8702	331.8263	522.3602	799.0824	1074.8961	1308.7611	(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	(98a)	
Space heating kWh	677.9302	548.0614	478.0309	287.8178	133.2254	0.0000	0.0000	0.0000	0.0000	284.0536	492.5903	686.7742	(98)	
Space heating												3588.4839	(98)	
Space heating per m2										(98) / (4) =		44.8897	(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	808.4733	636.4577	652.0501	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8313	0.9031	0.8719	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.0755	574.7620	568.5080	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	789.6847	753.3877	703.7334	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	84.6786	132.8975	100.6077	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												318.1838	(104)	

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	21.1696	33.2244	25.1519	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												79.5459 (107)
Space cooling per m2												0.9951 (108)
Energy for space heating												44.8897 (99)
Energy for space cooling												0.9951 (108)
Total												45.8848 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50															4.8800		
Infiltration rate															0.4442 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4108 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)					
Adj infilt rate	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)					
	0.4314	0.4006	0.4108	0.3903	0.3903	0.3800	0.3698	0.3595	0.3492	0.3800	0.3595	0.3800 (22b)					
Effective ac	0.5930	0.5802	0.5844	0.5762	0.5762	0.5722	0.5684	0.5646	0.5610	0.5722	0.5646	0.5722 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	0.6400	1.3760			(26)				
Window (Uw = 1.30)			5.7000	1.2357	7.0437			(27)				
French Door (Uw = 1.30)			4.5100	1.2357	5.5732			(27)				
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500	(28a)				
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200	(29a)				
EW Brick AAC018		9.7500	4.5100	0.2600	1.3624	60.0000	314.4000	(29a)				
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300	(30)				
Total net area of external elements Aum(A, m2)			169.7400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764			(33)				
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000	(32)				
GF Masonry			14.8700			39.0000	579.9300	(32c)				
GF Timber			73.8000			9.0000	664.2000	(32c)				
1F Timber			75.9100			9.0000	683.1900	(32c)				
Internal Floor			39.9700			18.0000	719.4600	(32d)				
Internal Ceiling			39.9700			9.0000	359.7300	(32e)				
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	11923.0100 (34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								149.1495 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.1498 (36)				
Total fabric heat loss						(33) + (36) =	47.0262	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.1116	Feb 38.2663	Mar 38.5411	Apr 37.9984	May 37.9984	Jun 37.7375	Jul 37.4836	Aug 37.2366	Sep 36.9966	Oct 37.7375	Nov 37.2366	Dec 37.7375 (38)
Heat transfer coeff	86.1378	85.2925	85.5673	85.0246	85.0246	84.7637	84.5098	84.2628	84.0228	84.7637	84.2628	84.7637 (39)
Average = Sum(39)m / 12 =												84.8664 (39)
HLP	Jan 1.0775	Feb 1.0670	Mar 1.0704	Apr 1.0636	May 1.0636	Jun 1.0603	Jul 1.0572	Aug 1.0541	Sep 1.0511	Oct 1.0603	Nov 1.0541	Dec 1.0603 (40)
HLP (average)												1.0616 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
Northeast				2.1700	14.6176	0.4600	0.0000	0.7700			11.2353 (75)	
Southwest				3.5300	45.1778	0.4600	0.0000	0.7700			56.4870 (79)	
Northeast				4.5100	14.6176	0.4600	0.0000	0.7700			23.3508 (75)	
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976	75.2330 (83)
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165	617.7549 (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	38.4494	38.8305	38.7058	38.9528	38.9528	39.0727	39.1901	39.3050	39.4172	39.0727	39.3050	39.0727
alpha	3.5633	3.5887	3.5804	3.5969	3.5969	3.6048	3.6127	3.6203	3.6278	3.6048	3.6203	3.6048
util living area	0.9634	0.9519	0.9197	0.8453	0.7174	0.5271	0.3932	0.4138	0.6549	0.8592	0.9403	0.9671 (86)
MIT	19.6598	19.8049	20.1111	20.4983	20.7949	20.9501	20.9868	20.9846	20.8908	20.5553	20.0866	19.6590 (87)
Th 2	20.0192	20.0279	20.0251	20.0307	20.0307	20.0334	20.0360	20.0385	20.0410	20.0334	20.0385	20.0334 (88)
util rest of house	0.9563	0.9428	0.9041	0.8152	0.6635	0.4487	0.3000	0.3167	0.5794	0.8244	0.9271	0.9607 (89)
MIT 2	18.2622	18.4754	18.9082	19.4452	19.8257	19.9972	20.0300	20.0314	19.9502	19.5352	18.8893	18.2711 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.6346	18.8297	19.2287	19.7258	20.0840	20.2511	20.2849	20.2854	20.2008	19.8070	19.2083	18.6409 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4846	18.6797	19.0787	19.5758	19.9340	20.1011	20.1349	20.1354	20.0508	19.6570	19.0583	18.4909 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9416	0.9265	0.8855	0.7990	0.6577	0.4544	0.3098	0.3267	0.5802	0.8084	0.9098	0.9469 (94)
Ext temp.	610.7945	643.9622	667.8105	655.6438	556.0984	392.1820	253.8131	252.6316	414.3824	528.9035	568.8417	584.9778 (95)
Heat loss rate W	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)
Month fracti	1170.1456	1141.1845	1033.5443	856.6894	632.0712	406.9567	256.4796	255.7699	449.5920	699.8950	940.2335	1143.5434 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
RHI space heating demand	416.1572	334.1334	272.1060	144.7528	56.5238	0.0000	0.0000	0.0000	0.0000	127.2177	267.4021	415.5728 (98)
												2033.8658 (98)
												2034 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.8800	
Infiltration rate																0.4442 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.4108 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.5238	0.5135	0.5033	0.4519	0.4417	0.3903	0.3903	0.3800	0.4108	0.4417	0.4622	0.4827	(22b)				
Effective ac	0.6372	0.6319	0.6266	0.6021	0.5975	0.5762	0.5762	0.5722	0.5844	0.5975	0.6068	0.6165	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.1500	0.6400	1.3760			(26)					
Window (Uw = 1.30)			5.7000	1.2357	7.0437			(27)					
French Door (Uw = 1.30)			4.5100	1.2357	5.5732			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500	(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200	(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000	(29a)					
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300	(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764			(33)					
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000	(32)					
GF Masonry			14.8700			39.0000	579.9300	(32c)					
GF Timber			73.8000			9.0000	664.2000	(32c)					
1F Timber			75.9100			9.0000	683.1900	(32c)					
Internal Floor			39.9700			18.0000	719.4600	(32d)					
Internal Ceiling			39.9700			9.0000	359.7300	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	11923.0100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								149.1495 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.1498 (36)					
Total fabric heat loss						(33) + (36) =		47.0262 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.0232	Feb 41.6719	Mar 41.3275	Apr 39.7099	May 39.4073	Jun 37.9984	Jul 37.9984	Aug 37.7375	Sep 38.5411	Oct 39.4073	Nov 40.0195	Dec 40.6596	(38)
Heat transfer coeff	89.0494	88.6981	88.3537	86.7361	86.4335	85.0246	85.0246	84.7637	85.5673	86.4335	87.0457	87.6858	(39)
Average = Sum(39)m / 12 =												86.7347	(39)
HLP	Jan 1.1140	Feb 1.1096	Mar 1.1053	Apr 1.0850	May 1.0812	Jun 1.0636	Jul 1.0636	Aug 1.0603	Sep 1.0704	Oct 1.0812	Nov 1.0889	Dec 1.0969	(40)
HLP (average)												1.0850	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.1700	11.2829	0.4600	0.0000	0.7700	8.6722 (75)			
Southwest				3.5300	36.7938	0.4600	0.0000	0.7700	46.0043 (79)			
Northeast				4.5100	11.2829	0.4600	0.0000	0.7700	18.0238 (75)			
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	630.3135	685.5834	736.1115	790.9554	827.9267	810.5758	772.7485	725.7504	678.3616	629.8648	603.0121	603.6934 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.1922	37.3395	37.4851	38.1842	38.3179	38.9528	38.9528	39.0727	38.7058	38.3179	38.0484	37.7706
util living area	3.4795	3.4893	3.4990	3.5456	3.5545	3.5969	3.5969	3.6048	3.5804	3.5545	3.5366	3.5180
	0.9703	0.9583	0.9333	0.8751	0.7688	0.6087	0.4651	0.5092	0.7245	0.8946	0.9554	0.9739 (86)
MIT	19.4751	19.6554	19.9628	20.3727	20.7059	20.9103	20.9740	20.9640	20.8256	20.4106	19.8885	19.4512 (87)
Th 2	19.9895	19.9930	19.9965	20.0131	20.0162	20.0307	20.0307	20.0334	20.0251	20.0162	20.0099	20.0034 (88)
util rest of house	0.9646	0.9503	0.9201	0.8499	0.7223	0.5346	0.3703	0.4130	0.6570	0.8680	0.9455	0.9689 (89)
MIT 2	17.9764	18.2379	18.6793	19.2632	19.7054	19.9572	20.0164	20.0121	19.8668	19.3286	18.5880	17.9511 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.3757	18.6156	19.0213	19.5588	19.9720	20.2112	20.2715	20.2657	20.1223	19.6169	18.9346	18.3508 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2257	18.4656	18.8713	19.4088	19.8220	20.0612	20.1215	20.1157	19.9723	19.4669	18.7846	18.2008 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9510	0.9343	0.9015	0.8317	0.7121	0.5371	0.3795	0.4216	0.6529	0.8499	0.9293	0.9564 (94)
Ext temp.	599.3994	640.5464	663.5911	657.8433	589.5792	435.3614	293.2806	305.9699	442.9346	535.3042	560.3851	577.3690 (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	1240.0756	1203.2430	1093.0478	911.4956	702.0101	464.3361	299.4176	314.9566	502.4769	766.3988	1017.0911	1227.6718 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	476.6631	378.1321	319.5158	182.6296	83.6486	0.0000	0.0000	0.0000	0.0000	171.9344	328.8284	483.8253 (98)
Space heating per m2												2425.1771 (98)
										(98) / (4) =		30.3375 (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													2679.7538 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	476.6631	378.1321	319.5158	182.6296	83.6486	0.0000	0.0000	0.0000	0.0000	171.9344	328.8284	483.8253	(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)	526.6996	417.8255	353.0561	201.8007	92.4294	0.0000	0.0000	0.0000	0.0000	189.9827	363.3463	534.6136	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.6539	89.5900	89.4502	89.1263	88.5366	87.3000	87.3000	87.3000	87.3000	89.0493	89.4799	89.6811	(216)
Fuel for water heating, kWh/month	184.3560	161.7870	168.2422	148.6792	144.7099	128.2841	120.5010	135.9628	136.9009	154.4485	165.8909	178.9686	(217)
Water heating fuel used												1828.7310	(219)
Annual totals kWh/year													
Space heating fuel - main system												2679.7538	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												3886.5884	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2679.7538	3.4800	93.2554 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.7310	3.4800	63.6398 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	378.0032	13.1900	49.8586 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1074.8994	13.1900	-141.7792 (252)
Total energy cost			194.8672 (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] =	0.6551 (257)
SAP value		90.8618
SAP rating (Section 12)		91 (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	2679.7538	0.2160	578.8268 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.7310	0.2160	395.0059 (264)
Space and water heating			973.8327 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			651.0685 (272)
CO2 emissions per m2			8.1400 (273)
EI value			93.0172
EI rating			93 (274)
EI band			A

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	$3.48 / 0.8865 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8865 = 0.2437$, 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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (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) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4442 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4108 (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												
Effective ac	0.4314	0.4006	0.4108	0.3903	0.3903	0.3800	0.3698	0.3595	0.3492	0.3800	0.3595	0.3800 (22b)
	0.5930	0.5802	0.5844	0.5762	0.5762	0.5722	0.5684	0.5646	0.5610	0.5722	0.5646	0.5722 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss							(33) + (36) = 47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1116	38.2663	38.5411	37.9984	37.9984	37.7375	37.4836	37.2366	36.9966	37.7375	37.2366	37.7375 (38)
Average = Sum(39)m / 12 =	86.1378	85.2925	85.5673	85.0246	85.0246	84.7637	84.5098	84.2628	84.0228	84.7637	84.2628	84.7637 (39)
												84.8664 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0775	1.0670	1.0704	1.0636	1.0636	1.0603	1.0572	1.0541	1.0511	1.0603	1.0541	1.0603 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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		
Northeast	2.1700				14.6176		0.4600		0.0000		0.7700		11.2353 (75)
Southwest	3.5300				45.1778		0.4600		0.0000		0.7700		56.4870 (79)
Northeast	4.5100				14.6176		0.4600		0.0000		0.7700		23.3508 (75)
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976	75.2330 (83)	
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165	617.7549 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.4494	38.8305	38.7058	38.9528	38.9528	39.0727	39.1901	39.3050	39.4172	39.0727	39.3050	39.0727
util living area	3.5633	3.5887	3.5804	3.5969	3.5969	3.6048	3.6127	3.6203	3.6278	3.6048	3.6203	3.6048
	0.9634	0.9519	0.9197	0.8453	0.7174	0.5271	0.3932	0.4138	0.6549	0.8592	0.9403	0.9671 (86)
MIT	19.6598	19.8049	20.1111	20.4983	20.7949	20.9501	20.9868	20.9846	20.8908	20.5553	20.0866	19.6590 (87)
Th 2	20.0192	20.0279	20.0251	20.0307	20.0307	20.0334	20.0360	20.0385	20.0410	20.0334	20.0385	20.0334 (88)
util rest of house	0.9563	0.9428	0.9041	0.8152	0.6635	0.4487	0.3000	0.3167	0.5794	0.8244	0.9271	0.9607 (89)
MIT 2	18.2622	18.4754	18.9082	19.4452	19.8257	19.9972	20.0300	20.0314	19.9502	19.5352	18.8893	18.2711 (90)
Living area fraction	18.6346	18.8297	19.2287	19.7258	20.0840	20.2511	20.2849	20.2854	20.2008	19.8070	19.2083	18.6409 (92)
MIT	18.6346	18.8297	19.2287	19.7258	20.0840	20.2511	20.2849	20.2854	20.2008	19.8070	19.2083	18.6409 (92)
Temperature adjustment	18.4846	18.6797	19.0787	19.5758	19.9340	20.1011	20.1349	20.1354	20.0508	19.6570	19.0583	-0.1500
adjusted MIT	18.4846	18.6797	19.0787	19.5758	19.9340	20.1011	20.1349	20.1354	20.0508	19.6570	19.0583	18.4909 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9416	0.9265	0.8855	0.7990	0.6577	0.4544	0.3098	0.3267	0.5802	0.8084	0.9098	0.9469 (94)
Ext temp.	610.7945	643.9622	667.8105	655.6438	556.0984	392.1820	253.8131	252.6316	414.3824	528.9035	568.8417	584.9778 (95)
Heat loss rate W	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)
Month fracti	1170.1456	1141.1845	1033.5443	856.6894	632.0712	406.9567	256.4796	255.7699	449.5920	699.8950	940.2335	1143.5434 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	416.1572	334.1334	272.1060	144.7528	56.5238	0.0000	0.0000	0.0000	0.0000	127.2177	267.4021	415.5728 (98)
Space heating per m2												2033.8658 (98)
										(98) / (4) =		25.4424 (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													2247.3655 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	416.1572	334.1334	272.1060	144.7528	56.5238	0.0000	0.0000	0.0000	0.0000	127.2177	267.4021	415.5728	(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)	459.8422	369.2082	300.6696	159.9478	62.4572	0.0000	0.0000	0.0000	0.0000	140.5720	295.4719	459.1965	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.5667	89.5074	89.3339	88.9419	88.2553	87.3000	87.3000	87.3000	87.3000	88.8089	89.3311	89.5851	(216)
Fuel for water heating, kWh/month	184.5353	161.9364	168.4612	148.9875	145.1711	128.2841	120.5010	135.9628	136.9009	154.8666	166.1671	179.1605	(219)
Water heating fuel used												1830.9344	(219)
Annual totals kWh/year													
Space heating fuel - main system												2247.3655	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =										-1220.7247		-1220.7247	(233)
Total delivered energy for all uses												3310.5784	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2247.3655	9.7400	218.8934 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1830.9344	9.7400	178.3330 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	378.0032	36.8500	139.2942 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1220.7247	36.8500	-449.8370 (252)
Total energy cost			218.3210 (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	2247.3655	0.2160	485.4310 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1830.9344	0.2160	395.4818 (264)
Space and water heating			880.9128 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			482.4653 (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	2247.3655	1.2200	2741.7859 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1830.9344	1.2200	2233.7400 (264)
Space and water heating			4975.5259 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			2618.6209 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

32.7573 (273)

SAP 2012 EPC IMPROVEMENTS

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

(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	+ 1.2	-£ 77	-185 kg (38.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.31 kg/m ²	A 92 A 95
Total Savings	£77	2.31 kg/m ²	

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 521 TEST (19 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	£167	£185	-£18
Mains gas	£501	£406	£95
Space heating	£351	£351	£0
Water heating	£178	£102	£77
Lighting	£139	£139	£0
Generated (PV)	-£450	-£450	£0
Total cost of fuels	£218	£141	£77
Total cost of uses	£218	£142	£77
Delivered energy	41 kWh/m ²	30 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m ²	6 kg/m ²	4 kg/m ²	2 kg/m ²
Primary energy	33 kWh/m ²	20 kWh/m ²	13 kWh/m ²

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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4442 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4108 (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	0.5238	0.5135	0.5033	0.4519	0.4417	0.3903	0.3903	0.3800	0.4108	0.4417	0.4622	0.4827 (22b)
Effective ac	0.6372	0.6319	0.6266	0.6021	0.5975	0.5762	0.5762	0.5722	0.5844	0.5975	0.6068	0.6165 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss							(33) + (36) = 47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.0232	41.6719	41.3275	39.7099	39.4073	37.9984	37.9984	37.7375	38.5411	39.4073	40.0195	40.6596 (38)
Average = Sum(39)m / 12 =	89.0494	88.6981	88.3537	86.7361	86.4335	85.0246	85.0246	84.7637	85.5673	86.4335	87.0457	87.6858 (39)
	86.7347 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1140	1.1096	1.1053	1.0850	1.0812	1.0636	1.0636	1.0603	1.0704	1.0812	1.0889	1.0969 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.2439 (H8)
Utilisation factor												0.5524 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-843.6871 (H17)
Solar input	-24.4652	-40.8255	-69.5304	-93.1845	-115.1216	-113.1828	-111.6871	-97.5816	-76.4259	-52.1899	-29.0193	-20.4732 (63)
												-843.6871 (63)
Output from w/h	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279 (64)
												787.2219 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				2.1700	11.2829		0.4600	0.0000		0.7700		8.6722 (75)
Southwest				3.5300	36.7938		0.4600	0.0000		0.7700		46.0043 (79)
Northeast				4.5100	11.2829		0.4600	0.0000		0.7700		18.0238 (75)
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	630.3135	685.5834	736.1115	790.9554	827.9267	810.5758	772.7485	725.7504	678.3616	629.8648	603.0121	603.6934 (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	37.1922	37.3395	37.4851	38.1842	38.3179	38.9528	38.9528	39.0727	38.7058	38.3179	38.0484	37.7706
alpha	3.4795	3.4893	3.4990	3.5456	3.5545	3.5969	3.5969	3.6048	3.5804	3.5545	3.5366	3.5180
util living area	0.9703	0.9583	0.9333	0.8751	0.7688	0.6087	0.4651	0.5092	0.7245	0.8946	0.9554	0.9739 (86)
MIT	19.4751	19.6554	19.9628	20.3727	20.7059	20.9103	20.9740	20.9640	20.8256	20.4106	19.8885	19.4512 (87)
Th 2	19.9895	19.9930	19.9965	20.0131	20.0162	20.0307	20.0307	20.0334	20.0251	20.0162	20.0099	20.0034 (88)
util rest of house	0.9646	0.9503	0.9201	0.8499	0.7223	0.5346	0.3703	0.4130	0.6570	0.8680	0.9455	0.9689 (89)
MIT 2	17.9764	18.2379	18.6793	19.2632	19.7054	19.9572	20.0164	20.0121	19.8668	19.3286	18.5880	17.9511 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.3757	18.6156	19.0213	19.5588	19.9720	20.2112	20.2715	20.2657	20.1223	19.6169	18.9346	18.3508 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2257	18.4656	18.8713	19.4088	19.8220	20.0612	20.1215	20.1157	19.9723	19.4669	18.7846	18.2008 (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	0.9510	0.9343	0.9015	0.8317	0.7121	0.5371	0.3795	0.4216	0.6529	0.8499	0.9293	0.9564	(94)
Useful gains	599.3994	640.5464	663.5911	657.8433	589.5792	435.3614	293.2806	305.9699	442.9346	535.3042	560.3851	577.3690	(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	1240.0756	1203.2430	1093.0478	911.4956	702.0101	464.3361	299.4176	314.9566	502.4769	766.3988	1017.0911	1227.6718	(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	476.6631	378.1321	319.5158	182.6296	83.6486	0.0000	0.0000	0.0000	0.0000	171.9344	328.8284	483.8253	(98)
Space heating												2425.1771	(98)
Space heating per m2											(98) / (4) =	30.3375	(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													2679.7538	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	476.6631	378.1321	319.5158	182.6296	83.6486	0.0000	0.0000	0.0000	0.0000	171.9344	328.8284	483.8253	(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)	526.6996	417.8255	353.0561	201.8007	92.4294	0.0000	0.0000	0.0000	0.0000	189.9827	363.3463	534.6136	(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	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279	(64)	
Efficiency of water heater	89.7498	89.7894	89.8343	89.9160	90.0560	87.3000	87.3000	87.3000	87.3000	89.4128	89.6248	87.3000	(216)	
(217)m	89.7498	89.7894	89.8343	89.9160	90.0560	87.3000	87.3000	87.3000	87.3000	89.4128	89.6248	87.3000	(217)	
Fuel for water heating, kWh/month	156.8996	115.9597	90.1242	43.7384	14.4350	0.0000	0.0000	24.1855	49.3568	95.4510	133.2441	156.0000	(219)	
Water heating fuel used												879.3944	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2679.7538	(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)													378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)	
Total delivered energy for all uses												2987.2518	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2679.7538	3.4800	93.2554	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.3944	3.4800	30.6029	(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	378.0032	13.1900	49.8586	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1074.8994	13.1900	-141.7792	(252)
Total energy cost			168.4252	(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] =	0.5662	(257)
SAP value		92.1018	
SAP rating (Section 12)		92	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2679.7538	0.2160	578.8268	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	879.3944	0.2160	189.9492	(264)
Space and water heating			768.7760	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)
Energy saving/generation technologies				
PV Unit	-1074.8994	0.5190	-557.8728	(269)
Total kg/year			471.9618	(272)
CO2 emissions per m2			5.9000	(273)
EI value			94.9381	
EI rating			95	(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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test										Yes							
Measured/design AP50										4.8800							
Infiltration rate										0.4442 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4108 (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	0.4314	0.4006	0.4108	0.3903	0.3903	0.3800	0.3698	0.3595	0.3492	0.3800	0.3595	0.3800 (22b)					
Effective ac	0.5930	0.5802	0.5844	0.5762	0.5762	0.5722	0.5684	0.5646	0.5610	0.5722	0.5646	0.5722 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	39.1116	38.2663	38.5411	37.9984	37.9984	37.7375	37.4836	37.2366	36.9966	37.7375	37.2366	37.7375 (38)
Heat transfer coeff	86.1378	85.2925	85.5673	85.0246	85.0246	84.7637	84.5098	84.2628	84.0228	84.7637	84.2628	84.7637 (39)
Average = Sum(39)m / 12 =												84.8664 (39)
HLP	1.0775	1.0670	1.0704	1.0636	1.0636	1.0603	1.0572	1.0541	1.0511	1.0603	1.0541	1.0603 (40)
HLP (average)												1.0616 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.3921 (H8)
Utilisation factor												0.5124 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input	-28.5725	-40.6283	-69.8302	-94.2171	-110.6637	-118.2063	-115.7204	-103.5733	-81.0907	-56.0633	-33.7937	-875.8544 (H17)
Solar input (sum of months) = Sum (63)m =												-23.4949 (63)
Output from w/h	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062 (64)
Total per year (kWh/year) = Sum (64)m =												764.1114 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				2.1700	14.6176		0.4600		0.0000		0.7700		11.2353 (75)
Southwest				3.5300	45.1778		0.4600		0.0000		0.7700		56.4870 (79)
Northeast				4.5100	14.6176		0.4600		0.0000		0.7700		23.3508 (75)
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976		75.2330 (83)
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165		617.7549 (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	38.4494	38.8305	38.7058	38.9528	38.9528	39.0727	39.1901	39.3050	39.4172	39.0727	39.3050	39.0727	
alpha	3.5633	3.5887	3.5804	3.5969	3.5969	3.6048	3.6127	3.6203	3.6278	3.6048	3.6203	3.6048	
util living area													
	0.9634	0.9519	0.9197	0.8453	0.7174	0.5271	0.3932	0.4138	0.6549	0.8592	0.9403	0.9671	(86)
MIT	19.6598	19.8049	20.1111	20.4983	20.7949	20.9501	20.9868	20.9846	20.8908	20.5553	20.0866	19.6590	(87)
Th 2	20.0192	20.0279	20.0251	20.0307	20.0307	20.0334	20.0360	20.0385	20.0410	20.0334	20.0385	20.0334	(88)
util rest of house													
	0.9563	0.9428	0.9041	0.8152	0.6635	0.4487	0.3000	0.3167	0.5794	0.8244	0.9271	0.9607	(89)
MIT 2	18.2622	18.4754	18.9082	19.4452	19.8257	19.9972	20.0300	20.0314	19.9502	19.5352	18.8893	18.2711	(90)
Living area fraction													
MIT	18.6346	18.8297	19.2287	19.7258	20.0840	20.2511	20.2849	20.2854	20.2008	19.8070	19.2083	18.6409	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.4846	18.6797	19.0787	19.5758	19.9340	20.1011	20.1349	20.1354	20.0508	19.6570	19.0583	18.4909	(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	0.9416	0.9265	0.8855	0.7990	0.6577	0.4544	0.3098	0.3267	0.5802	0.8084	0.9098	0.9469	(94)
Useful gains	610.7945	643.9622	667.8105	655.6438	556.0984	392.1820	253.8131	252.6316	414.3824	528.9035	568.8417	584.9778	(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	1170.1456	1141.1845	1033.5443	856.6894	632.0712	406.9567	256.4796	255.7699	449.5920	699.8950	940.2335	1143.5434	(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	416.1572	334.1334	272.1060	144.7528	56.5238	0.0000	0.0000	0.0000	0.0000	127.2177	267.4021	415.5728	(98)
Space heating												2033.8658	(98)
Space heating per m2											(98) / (4) =	25.4424	(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													2247.3655 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	416.1572	334.1334	272.1060	144.7528	56.5238	0.0000	0.0000	0.0000	0.0000	127.2177	267.4021	415.5728	(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)	459.8422	369.2082	300.6696	159.9478	62.4572	0.0000	0.0000	0.0000	0.0000	140.5720	295.4719	459.1965	(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	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062	(64)
Efficiency of water heater	89.6871	89.7176	89.7478	89.8113	89.7239	87.3000	87.3000	87.3000	87.3000	89.2232	89.5154	89.6849	(216)
Fuel for water heating, kWh/month	152.4297	116.2724	89.8771	42.6396	19.4569	0.0000	0.0000	17.3222	44.0135	91.3126	128.0733	152.7639	(219)
Water heating fuel used												854.1611	(219)
Annual totals kWh/year													
Space heating fuel - main system												2247.3655	(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)													378.0032 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =									-1220.7247			-1220.7247	(233)
Total delivered energy for all uses												2383.8051	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2247.3655	9.7400	218.8934	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.1611	9.7400	83.1953	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	378.0032	36.8500	139.2942	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1220.7247	36.8500	-449.8370	(252)
Total energy cost			141.6083	(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	2247.3655	0.2160	485.4310	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.1611	0.2160	184.4988	(264)
Space and water heating			669.9298	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)

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 saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			297.4323 (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	2247.3655	1.2200	2741.7859 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	854.1611	1.2200	1042.0766 (264)
Space and water heating			3783.8625 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			1580.4575 (272)
Primary energy kWh/m2/year			19.7705 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	149.1 (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	263.80 (P1)
Transmission heat loss coefficient	47.03 (37)
Summer heat loss coefficient	310.83 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.1700	98.8453	0.4600	0.0000	0.9000	88.8006
South West	3.5300	119.9223	0.4600	0.0000	0.9000	175.2569
North East	4.5100	98.8453	0.4600	0.0000	0.9000	184.5580
total:						448.6155

	Jun	Jul	Aug	
Solar gains	479	449	387	(P4)
Internal gains	429	412	420	
Total summer gains	909	860	808	(P5)

	2.92	2.77	2.60	(P6)
Summer gain/loss ratio				
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 149.1)	0.96	0.96	0.96	
Threshold temperature	19.88	21.62	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-652			Issued on Date	27/06/2023
Assessment Reference	As Built	Prop Type Ref	Coiner-CB-As-SEMI		
Property	4, Flycatcher Road , BOTLEY, SO32 2FG				
SAP Rating	92 A	DER	8.41	TER	18.80
Environmental	94 A	% DER<TER	55.27		
CO ₂ Emissions (t/year)	0.37	DFEE	42.05	TFEE	52.77
General Requirements Compliance	Pass	% DFEE<TFEE	20.31		
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk			Assessor ID	Q919-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 80 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) 18.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.41 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.30 (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: 4.48 (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 North East: 6.68 m², No overhang
Windows facing South West: 3.53 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 0.64 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 1.48 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys										0	+	0	+	0 = 0 * 40 = 0.0000 (6a)
Number of open flues										0	+	0	+	0 = 0 * 20 = 0.0000 (6b)
Number of intermittent fans														4 * 10 = 40.0000 (7a)
Number of passive vents														0 * 10 = 0.0000 (7b)
Number of flueless gas fires														0 * 40 = 0.0000 (7c)
										Air changes per hour				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) = 0.2002 (8)				
Pressure test										Yes				
Measured/design AP50										4.4800				
Infiltration rate										0.4242 (18)				
Number of sides sheltered										1 (19)				
Shelter factor										(20) = 1 - [0.075 x (19)] = 0.9250 (20)				
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) = 0.3923 (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	0.5002	0.4904	0.4806	0.4316	0.4218	0.3727	0.3727	0.3629	0.3923	0.4218	0.4414	0.4610 (22b)		
Effective ac	0.6251	0.6203	0.6155	0.5931	0.5889	0.5695	0.5695	0.5659	0.5770	0.5889	0.5974	0.6063 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	41.2267	40.9063	40.5922	39.1171	38.8411	37.5562	37.5562	37.3183	38.0511	38.8411	39.3994	39.9831 (38)
Heat transfer coeff	88.2529	87.9325	87.6185	86.1433	85.8673	84.5824	84.5824	84.3445	85.0773	85.8673	86.4256	87.0093 (39)
Average = Sum(39)m / 12 =												86.1420 (39)
HLP	1.1040	1.1000	1.0961	1.0776	1.0741	1.0581	1.0581	1.0551	1.0643	1.0741	1.0811	1.0884 (40)
HLP (average)												1.0776 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1457.9953 (45)											
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 1623.2284 (64)											
	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	375.9454	373.6816	359.9393	337.9173	315.6170	294.2333	280.4489	286.5947	298.0240	320.2577	345.7036	364.7281	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.1700	11.2829	0.4600	0.0000	0.7700	8.6722 (75)			
Southwest				3.5300	36.7938	0.4600	0.0000	0.7700	46.0043 (79)			
Northeast				4.5100	11.2829	0.4600	0.0000	0.7700	18.0238 (75)			
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	448.6458	506.3845	565.0626	631.5539	680.5490	672.3767	638.4232	588.9562	533.4174	473.2733	434.3967	425.8995 (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	37.5279	37.6646	37.7997	38.4470	38.5705	39.1564	39.1564	39.2669	38.9287	38.5705	38.3214	38.0643	
alpha	3.5019	3.5110	3.5200	3.5631	3.5714	3.6104	3.6104	3.6178	3.5952	3.5714	3.5548	3.5376	
util living area	0.9891	0.9824	0.9671	0.9264	0.8390	0.6916	0.5452	0.6007	0.8182	0.9485	0.9827	0.9909	(86)
MIT	19.2011	19.3947	19.7329	20.1957	20.5993	20.8650	20.9573	20.9394	20.7342	20.2181	19.6391	19.1766	(87)
Th 2	19.9976	20.0008	20.0041	20.0192	20.0220	20.0352	20.0352	20.0377	20.0301	20.0220	20.0163	20.0103	(88)
util rest of house	0.9869	0.9788	0.9598	0.9092	0.7999	0.6174	0.4403	0.4961	0.7601	0.9331	0.9784	0.9890	(89)
MIT 2	17.5865	17.8698	18.3613	19.0308	19.5831	19.9198	20.0107	19.9998	19.7740	19.0745	18.2370	17.5587	(90)
Living area fraction	18.0167	18.2761	18.7268	19.3412	19.8538	20.1716	20.2629	20.2502	20.0298	19.3792	18.6106	17.9898	(91)
MIT	17.8667	18.1261	18.5768	19.1912	19.7038	20.0216	20.1129	20.1002	19.8798	19.2292	18.4606	17.8398	(92)
Temperature adjustment													-0.1500
adjusted MIT													17.8398 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	439.5173	490.5821	534.3216	562.6339	534.2779	414.3830	286.7861	296.5135	399.7947	433.6863	420.7207	418.5552	(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	1197.3048	1163.0055	1058.1498	886.5176	687.2687	458.5753	297.1300	312.0886	491.7298	740.9648	981.8475	1186.7886	(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	563.7939	451.8686	389.7282	233.1963	113.8252	0.0000	0.0000	0.0000	0.0000	228.6152	404.0113	571.5656	(98)
Space heating													2956.6042 (98)
Space heating per m2													(98) / (4) = 36.9853 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													3266.9660 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	563.7939	451.8686	389.7282	233.1963	113.8252	0.0000	0.0000	0.0000	0.0000	228.6152	404.0113	571.5656	(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)	622.9767	499.3023	430.6389	257.6754	125.7737	0.0000	0.0000	0.0000	0.0000	252.6135	446.4213	631.5642	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.7542	89.7015	89.5852	89.3138	88.7768	87.3000	87.3000	87.3000	87.3000	89.2709	89.6174	89.7785	(216)
Fuel for water heating, kWh/month	184.1500	161.5860	167.9885	148.3672	144.3183	128.2841	120.5010	135.9628	136.9009	154.0652	165.6365	178.7746	(219)
Water heating fuel used													1826.5349 (219)
Annual totals kWh/year													
Space heating fuel - main system													3266.9660 (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)													378.0032 (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													4268.3469 (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	3266.9660	0.2160	705.6647	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.5349	0.2160	394.5315	(264)
Space and water heating			1100.1962	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)
Energy saving/generation technologies				
PV Unit	-1278.1572	0.5190	-663.3636	(269)
Total CO2, kg/year			671.9413	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4100	(273)

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

DER			8.4100	ZC1
Total Floor Area		TFA	79.9400	
Assumed number of occupants		N	2.4617	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.2574	ZC2
CO2 emissions from cooking, equation (L16)			2.2277	ZC3
Total CO2 emissions			26.8951	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			26.8951	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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														3 * 10 = 30.0000 (7a)
Number of passive vents														0 * 10 = 0.0000 (7b)
Number of flueless gas fires														0 * 40 = 0.0000 (7c)
										Air changes per hour				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) = 0.1501 (8)				
Pressure test										Yes				
Measured/design AP50										5.0000				
Infiltration rate										0.4001 (18)				
Number of sides sheltered										1 (19)				
Shelter factor										(20) = 1 - [0.075 x (19)] = 0.9250 (20)				
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) = 0.3701 (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	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349 (22b)		
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946 (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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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 EMISSIONS 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	0.0000	0.0000	(57)
Combi loss	50.9589	45.2108	48.1660	44.7843	44.3882	41.1284	42.4994	44.3882	44.7843	48.1660	48.4401	50.9589	(61)	
Total heat required for water heating calculated for each month	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
Heat gains from water heating, kWh/month	63.0014	55.2619	57.4034	50.7437	49.0440	43.0274	40.9682	45.9165	46.4313	53.1048	56.9338	61.4155	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	84.6793	82.2349	77.1551	70.4774	65.9193	59.7603	55.0647	61.7157	64.4880	71.3774	79.0748	82.5477	(72)
Total internal gains	388.3243	385.7626	371.3976	348.7549	325.8298	303.8231	290.0457	296.8140	308.8714	331.7259	357.7903	377.1108	(73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Table 6b		Table 6c		factor		W	
					W/m2		or		or Table 6c		Table 6d			
Northeast	6.6800				11.2829		0.6300		0.7000		0.7700		23.0341	
Southwest	3.5300				36.7938		0.6300		0.7000		0.7700		39.6937 (75)	
Solar gains	62.7278	114.4996	176.9857	253.3573	314.8728	326.2719	308.8696	260.8854	203.1036	132.0259	76.5267	52.7803	(83)	
Total gains	451.0521	500.2622	548.3833	602.1122	640.7026	630.0950	598.9153	557.6994	511.9750	463.7517	434.3170	429.8911	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642	
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976	
util living area	0.9985	0.9971	0.9930	0.9767	0.9207	0.7795	0.6103	0.6705	0.8975	0.9853	0.9970	0.9989	(86)
MIT	19.7701	19.8954	20.1221	20.4428	20.7380	20.9294	20.9846	20.9753	20.8370	20.4662	20.0683	19.7536	(87)
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)
util rest of house	0.9980	0.9961	0.9904	0.9672	0.8866	0.6941	0.4854	0.5460	0.8403	0.9775	0.9958	0.9985	(89)
MIT 2	18.3420	18.5271	18.8595	19.3312	19.7373	19.9702	20.0145	20.0117	19.8746	19.3710	18.7900	18.3259	(90)
Living area fraction	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(91)
MIT	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7225	18.8917	19.1959	19.6273	20.0039	20.2258	20.2730	20.2685	20.1310	19.6628	19.1306	18.7063	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	449.7229	497.5414	541.4980	579.4666	567.9103	449.7169	310.7922	323.0404	434.3269	451.5981	431.8213	428.9029	(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	1287.5581	1245.1051	1126.2489	937.5351	723.6972	483.8616	315.9035	331.8993	521.3699	789.8314	1054.4608	1278.9838	(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	623.3494	502.3628	435.0546	257.8094	115.9054	0.0000	0.0000	0.0000	0.0000	251.6456	448.3004	632.4602	(98)
Space heating												3266.8877	(98)
Space heating per m2												40.8667	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3497.7384 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	623.3494	502.3628	435.0546	257.8094	115.9054	0.0000	0.0000	0.0000	0.0000	251.6456	448.3004	632.4602	(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)	667.3976	537.8616	465.7972	276.0272	124.0957	0.0000	0.0000	0.0000	0.0000	269.4278	479.9790	677.1522	(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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(64)
Efficiency of water heater (217)m	87.6991	87.5267	87.1351	86.1894	84.2770	80.3000	80.3000	80.3000	80.3000	86.0128	87.2170	80.3000	(216)
Fuel for water heating, kWh/month	230.4720	202.7025	211.8467	189.9590	188.0873	173.8611	166.5722	185.6890	187.7397	199.5804	210.1065	224.8403	(219)
Water heating fuel used												2371.4566	(219)
Annual totals kWh/year													
Space heating fuel - main system												3497.7384	(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)												378.0032	(232)
Total delivered energy for all uses												6322.1982	(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	3497.7384	0.2160	755.5115 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2371.4566	0.2160	512.2346 (264)
Space and water heating			1267.7461 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/m2/year			1502.8548 (272)
Emissions per m2 for space and water heating			15.8587 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4541 (272b)
Emissions per m2 for pumps and fans			0.4869 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8587 * 1.00) + 2.4541 + 0.4869, rounded to 2 d.p.			18.8000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1501 (8)
Pressure test										Yes							
Measured/design AP50																	4.4800
Infiltration rate																	0.3741 (18)
Number of sides sheltered																	1 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3461 (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	0.4412	0.4326	0.4239	0.3807	0.3720	0.3288	0.3288	0.3201	0.3461	0.3720	0.3893	0.4066	(22b)				
Effective ac	0.5973	0.5936	0.5899	0.5725	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	39.3947	39.1454	38.9011	37.7534	37.5387	36.5391	36.5391	36.3540	36.9242	37.5387	37.9731	38.4272 (38)
Heat transfer coeff	86.4209	86.1716	85.9273	84.7796	84.5649	83.5654	83.5654	83.3802	83.9504	84.5649	84.9993	85.4534 (39)
Average = Sum(39)m / 12 =												84.7786 (39)
HLP	1.0811	1.0780	1.0749	1.0605	1.0579	1.0454	1.0454	1.0430	1.0502	1.0579	1.0633	1.0690 (40)
HLP (average)												1.0605 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

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Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	31.1086 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.1700	11.2829	0.4600	0.0000	0.7700	8.6722 (75)			
Southwest				3.5300	36.7938	0.4600	0.0000	0.7700	46.0043 (79)			
Northeast				4.5100	11.2829	0.4600	0.0000	0.7700	18.0238 (75)			
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	416.5203	475.0375	535.3318	604.0180	654.4389	648.2720	616.0203	564.3698	508.0530	445.6376	404.1958	394.5472 (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	38.3235	38.4343	38.5436	39.0654	39.1646	39.6330	39.6330	39.7210	39.4513	39.1646	38.9644	38.7573	
alpha	3.5549	3.5623	3.5696	3.6044	3.6110	3.6422	3.6422	3.6481	3.6301	3.6110	3.5976	3.5838	
util living area	0.9914	0.9854	0.9714	0.9332	0.8487	0.7037	0.5565	0.6158	0.8322	0.9557	0.9860	0.9929	(86)
MIT	19.1895	19.3832	19.7222	20.1833	20.5914	20.8604	20.9558	20.9361	20.7228	20.1979	19.6174	19.1595	(87)
Th 2	20.0163	20.0189	20.0214	20.0332	20.0354	20.0457	20.0457	20.0476	20.0417	20.0354	20.0309	20.0263	(88)
util rest of house	0.9896	0.9824	0.9651	0.9174	0.8112	0.6305	0.4514	0.5113	0.7768	0.9422	0.9825	0.9914	(89)
MIT 2	18.3538	18.5482	18.8856	19.3444	19.7277	19.9635	20.0281	20.0200	19.8571	19.3668	18.7913	18.3315	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5765	18.7707	19.1085	19.5679	19.9578	20.2025	20.2753	20.2640	20.0878	19.5883	19.0114	18.5521	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5765	18.7707	19.1085	19.5679	19.9578	20.2025	20.2753	20.2640	20.0878	19.5883	19.0114	18.5521	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9859	0.9771	0.9575	0.9082	0.8078	0.6435	0.4779	0.5367	0.7798	0.9342	0.9776	0.9883	(94)
Useful gains	410.6676	464.1808	512.5571	548.5487	528.6503	417.1653	294.4210	302.8719	396.1952	416.3251	395.1377	389.9262	(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	1233.7868	1195.2626	1083.4163	904.4231	698.3235	468.1724	307.1297	322.1853	502.6756	760.0922	1012.4636	1226.4353	(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	612.4007	491.2869	424.7193	256.2296	126.2369	0.0000	0.0000	0.0000	0.0000	255.7627	444.4746	622.3628	(98)
Space heating												3233.4735	(98)
Space heating per m2										(98) / (4) =		40.4488	(99)

8c. Space cooling requirement

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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	785.5143	618.3836	633.6899	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8145	0.8764	0.8465	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	639.8326	541.9355	536.4422	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	850.3136	810.7828	752.2120	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	151.5463	200.0224	160.5328	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												512.1015	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.8866	50.0056	40.1332	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												128.0254	(107)
Space cooling per m2												1.6015	(108)
Energy for space heating												40.4488	(99)
Energy for space cooling												1.6015	(108)
Total												42.0503	(109)
Dwelling Fabric Energy Efficiency (DFEE)												42.1	(109)

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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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1501 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3701 (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	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349 (22b)					
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946 (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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 40.0174			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m = 1457.9953		(45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Built)

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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
Northeast					6.6800	11.2829	0.6300	0.7000			0.7700			23.0341	(75)
Southwest					3.5300	36.7938	0.6300	0.7000			0.7700			39.6937	(79)
Solar gains	62.7278	114.4996	176.9857	253.3573	314.8728	326.2719	308.8696	260.8854	203.1036	132.0259	76.5267			52.7803	(83)
Total gains	406.5477	456.8341	507.1942	563.7387	604.3797	596.4006	566.9155	522.8937	475.7631	424.6478	392.0294			386.1560	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642		
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976		
util living area	0.9991	0.9981	0.9951	0.9823	0.9351	0.8058	0.6393	0.7048	0.9192	0.9900	0.9982	0.9993	(86)	
MIT	19.7179	19.8447	20.0750	20.4020	20.7086	20.9168	20.9809	20.9689	20.8106	20.4228	20.0189	19.7021	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)	
util rest of house	0.9988	0.9975	0.9932	0.9748	0.9053	0.7231	0.5111	0.5786	0.8696	0.9845	0.9974	0.9991	(89)	
MIT 2	18.8118	18.9408	19.1725	19.5064	19.7987	19.9789	20.0153	20.0129	19.8998	19.5314	19.1258	18.8050	(90)	
Living area fraction									fLA = Living area / (4) =			0.2664	(91)	
MIT	19.0532	19.1816	19.4130	19.7450	20.0411	20.2288	20.2726	20.2676	20.1425	19.7689	19.3638	19.0440	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0532	19.1816	19.4130	19.7450	20.0411	20.2288	20.2726	20.2676	20.1425	19.7689	19.3638	19.0440	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	405.8835	455.3388	502.9859	548.0728	547.8698	442.8949	309.4174	320.3567	417.3989	417.2899	390.7430	385.6775	(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	1317.0800	1270.9064	1145.5006	947.8198	726.9362	484.1209	315.8702	331.8263	522.3602	799.0824	1074.8961	1308.7611	(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	(98a)	
Space heating kWh	677.9302	548.0614	478.0309	287.8178	133.2254	0.0000	0.0000	0.0000	0.0000	284.0536	492.5903	686.7742	(98)	
Space heating												3588.4839	(98)	
Space heating per m2												44.8897	(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	808.4733	636.4577	652.0501	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8313	0.9031	0.8719	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.0755	574.7620	568.5080	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	789.6847	753.3877	703.7334	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	84.6786	132.8975	100.6077	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												318.1838	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	21.1696	33.2244	25.1519	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												79.5459 (107)
Space cooling per m2												0.9951 (108)
Energy for space heating												44.8897 (99)
Energy for space cooling												0.9951 (108)
Total												45.8848 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.4800	
Infiltration rate																0.4242 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.3923 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4120	0.3825	0.3923	0.3727	0.3727	0.3629	0.3531	0.3433	0.3335	0.3629	0.3433	0.3629	(22b)				
Effective ac	0.5849	0.5732	0.5770	0.5695	0.5695	0.5659	0.5623	0.5589	0.5556	0.5659	0.5589	0.5659	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018		9.7500	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	38.5714	37.8005	38.0511	37.5562	37.5562	37.3183	37.0867	36.8615	36.6426	37.3183	36.8615	37.3183 (38)
Heat transfer coeff	85.5976	84.8267	85.0773	84.5824	84.5824	84.3445	84.1129	83.8877	83.6688	84.3445	83.8877	84.3445 (39)
Average = Sum(39)m / 12 =												84.4381 (39)
HLP	1.0708	1.0611	1.0643	1.0581	1.0581	1.0551	1.0522	1.0494	1.0466	1.0551	1.0494	1.0551 (40)
HLP (average)												1.0563 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
Northeast					2.1700	14.6176	0.4600		0.0000		0.7700	11.2353 (75)
Southwest					3.5300	45.1778	0.4600		0.0000		0.7700	56.4870 (79)
Northeast					4.5100	14.6176	0.4600		0.0000		0.7700	23.3508 (75)
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976	75.2330 (83)
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165	617.7549 (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	38.6920	39.0437	38.9287	39.1564	39.1564	39.2669	39.3750	39.4807	39.5840	39.2669	39.4807	39.2669
alpha	3.5795	3.6029	3.5952	3.6104	3.6104	3.6178	3.6250	3.6320	3.6389	3.6178	3.6320	3.6178
util living area	0.9632	0.9517	0.9192	0.8443	0.7157	0.5252	0.3916	0.4122	0.6533	0.8583	0.9400	0.9670 (86)
MIT	19.6724	19.8156	20.1210	20.5050	20.7987	20.9513	20.9872	20.9850	20.8927	20.5607	20.0938	19.6688 (87)
Th 2	20.0248	20.0327	20.0301	20.0352	20.0352	20.0377	20.0401	20.0424	20.0446	20.0377	20.0424	20.0377 (88)
util rest of house	0.9561	0.9425	0.9035	0.8141	0.6619	0.4472	0.2991	0.3158	0.5780	0.8235	0.9268	0.9606 (89)
MIT 2	18.2840	18.4939	18.9256	19.4576	19.8341	20.0023	20.0342	20.0355	19.9554	19.5457	18.9022	18.2881 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.6539	18.8461	19.2442	19.7367	20.0911	20.2552	20.2881	20.2885	20.2051	19.8161	19.2197	18.6560 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5039	18.6961	19.0942	19.5867	19.9411	20.1052	20.1381	20.1385	20.0551	19.6661	19.0697	18.5060 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9414	0.9262	0.8850	0.7981	0.6562	0.4529	0.3088	0.3257	0.5789	0.8076	0.9096	0.9468 (94)
Ext temp.	610.6913	643.8063	667.4502	654.9018	554.8695	390.8965	252.9575	251.8359	413.4764	528.3848	568.6796	584.9119 (95)
Heat loss rate W	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)
Month fracti	1164.4651	1136.3467	1028.9391	853.1595	629.3882	405.2931	255.5461	254.8894	448.0587	697.2032	937.0002	1139.1567 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	412.0077	330.9872	268.9477	142.7456	55.4419	0.0000	0.0000	0.0000	0.0000	125.6009	265.1908	412.3581 (98)
RHI space heating demand												2013.2799 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.4242 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3923 (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												
Effective ac	0.5002	0.4904	0.4806	0.4316	0.4218	0.3727	0.3727	0.3629	0.3923	0.4218	0.4414	0.4610 (22b)
	0.6251	0.6203	0.6155	0.5931	0.5889	0.5695	0.5695	0.5659	0.5770	0.5889	0.5974	0.6063 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.2267	40.9063	40.5922	39.1171	38.8411	37.5562	37.5562	37.3183	38.0511	38.8411	39.3994	39.9831 (38)
Average = Sum(39)m / 12 =	88.2529	87.9325	87.6185	86.1433	85.8673	84.5824	84.5824	84.3445	85.0773	85.8673	86.4256	87.0093 (39)
												86.1420 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1040	1.1000	1.0961	1.0776	1.0741	1.0581	1.0581	1.0551	1.0643	1.0741	1.0811	1.0884 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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			
Northeast	2.1700			11.2829		0.4600		0.0000		0.7700		8.6722 (75)	
Southwest	3.5300			36.7938		0.4600		0.0000		0.7700		46.0043 (79)	
Northeast	4.5100			11.2829		0.4600		0.0000		0.7700		18.0238 (75)	
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714	(83)
Total gains	630.3135	685.5834	736.1115	790.9554	827.9267	810.5758	772.7485	725.7504	678.3616	629.8648	603.0121	603.6934	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.5279	37.6646	37.7997	38.4470	38.5705	39.1564	39.1564	39.2669	38.9287	38.5705	38.3214	38.0643
util living area	3.5019	3.5110	3.5200	3.5631	3.5714	3.6104	3.6104	3.6178	3.5952	3.5714	3.5548	3.5376
	0.9701	0.9580	0.9327	0.8740	0.7669	0.6067	0.4631	0.5073	0.7227	0.8938	0.9551	0.9738 (86)
MIT	19.4940	19.6731	19.9781	20.3826	20.7120	20.9124	20.9747	20.9649	20.8291	20.4189	19.9010	19.4674 (87)
Th 2	19.9976	20.0008	20.0041	20.0192	20.0220	20.0352	20.0352	20.0377	20.0301	20.0220	20.0163	20.0103 (88)
util rest of house	0.9644	0.9500	0.9195	0.8488	0.7205	0.5330	0.3691	0.4117	0.6553	0.8671	0.9452	0.9688 (89)
MIT 2	18.0089	18.2684	18.7061	19.2811	19.7176	19.9635	20.0213	20.0169	19.8750	19.3441	18.6101	17.9790 (90)
Living area fraction	18.4046	18.6427	19.0450	19.5746	19.9825	20.2163	20.2754	20.2695	20.1292	19.6305	18.9541	18.3756 (92)
MIT												0.2664 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.2546	18.4927	18.8950	19.4246	19.8325	20.0663	20.1254	20.1195	19.9792	19.4805	18.8041	18.2256 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9508	0.9341	0.9010	0.8308	0.7105	0.5355	0.3782	0.4202	0.6514	0.8491	0.9291	0.9563 (94)
Ext temp.	599.3163	640.3702	663.2094	657.1027	588.2673	434.0599	292.2263	304.9682	441.8834	534.8285	560.2339	577.3166 (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	1231.5333	1195.2394	1086.0301	906.6238	698.3187	462.3520	298.1836	313.7189	500.1905	762.5428	1011.5309	1220.3581 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	470.3694	372.8721	314.5786	179.6552	81.8783	0.0000	0.0000	0.0000	0.0000	169.4194	324.9338	478.4229 (98)
Space heating per m2												2392.1297 (98)
										(98) / (4) =		29.9241 (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													2643.2372 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	470.3694	372.8721	314.5786	179.6552	81.8783	0.0000	0.0000	0.0000	0.0000	169.4194	324.9338	478.4229	(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)	519.7452	412.0134	347.6006	198.5140	90.4732	0.0000	0.0000	0.0000	0.0000	187.2038	359.0429	528.6441	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.6456	89.5809	89.4391	89.1134	88.5204	87.3000	87.3000	87.3000	87.3000	89.0377	89.4716	89.6743	(216)
Fuel for water heating, kWh/month	184.3730	161.8035	168.2629	148.7007	144.7363	128.2841	120.5010	135.9628	136.9009	154.4687	165.9063	178.9823	(217)
Water heating fuel used												1828.8826	(219)
Annual totals kWh/year													
Space heating fuel - main system												2643.2372	(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)												378.0032	(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												3646.9658	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2643.2372	3.4800	91.9847 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.8826	3.4800	63.6451 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	378.0032	13.1900	49.8586 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1278.1572	13.1900	-168.5889 (252)
Total energy cost			166.7920 (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] = 0.5607 (257)
SAP value	92.1784
SAP rating (Section 12)	92 (258)
SAP band	A

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	2643.2372	0.2160	570.9392 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.8826	0.2160	395.0386 (264)
Space and water heating			965.9779 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1278.1572	0.5190	-663.3636 (269)
Total kg/year			537.7230 (272)
CO2 emissions per m2			6.7300 (273)
EI value			94.2328
EI rating			94 (274)
EI band			A

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	$3.48 / 0.8864 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8864 = 0.2437$, 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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test										Yes							
Measured/design AP50										4.4800							
Infiltration rate										0.4242 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3923 (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	0.4120	0.3825	0.3923	0.3727	0.3727	0.3629	0.3531	0.3433	0.3335	0.3629	0.3433	0.3629	(22b)				
Effective ac	0.5849	0.5732	0.5770	0.5695	0.5695	0.5659	0.5623	0.5589	0.5556	0.5659	0.5589	0.5659	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	38.5714	37.8005	38.0511	37.5562	37.5562	37.3183	37.0867	36.8615	36.6426	37.3183	36.8615	37.3183 (38)
Heat transfer coeff	85.5976	84.8267	85.0773	84.5824	84.5824	84.3445	84.1129	83.8877	83.6688	84.3445	83.8877	84.3445 (39)
Average = Sum(39)m / 12 =												84.4381 (39)
HLP	1.0708	1.0611	1.0643	1.0581	1.0581	1.0551	1.0522	1.0494	1.0466	1.0551	1.0494	1.0551 (40)
HLP (average)												1.0563 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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		
Northeast			2.1700		14.6176		0.4600		0.0000		0.7700	11.2353 (75)
Southwest			3.5300		45.1778		0.4600		0.0000		0.7700	56.4870 (79)
Northeast			4.5100		14.6176		0.4600		0.0000		0.7700	23.3508 (75)
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976	75.2330 (83)
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165	617.7549 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.6920	39.0437	38.9287	39.1564	39.1564	39.2669	39.3750	39.4807	39.5840	39.2669	39.4807	39.2669
util living area	3.5795	3.6029	3.5952	3.6104	3.6104	3.6178	3.6250	3.6320	3.6389	3.6178	3.6320	3.6178
	0.9632	0.9517	0.9192	0.8443	0.7157	0.5252	0.3916	0.4122	0.6533	0.8583	0.9400	0.9670 (86)
MIT	19.6724	19.8156	20.1210	20.5050	20.7987	20.9513	20.9872	20.9850	20.8927	20.5607	20.0938	19.6688 (87)
Th 2	20.0248	20.0327	20.0301	20.0352	20.0352	20.0377	20.0401	20.0424	20.0446	20.0377	20.0424	20.0377 (88)
util rest of house	0.9561	0.9425	0.9035	0.8141	0.6619	0.4472	0.2991	0.3158	0.5780	0.8235	0.9268	0.9606 (89)
MIT 2	18.2840	18.4939	18.9256	19.4576	19.8341	20.0023	20.0342	20.0355	19.9554	19.5457	18.9022	18.2881 (90)
Living area fraction	18.6539	18.8461	19.2442	19.7367	20.0911	20.2552	20.2881	20.2885	fLA = Living area / (4) =	19.2197	19.2197	0.2664 (91)
MIT	18.6539	18.8461	19.2442	19.7367	20.0911	20.2552	20.2881	20.2885	20.2051	19.8161	19.2197	18.6560 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5039	18.6961	19.0942	19.5867	19.9411	20.1052	20.1381	20.1385	20.0551	19.6661	19.0697	18.5060 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9414	0.9262	0.8850	0.7981	0.6562	0.4529	0.3088	0.3257	0.5789	0.8076	0.9096	0.9468 (94)
Ext temp.	610.6913	643.8063	667.4502	654.9018	554.8695	390.8965	252.9575	251.8359	413.4764	528.3848	568.6796	584.9119 (95)
Heat loss rate W	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)
Month fracti	1164.4651	1136.3467	1028.9391	853.1595	629.3882	405.2931	255.5461	254.8894	448.0587	697.2032	937.0002	1139.1567 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	412.0077	330.9872	268.9477	142.7456	55.4419	0.0000	0.0000	0.0000	0.0000	125.6009	265.1908	412.3581 (98)
Space heating per m2												2013.2799 (98)
										(98) / (4) =		25.1849 (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													2224.6187 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	412.0077	330.9872	268.9477	142.7456	55.4419	0.0000	0.0000	0.0000	0.0000	125.6009	265.1908	412.3581	(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)	455.2572	365.7317	297.1798	157.7299	61.2617	0.0000	0.0000	0.0000	0.0000	138.7855	293.0286	455.6443	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater	89.5601	89.5009	89.3252	88.9307	88.2424	87.3000	87.3000	87.3000	87.3000	88.7987	89.3250	89.5800	(216)
(217)m													(217)
Fuel for water heating, kWh/month	184.5490	161.9482	168.4775	149.0062	145.1923	128.2841	120.5010	135.9628	136.9009	154.8844	166.1786	179.1707	(219)
Water heating fuel used												1831.0555	(219)
Annual totals kWh/year													
Space heating fuel - main system												2224.6187	(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)												378.0032	(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												3078.2265	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2224.6187	9.7400	216.6779 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.0555	9.7400	178.3448 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	378.0032	36.8500	139.2942 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1430.4508	36.8500	-527.1211 (252)
Total energy cost			138.8332 (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	2224.6187	0.2160	480.5176 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.0555	0.2160	395.5080 (264)
Space and water heating			876.0256 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	0.5190	-742.4040 (269)
Total kg/year			368.7303 (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	2224.6187	1.2200	2714.0348 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.0555	1.2200	2233.8877 (264)
Space and water heating			4947.9225 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	3.0700	-4391.4840 (269)
Primary energy kWh/year			1947.1582 (272)

FULL SAP CALCULATION PRINTOUT

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

Primary energy kWh/m²/year

24.3577 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
Current environmental impact rating: A 94

(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	+ 1.2	-£ 77	-185 kg (50.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.31 kg/m ²	A 93
Total Savings	£77	2.31 kg/m ²	A 96

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 521 TEST (19 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	£167	£185	-£18
Mains gas	£499	£404	£95
Space heating	£348	£348	£0
Water heating	£178	£102	£77
Lighting	£139	£139	£0
Generated (PV)	-£527	-£527	£0
Total cost of fuels	£139	£62	£77
Total cost of uses	£138	£62	£77
Delivered energy	39 kWh/m ²	27 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	24 kWh/m ²	11 kWh/m ²	13 kWh/m ²

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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.2002 (8)				
Pressure test							Yes					
Measured/design AP50							4.4800					
Infiltration rate							0.4242	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3923 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	0.5002	0.4904	0.4806	0.4316	0.4218	0.3727	0.3727	0.3629	0.3923	0.4218	0.4414	0.4610 (22b)
Effective ac	0.6251	0.6203	0.6155	0.5931	0.5889	0.5695	0.5695	0.5659	0.5770	0.5889	0.5974	0.6063 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	41.2267	40.9063	40.5922	39.1171	38.8411	37.5562	37.5562	37.3183	38.0511	38.8411	39.3994	39.9831 (38)
Heat transfer coeff	88.2529	87.9325	87.6185	86.1433	85.8673	84.5824	84.5824	84.3445	85.0773	85.8673	86.4256	87.0093 (39)
Average = Sum(39)m / 12 =												86.1420 (39)
HLP	1.1040	1.1000	1.0961	1.0776	1.0741	1.0581	1.0581	1.0551	1.0643	1.0741	1.0811	1.0884 (40)
HLP (average)												1.0776 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.2439 (H8)
Utilisation factor												0.5524 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-843.6871 (H17)
Solar input	-24.4652	-40.8255	-69.5304	-93.1845	-115.1216	-113.1828	-111.6871	-97.5816	-76.4259	-52.1899	-29.0193	-20.4732 (63)
												-843.6871 (63)
Output from w/h	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279 (64)
												787.2219 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.1700	11.2829	0.4600	0.0000	0.7700	8.6722 (75)			
Southwest				3.5300	36.7938	0.4600	0.0000	0.7700	46.0043 (79)			
Northeast				4.5100	11.2829	0.4600	0.0000	0.7700	18.0238 (75)			
Solar gains	72.7004	132.7029	205.1233	293.6366	364.9319	378.1433	357.9743	302.3615	235.3934	153.0156	88.6931	61.1714 (83)
Total gains	630.3135	685.5834	736.1115	790.9554	827.9267	810.5758	772.7485	725.7504	678.3616	629.8648	603.0121	603.6934 (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	37.5279	37.6646	37.7997	38.4470	38.5705	39.1564	39.1564	39.2669	38.9287	38.5705	38.3214	38.0643	
alpha	3.5019	3.5110	3.5200	3.5631	3.5714	3.6104	3.6104	3.6178	3.5952	3.5714	3.5548	3.5376	
util living area	0.9701	0.9580	0.9327	0.8740	0.7669	0.6067	0.4631	0.5073	0.7227	0.8938	0.9551	0.9738	(86)
MIT	19.4940	19.6731	19.9781	20.3826	20.7120	20.9124	20.9747	20.9649	20.8291	20.4189	19.9010	19.4674	(87)
Th 2	19.9976	20.0008	20.0041	20.0192	20.0220	20.0352	20.0352	20.0377	20.0301	20.0220	20.0163	20.0103	(88)
util rest of house	0.9644	0.9500	0.9195	0.8488	0.7205	0.5330	0.3691	0.4117	0.6553	0.8671	0.9452	0.9688	(89)
MIT 2	18.0089	18.2684	18.7061	19.2811	19.7176	19.9635	20.0213	20.0169	19.8750	19.3441	18.6101	17.9790	(90)
Living area fraction	18.4046	18.6427	19.0450	19.5746	19.9825	20.2163	20.2754	20.2695	20.1292	19.6305	18.9541	18.3756	(91)
Temperature adjustment												-0.1500	(92)
adjusted MIT	18.2546	18.4927	18.8950	19.4246	19.8325	20.0663	20.1254	20.1195	19.9792	19.4805	18.8041	18.2256	(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	0.9508	0.9341	0.9010	0.8308	0.7105	0.5355	0.3782	0.4202	0.6514	0.8491	0.9291	0.9563	(94)
Useful gains	599.3163	640.3702	663.2094	657.1027	588.2673	434.0599	292.2263	304.9682	441.8834	534.8285	560.2339	577.3166	(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	1231.5333	1195.2394	1086.0301	906.6238	698.3187	462.3520	298.1836	313.7189	500.1905	762.5428	1011.5309	1220.3581	(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	470.3694	372.8721	314.5786	179.6552	81.8783	0.0000	0.0000	0.0000	0.0000	169.4194	324.9338	478.4229	(98)
Space heating												2392.1297	(98)
Space heating per m2											(98) / (4) =	29.9241	(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													2643.2372	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	470.3694	372.8721	314.5786	179.6552	81.8783	0.0000	0.0000	0.0000	0.0000	169.4194	324.9338	478.4229	(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)	519.7452	412.0134	347.6006	198.5140	90.4732	0.0000	0.0000	0.0000	0.0000	187.2038	359.0429	528.6441	(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	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279	(64)	
Efficiency of water heater	89.7421	89.7816	89.8260	89.9081	90.0478	87.3000	87.3000	87.3000	87.3000	89.4022	89.6172	87.3000	(216)	
(217)m	89.7421	89.7816	89.8260	89.9081	90.0478	87.3000	87.3000	87.3000	87.3000	89.4022	89.6172	87.3000	(217)	
Fuel for water heating, kWh/month	156.9130	115.9698	90.1325	43.7422	14.4363	0.0000	0.0000	24.1855	49.3568	95.4623	133.2554	156.0111	(219)	
Water heating fuel used												879.4649	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2643.2372	(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)													378.0032	(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												2747.5481	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2643.2372	3.4800	91.9847	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.4649	3.4800	30.6054	(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	378.0032	13.1900	49.8586	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1278.1572	13.1900	-168.5889	(252)
Total energy cost			140.3472	(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] =	0.4718	(257)
SAP value		93.4185	
SAP rating (Section 12)		93	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2643.2372	0.2160	570.9392 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.4649	0.2160	189.9644 (264)
Space and water heating			760.9037 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1278.1572	0.5190	-663.3636 (269)
Total kg/year			358.5987 (272)
CO2 emissions per m2			4.4900 (273)
EI value			96.1540
EI rating			96 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test										Yes							
Measured/design AP50										4.4800							
Infiltration rate										0.4242 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3923 (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	0.4120	0.3825	0.3923	0.3727	0.3727	0.3629	0.3531	0.3433	0.3335	0.3629	0.3433	0.3629	(22b)				
Effective ac	0.5849	0.5732	0.5770	0.5695	0.5695	0.5659	0.5623	0.5589	0.5556	0.5659	0.5589	0.5659	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	38.5714	37.8005	38.0511	37.5562	37.5562	37.3183	37.0867	36.8615	36.6426	37.3183	36.8615	37.3183 (38)
Heat transfer coeff	85.5976	84.8267	85.0773	84.5824	84.5824	84.3445	84.1129	83.8877	83.6688	84.3445	83.8877	84.3445 (39)
Average = Sum(39)m / 12 =												84.4381 (39)
HLP	1.0708	1.0611	1.0643	1.0581	1.0581	1.0551	1.0522	1.0494	1.0466	1.0551	1.0494	1.0551 (40)
HLP (average)												1.0563 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.3921 (H8)
Utilisation factor												0.5124 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-875.8544 (H17)
Solar input	-28.5725	-40.6283	-69.8302	-94.2171	-110.6637	-118.2063	-115.7204	-103.5733	-81.0907	-56.0633	-33.7937	-23.4949 (63)
												-875.8544 (63)
Output from w/h												
	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062 (64)
												764.1114 (64)
Heat gains from water heating, kWh/month												
	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
Northeast				2.1700	14.6176	0.4600	0.0000	0.7700				11.2353 (75)
Southwest				3.5300	45.1778	0.4600	0.0000	0.7700				56.4870 (79)
Northeast				4.5100	14.6176	0.4600	0.0000	0.7700				23.3508 (75)
Solar gains	91.0732	142.1881	223.1752	323.2918	382.5534	430.5855	404.4558	349.7971	271.2309	177.3769	110.8976	75.2330 (83)
Total gains	648.6863	695.0685	754.1634	820.6106	845.5481	863.0181	819.2300	773.1859	714.1991	654.2261	625.2165	617.7549 (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	38.6920	39.0437	38.9287	39.1564	39.1564	39.2669	39.3750	39.4807	39.5840	39.2669	39.4807	39.2669	
alpha	3.5795	3.6029	3.5952	3.6104	3.6104	3.6178	3.6250	3.6320	3.6389	3.6178	3.6320	3.6178	
util living area	0.9632	0.9517	0.9192	0.8443	0.7157	0.5252	0.3916	0.4122	0.6533	0.8583	0.9400	0.9670	(86)
MIT	19.6724	19.8156	20.1210	20.5050	20.7987	20.9513	20.9872	20.9850	20.8927	20.5607	20.0938	19.6688	(87)
Th 2	20.0248	20.0327	20.0301	20.0352	20.0352	20.0377	20.0401	20.0424	20.0446	20.0377	20.0424	20.0377	(88)
util rest of house	0.9561	0.9425	0.9035	0.8141	0.6619	0.4472	0.2991	0.3158	0.5780	0.8235	0.9268	0.9606	(89)
MIT 2	18.2840	18.4939	18.9256	19.4576	19.8341	20.0023	20.0342	20.0355	19.9554	19.5457	18.9022	18.2881	(90)
Living area fraction													0.2664 (91)
MIT	18.6539	18.8461	19.2442	19.7367	20.0911	20.2552	20.2881	20.2885	20.2051	19.8161	19.2197	18.6560	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.5039	18.6961	19.0942	19.5867	19.9411	20.1052	20.1381	20.1385	20.0551	19.6661	19.0697	18.5060	(93)

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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	0.9414	0.9262	0.8850	0.7981	0.6562	0.4529	0.3088	0.3257	0.5789	0.8076	0.9096	0.9468	(94)
Useful gains	610.6913	643.8063	667.4502	654.9018	554.8695	390.8965	252.9575	251.8359	413.4764	528.3848	568.6796	584.9119	(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	1164.4651	1136.3467	1028.9391	853.1595	629.3882	405.2931	255.5461	254.8894	448.0587	697.2032	937.0002	1139.1567	(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	412.0077	330.9872	268.9477	142.7456	55.4419	0.0000	0.0000	0.0000	0.0000	125.6009	265.1908	412.3581	(98)
Space heating												2013.2799	(98)
Space heating per m2											(98) / (4) =	25.1849	(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													2224.6187 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	412.0077	330.9872	268.9477	142.7456	55.4419	0.0000	0.0000	0.0000	0.0000	125.6009	265.1908	412.3581	(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)	455.2572	365.7317	297.1798	157.7299	61.2617	0.0000	0.0000	0.0000	0.0000	138.7855	293.0286	455.6443	(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	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062	(64)
Efficiency of water heater	89.6810	89.7120	89.7410	89.8037	89.7125	87.3000	87.3000	87.3000	87.3000	89.2134	89.5097	87.3000	(216)
(217)m	89.6810	89.7120	89.7410	89.8037	89.7125	87.3000	87.3000	87.3000	87.3000	89.2134	89.5097	89.6802	(217)
Fuel for water heating, kWh/month	152.4401	116.2796	89.8838	42.6432	19.4593	0.0000	0.0000	17.3222	44.0135	91.3226	128.0814	152.7720	(219)
Water heating fuel used												854.2178	(219)
Annual totals kWh/year													
Space heating fuel - main system												2224.6187	(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)													378.0032 (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												2151.3888	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2224.6187	9.7400	216.6779	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.2178	9.7400	83.2008	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	378.0032	36.8500	139.2942	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1430.4508	36.8500	-527.1211	(252)
Total energy cost			62.1142	(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	2224.6187	0.2160	480.5176	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.2178	0.2160	184.5110	(264)
Space and water heating			665.0287	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)

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 saving/generation technologies			
PV Unit	-1430.4508	0.5190	-742.4040 (269)
Total kg/year			183.6833 (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	2224.6187	1.2200	2714.0348 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	854.2178	1.2200	1042.1457 (264)
Space and water heating			3756.1805 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1430.4508	3.0700	-4391.4840 (269)
Primary energy kWh/year			908.9161 (272)
Primary energy kWh/m2/year			11.3700 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	149.1 (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	263.80 (P1)
Transmission heat loss coefficient	47.03 (37)
Summer heat loss coefficient	310.83 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.1700	98.8453	0.4600	0.0000	0.9000	88.8006
South West	3.5300	119.9223	0.4600	0.0000	0.9000	175.2569
North East	4.5100	98.8453	0.4600	0.0000	0.9000	184.5580
total:						448.6155

	Jun	Jul	Aug	
Solar gains	479	449	387	(P4)
Internal gains	429	412	420	
Total summer gains	909	860	808	(P5)

	2.92	2.77	2.60	(P6)
Summer gain/loss ratio				
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 149.1)	0.96	0.96	0.96	
Threshold temperature	19.88	21.62	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-653			Issued on Date	27/06/2023
Assessment Reference	As Built	Prop Type Ref	Coiner-CB-Opp-SEMI		
Property	3, Flycatcher Road , BOTLEY, SO32 2FG				
SAP Rating	92 A	DER	8.40	TER	18.39
Environmental	94 A	% DER<TER	54.34		
CO ₂ Emissions (t/year)	0.37	DFEE	40.36	TFEE	50.72
General Requirements Compliance	Pass	% DFEE<TFEE	20.42		
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk			Assessor ID	Q919-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 80 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) 18.39 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)40.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.30 (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: 4.46 (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: 6.68 m², No overhang

Windows facing North West: 3.53 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 0.64 W/m²K

Thermal bridging y-value 0.030 W/m²K

Photovoltaic array 1.48 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.4600
Infiltration rate					0.4232 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3914 (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	0.4991	0.4893	0.4795	0.4306	0.4208	0.3718	0.3718	0.3621	0.3914	0.4208	0.4403	0.4599 (22b)
Effective ac	0.6245	0.6197	0.6150	0.5927	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6058 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss							(33) + (36) = 47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1879	40.8689	40.5564	39.0881	38.8134	37.5346	37.5346	37.2978	38.0272	38.8134	39.3691	39.9501 (38)
Average = Sum(39)m / 12 =	88.2141	87.8952	87.5826	86.1143	85.8396	84.5609	84.5609	84.3241	85.0534	85.8396	86.3954	86.9763 (39)
	86.1130											86.1130 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1035	1.0995	1.0956	1.0772	1.0738	1.0578	1.0578	1.0548	1.0640	1.0738	1.0808	1.0880 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325	(44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1457.9953	(45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590	(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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079	(61)
Total heat required for water heating calculated for each month													
	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
								Total per year (kWh/year) = Sum(64)m =				1623.2284	(64)
Heat gains from water heating, kWh/month													
	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	375.9454	373.6816	359.9393	337.9173	315.6170	294.2333	280.4489	286.5947	298.0240	320.2577	345.7036	364.7281 (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				2.1700	36.7938	0.4600	0.0000	0.7700	28.2803 (77)			
Northwest				3.5300	11.2829	0.4600	0.0000	0.7700	14.1074 (81)			
Southeast				4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)			
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	477.1091	550.6865	614.5718	674.2816	711.4153	695.5455	663.8709	624.3957	580.7593	519.2418	467.7277	450.7509 (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	37.5444	37.6807	37.8151	38.4599	38.5830	39.1664	39.1664	39.2764	38.9396	38.5830	38.3348	38.0787
alpha	3.5030	3.5120	3.5210	3.5640	3.5722	3.6111	3.6111	3.6184	3.5960	3.5722	3.5557	3.5386
util living area	0.9869	0.9775	0.9584	0.9133	0.8239	0.6763	0.5277	0.5740	0.7865	0.9341	0.9783	0.9892 (86)
MIT	19.2493	19.4668	19.8081	20.2503	20.6264	20.8748	20.9616	20.9478	20.7703	20.2821	19.6937	19.2191 (87)
Th 2	19.9980	20.0012	20.0044	20.0195	20.0223	20.0354	20.0354	20.0379	20.0304	20.0223	20.0166	20.0106 (88)
util rest of house	0.9842	0.9729	0.9495	0.8938	0.7829	0.6019	0.4249	0.4715	0.7243	0.9153	0.9731	0.9869 (89)
MIT 2	17.6567	17.9740	18.4682	19.1052	19.6163	19.9293	20.0136	20.0058	19.8137	19.1621	18.3157	17.6207 (90)
Living area fraction												
MIT	18.0810	18.3718	18.8252	19.4103	19.8855	20.1812	20.2662	20.2568	20.0686	19.4606	18.6829	0.2664 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.9310	18.2218	18.6752	19.2603	19.7355	20.0312	20.1162	20.1068	19.9186	19.3106	18.5329	17.8966 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9760	0.9613	0.9336	0.8752	0.7691	0.6015	0.4339	0.4793	0.7160	0.8976	0.9618	0.9798 (94)
Useful gains	465.6368	529.3565	573.7892	590.1321	547.1182	418.3849	288.0744	299.2595	415.8391	466.0786	449.8762	441.6473 (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												
	1202.4480	1170.9194	1066.3335	892.1696	689.7626	459.2671	297.3298	312.5691	494.8931	747.7107	987.7456	1191.2828 (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												
	548.1875	431.1303	366.4530	217.4670	106.1274	0.0000	0.0000	0.0000	0.0000	209.5342	387.2660	557.7288 (98)
Space heating												2823.8942 (98)
Space heating per m2												35.3252 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													3120.3251 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.1875	431.1303	366.4530	217.4670	106.1274	0.0000	0.0000	0.0000	0.0000	209.5342	387.2660	557.7288	(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)	605.7320	476.3871	404.9205	240.2950	117.2679	0.0000	0.0000	0.0000	0.0000	231.5296	427.9182	616.2749	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.7380	89.6730	89.5445	89.2612	88.7213	87.3000	87.3000	87.3000	87.3000	89.2043	89.5900	87.3000	(216)
Fuel for water heating, kWh/month	184.1832	161.6373	168.0650	148.4546	144.4086	128.2841	120.5010	135.9628	136.9009	154.1803	165.6870	178.8020	(219)
Water heating fuel used												1827.0666	(219)
Annual totals kWh/year													
Space heating fuel - main system													3120.3251 (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)													378.0032 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571			-1218.5571 (233)
Total delivered energy for all uses													4181.8378 (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	3120.3251	0.2160	673.9902 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1827.0666	0.2160	394.6464 (264)
Space and water heating			1068.6366 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total CO2, kg/year			671.3141 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4000 (273)

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

DER			8.4000 ZC1
Total Floor Area		TFA	79.9400
Assumed number of occupants		N	2.4617
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.2574 ZC2
CO2 emissions from cooking, equation (L16)			2.2277 ZC3
Total CO2 emissions			26.8851 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			26.8851 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1501 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3701 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349	(22b)				
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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 EMISSIONS 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	0.0000	0.0000	(57)
Combi loss	50.9589	45.2108	48.1660	44.7843	44.3882	41.1284	42.4994	44.3882	44.7843	48.1660	48.4401	50.9589	(61)	
Total heat required for water heating calculated for each month	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000							
								Solar input	(sum of months) =	Sum (63)m =	0.0000	(63)		
Output from w/h	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(64)	
								Total per year (kWh/year) =	Sum (64)m =	2011.8688	(64)			
Heat gains from water heating, kWh/month	63.0014	55.2619	57.4034	50.7437	49.0440	43.0274	40.9682	45.9165	46.4313	53.1048	56.9338	61.4155	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	84.6793	82.2349	77.1551	70.4774	65.9193	59.7603	55.0647	61.7157	64.4880	71.3774	79.0748	82.5477	(72)
Total internal gains	388.3243	385.7626	371.3976	348.7549	325.8298	303.8231	290.0457	296.8140	308.8714	331.7259	357.7903	377.1108	(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					6.6800	36.7938		0.6300		0.7000		0.7700		75.1144 (77)	
Northwest					3.5300	11.2829		0.6300		0.7000		0.7700		12.1722 (81)	
Solar gains	87.2866	152.7245	219.7036	290.2239	341.5051	346.2626	330.8265	291.4636	243.9513	171.6887	105.2855	74.2227 (83)			
Total gains	475.6109	538.4871	591.1012	638.9788	667.3349	650.0857	620.8722	588.2776	552.8228	503.4146	463.0758	451.3335 (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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642	
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976	
util living area	0.9981	0.9960	0.9902	0.9704	0.9094	0.7641	0.5915	0.6421	0.8709	0.9791	0.9960	0.9986 (86)	
MIT	19.7989	19.9398	20.1704	20.4807	20.7581	20.9360	20.9867	20.9798	20.8632	20.5089	20.1018	19.7788 (87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984 (88)	
util rest of house	0.9974	0.9946	0.9867	0.9587	0.8721	0.6775	0.4690	0.5198	0.8064	0.9687	0.9944	0.9981 (89)	
MIT 2	18.3840	18.5916	18.9291	19.3837	19.7616	19.9756	20.0154	20.0140	19.9016	19.4307	18.8386	18.3627 (90)	
Living area fraction	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (91)	
MIT	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	473.8443	534.4919	581.1112	609.3748	582.5490	453.6100	311.6262	325.0148	451.7580	485.5611	459.5804	450.0446	(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	1290.9905	1250.3691	1131.9155	941.7879	725.7184	484.3510	316.0075	332.1431	523.6887	794.6401	1058.3680	1281.9593	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	607.9567	481.0695	409.7984	239.3375	106.5180	0.0000	0.0000	0.0000	0.0000	229.9548	431.1271	618.9445	(98)
Space heating												3124.7064	(98)
Space heating per m2												39.0881	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3345.5101 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	607.9567	481.0695	409.7984	239.3375	106.5180	0.0000	0.0000	0.0000	0.0000	229.9548	431.1271	618.9445 (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)	650.9173	515.0637	438.7563	256.2500	114.0450	0.0000	0.0000	0.0000	0.0000	246.2043	461.5921	662.6815 (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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521 (64)
Efficiency of water heater (217)m	87.6493	87.4369	87.0016	86.0058	84.0752	80.3000	80.3000	80.3000	80.3000	85.7879	87.1312	80.3000 (216)
Fuel for water heating, kWh/month	230.6029	202.9108	212.1718	190.3644	188.5385	173.8611	166.5722	185.6890	187.7397	200.1035	210.3133	224.9484 (219)
Water heating fuel used												2373.8157 (219)
Annual totals kWh/year												
Space heating fuel - main system												3345.5101 (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)												378.0032 (232)
Total delivered energy for all uses												6172.3289 (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	3345.5101	0.2160	722.6302 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2373.8157	0.2160	512.7442 (264)
Space and water heating			1235.3744 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/m2/year			1470.4830 (272)
Emissions per m2 for space and water heating			15.4538 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4541 (272b)
Emissions per m2 for pumps and fans			0.4869 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4538 * 1.00) + 2.4541 + 0.4869, rounded to 2 d.p.			18.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1501 (8)
Pressure test										Yes							
Measured/design AP50										4.4600							
Infiltration rate										0.3731 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3451 (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	0.4400	0.4314	0.4228	0.3796	0.3710	0.3279	0.3279	0.3192	0.3451	0.3710	0.3883	0.4055 (22b)					
Effective ac	0.5968	0.5931	0.5894	0.5721	0.5688	0.5538	0.5538	0.5510	0.5596	0.5688	0.5754	0.5822 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	39.3604	39.1125	38.8694	37.7279	37.5143	36.5201	36.5201	36.3360	36.9031	37.5143	37.9464	38.3981 (38)
Heat transfer coeff	86.3866	86.1387	85.8957	84.7541	84.5406	83.5463	83.5463	83.3622	83.9293	84.5406	84.9726	85.4243 (39)
Average = Sum(39)m / 12 =												84.7531 (39)
HLP	1.0806	1.0775	1.0745	1.0602	1.0576	1.0451	1.0451	1.0428	1.0499	1.0576	1.0630	1.0686 (40)
HLP (average)												1.0602 (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	2.4617 (42)
Average daily hot water use (litres/day)	92.6659 (43)

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

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Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	31.1086 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(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				2.1700	36.7938	0.4600	0.0000	0.7700	28.2803 (77)			
Northwest				3.5300	11.2829	0.4600	0.0000	0.7700	14.1074 (81)			
Southeast				4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)			
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	444.9835	519.3395	584.8410	646.7458	685.3052	671.4408	641.4679	599.8093	555.3948	491.6061	437.5268	419.3985 (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	38.3387	38.4490	38.5578	39.0771	39.1758	39.6420	39.6420	39.7296	39.4612	39.1758	38.9766	38.7705	
alpha	3.5559	3.5633	3.5705	3.6051	3.6117	3.6428	3.6428	3.6486	3.6307	3.6117	3.5984	3.5847	
util living area	0.9894	0.9809	0.9632	0.9204	0.8335	0.6879	0.5382	0.5878	0.8001	0.9420	0.9822	0.9914	(86)
MIT	19.2383	19.4566	19.7990	20.2396	20.6197	20.8708	20.9604	20.9451	20.7612	20.2640	19.6730	19.2026	(87)
Th 2	20.0167	20.0192	20.0217	20.0335	20.0357	20.0459	20.0459	20.0478	20.0420	20.0357	20.0312	20.0266	(88)
util rest of house	0.9872	0.9769	0.9552	0.9022	0.7940	0.6143	0.4351	0.4851	0.7400	0.9252	0.9778	0.9896	(89)
MIT 2	18.4025	18.6208	18.9605	19.3971	19.7516	19.9705	20.0303	20.0245	19.8865	19.4292	18.8462	18.3744	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.6252	18.8435	19.1839	19.6215	19.9829	20.2104	20.2781	20.2698	20.1196	19.6517	19.0665	18.5951	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6252	18.8435	19.1839	19.6215	19.9829	20.2104	20.2781	20.2698	20.1196	19.6517	19.0665	18.5951	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.4084	504.1475	553.6412	577.5841	542.4352	421.6373	295.9564	306.1628	414.0460	450.7418	425.2851	413.5107	(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	1237.5069	1201.0774	1089.4926	908.6947	700.2410	468.7245	307.2942	322.5946	505.2188	765.2329	1016.8257	1229.6909	(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	595.2733	468.3369	398.6734	238.3996	117.4075	0.0000	0.0000	0.0000	0.0000	233.9814	425.9093	607.2381	(98)
Space heating												3085.2195	(98)
Space heating per m2												38.5942	(99)

8c. Space cooling requirement

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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	785.3355	618.2428	633.5528	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8258	0.8863	0.8634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	648.5519	547.9470	547.0123	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	877.3940	840.5269	793.6348	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	164.7663	217.6794	183.4872	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												565.9329	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.1916	54.4198	45.8718	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												141.4832	(107)
Space cooling per m2												1.7699	(108)
Energy for space heating												38.5942	(99)
Energy for space cooling												1.7699	(108)
Total												40.3641	(109)
Dwelling Fabric Energy Efficiency (DFEE)												40.4	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1501 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3701 (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	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349 (22b)					
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946 (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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast												6.6800	36.7938	0.6300	0.7000	0.7700	75.1144	(77)
Northwest												3.5300	11.2829	0.6300	0.7000	0.7700	12.1722	(81)
Solar gains	87.2866	152.7245	219.7036	290.2239	341.5051	346.2626	330.8265	291.4636	243.9513	171.6887	105.2855	74.2227	(83)					
Total gains	431.1065	495.0590	549.9121	600.6053	631.0120	616.3913	588.8724	553.4718	516.6109	464.3106	420.7883	407.5984	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642		
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976		
util living area	0.9988	0.9973	0.9929	0.9770	0.9247	0.7902	0.6192	0.6746	0.8946	0.9852	0.9975	0.9991	(86)	
MIT	19.7468	19.8894	20.1239	20.4412	20.7304	20.9245	20.9835	20.9746	20.8402	20.4668	20.0525	19.7273	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)	
util rest of house	0.9984	0.9963	0.9902	0.9675	0.8917	0.7057	0.4932	0.5498	0.8365	0.9774	0.9964	0.9988	(89)	
MIT 2	18.8406	18.9852	19.2208	19.5438	19.8171	19.9834	20.0161	20.0150	19.9217	19.5739	19.1594	18.8303	(90)	
Living area fraction									fLA = Living area / (4) =			0.2664	(91)	
MIT	19.0820	19.2261	19.4614	19.7829	20.0604	20.2342	20.2739	20.2707	20.1665	19.8118	19.3974	19.0693	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0820	19.2261	19.4614	19.7829	20.0604	20.2342	20.2739	20.2707	20.1665	19.8118	19.3974	19.0693	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.1879	492.7514	543.5204	579.4503	563.9615	447.5166	310.4781	322.9230	437.5911	452.8683	418.8958	406.9502	(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	(95)
Heat loss rate W	1319.6520	1274.8647	1149.7995	951.1340	728.6200	484.5818	315.9808	332.0880	524.4340	802.8199	1077.8385	1310.9886	(96)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	661.7613	525.5801	451.0717	267.6123	122.5059	0.0000	0.0000	0.0000	0.0000	260.3640	474.4388	672.6046	(98)
Space heating												3435.9387	(98)
Space heating per m2												42.9815	(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	808.4733	636.4577	652.0501	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8437	0.9130	0.8895	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.1177	581.1004	579.9800	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	813.0504	779.0516	739.4741	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	94.2715	147.2757	118.6636	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												360.2108	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.5679	36.8189	29.6659	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												90.0527 (107)
Space cooling per m2												1.1265 (108)
Energy for space heating												42.9815 (99)
Energy for space cooling												1.1265 (108)
Total												44.1080 (109)
Target Fabric Energy Efficiency (TFEE)												50.7 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.2002 (8)
Pressure test					Yes
Measured/design AP50					4.4600
Infiltration rate					0.4232 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3914 (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	0.4110	0.3816	0.3914	0.3718	0.3718	0.3621	0.3523	0.3425	0.3327	0.3621	0.3425	0.3621 (22b)
Effective ac	0.5845	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.5450	37.7778	38.0272	37.5346	37.5346	37.2978	37.0673	36.8432	36.6253	37.2978	36.8432	37.2978 (38)
Average = Sum(39)m / 12 =	85.5713	84.8040	85.0534	84.5609	84.5609	84.3241	84.0936	83.8694	83.6515	84.3241	83.8694	84.3241 (39)
	84.4172 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0704	1.0608	1.0640	1.0578	1.0578	1.0548	1.0520	1.0492	1.0464	1.0548	1.0492	1.0548 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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			2.1700	45.1778	0.4600	0.0000	0.7700	34.7243 (77)				
Northwest			3.5300	14.6176	0.4600	0.0000	0.7700	18.2768 (81)				
Southeast			4.5100	45.1778	0.4600	0.0000	0.7700	72.1690 (77)				
Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878 (83)
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098 (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	38.7040	39.0541	38.9396	39.1664	39.1664	39.2764	39.3841	39.4893	39.5922	39.2764	39.4893	39.2764
alpha	3.5803	3.6036	3.5960	3.6111	3.6111	3.6184	3.6256	3.6326	3.6395	3.6184	3.6326	3.6184
util living area	0.9574	0.9427	0.9055	0.8278	0.7018	0.5145	0.3813	0.3955	0.6229	0.8347	0.9294	0.9623 (86)
MIT	19.7241	19.8795	20.1818	20.5417	20.8118	20.9545	20.9893	20.9869	20.9084	20.6069	20.1478	19.7142 (87)
Th 2	20.0250	20.0329	20.0304	20.0354	20.0354	20.0379	20.0403	20.0426	20.0448	20.0379	20.0426	20.0379 (88)
util rest of house	0.9494	0.9322	0.8880	0.7960	0.6476	0.4374	0.2909	0.3024	0.5481	0.7967	0.9144	0.9551 (89)
MIT 2	18.3575	18.5840	19.0089	19.5045	19.8485	20.0050	20.0349	20.0366	19.9698	19.6032	18.9769	18.3528 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7216	18.9292	19.3214	19.7808	20.1051	20.2580	20.2889	20.2898	20.2199	19.8707	19.2889	18.7155 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5716	18.7792	19.1714	19.6308	19.9551	20.1080	20.1389	20.1398	20.0699	19.7207	19.1389	18.5655 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9338	0.9150	0.8693	0.7808	0.6427	0.4433	0.3004	0.3121	0.5502	0.7823	0.8965	0.9404 (94)
Ext temp.	637.5984	676.8105	698.2328	672.8401	560.7588	392.0033	253.1932	252.2936	419.8301	550.5436	596.0992	608.5636 (95)
Heat loss rate W	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)
Month fracti	1169.8974	1143.0867	1035.2230	856.6717	630.4135	405.4308	255.5556	254.9448	449.1986	701.6316	942.5968	1143.8996 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	396.0304	313.3376	250.7207	132.3588	51.8230	0.0000	0.0000	0.0000	0.0000	112.4095	249.4783	398.2900 (98)
RHI space heating demand												1904.4483 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.2002 (8)
Pressure test										Yes							
Measured/design AP50										4.4600							
Infiltration rate										0.4232 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3914 (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	0.4991	0.4893	0.4795	0.4306	0.4208	0.3718	0.3718	0.3621	0.3914	0.4208	0.4403	0.4599	(22b)				
Effective ac	0.6245	0.6197	0.6150	0.5927	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6058	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss					(33) + (36) =		47.0262 (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	41.1879	40.8689	40.5564	39.0881	38.8134	37.5346	37.5346	37.2978	38.0272	38.8134	39.3691	39.9501 (38)
Heat transfer coeff	88.2141	87.8952	87.5826	86.1143	85.8396	84.5609	84.5609	84.3241	85.0534	85.8396	86.3954	86.9763 (39)
Average = Sum(39)m / 12 =												86.1130 (39)
HLP	1.1035	1.0995	1.0956	1.0772	1.0738	1.0578	1.0578	1.0548	1.0640	1.0738	1.0808	1.0880 (40)
HLP (average)												1.0772 (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	2.4617 (42)
Average daily hot water use (litres/day)	92.6659 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (73)

6. Solar gains

[Jan]												
			Area	Solar flux		g		FF		Access	Gains	
			m2	Table 6a	Table 6b	Specific data	Specific data	Specific data	factor	W		
				W/m2		or Table 6b	or Table 6c	or Table 6c	Table 6d			
Southeast			2.1700	36.7938		0.4600		0.0000	0.7700	28.2803 (77)		
Northwest			3.5300	11.2829		0.4600		0.0000	0.7700	14.1074 (81)		
Southeast			4.5100	36.7938		0.4600		0.0000	0.7700	58.7760 (77)		
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	658.7768	729.8854	785.6207	833.6832	858.7930	833.7446	798.1962	761.1899	725.7034	675.8333	636.3430	628.5447 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.5444	37.6807	37.8151	38.4599	38.5830	39.1664	39.1664	39.2764	38.9396	38.5830	38.3348	38.0787
util living area	3.5030	3.5120	3.5210	3.5640	3.5722	3.6111	3.6111	3.6184	3.5960	3.5722	3.5557	3.5386
	0.9661	0.9501	0.9206	0.8586	0.7519	0.5937	0.4498	0.4868	0.6930	0.8751	0.9480	0.9706 (86)
MIT	19.5386	19.7382	20.0431	20.4262	20.7314	20.9183	20.9770	20.9693	20.8518	20.4695	19.9496	19.5071 (87)
Th 2	19.9980	20.0012	20.0044	20.0195	20.0223	20.0354	20.0354	20.0379	20.0304	20.0223	20.0166	20.0106 (88)
util rest of house	0.9597	0.9409	0.9056	0.8315	0.7045	0.5205	0.3579	0.3939	0.6245	0.8455	0.9368	0.9650 (89)
MIT 2	18.0728	18.3608	18.7963	19.3384	19.7403	19.9690	20.0229	20.0199	19.8980	19.4100	18.6785	18.0361 (90)
Living area fraction	18.4634	18.7278	19.1285	19.6283	20.0043	20.2219	20.2771	20.2729	20.1521	19.6923	19.0172	18.4280 (92)
MIT									fLA = Living area / (4) =			0.2664 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.3134	18.5778	18.9785	19.4783	19.8543	20.0719	20.1271	20.1229	20.0021	19.5423	18.8672	18.2780 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9453	0.9239	0.8866	0.8141	0.6955	0.5234	0.3669	0.4024	0.6223	0.8281	0.9198	0.9517 (94)
Ext temp.	622.7247	674.3398	696.5027	678.7103	597.3113	436.4090	292.8571	306.3173	451.6144	559.6556	585.3102	598.1806 (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	1236.1778	1202.2128	1092.8990	910.9394	699.9649	462.7113	298.2552	313.9265	501.9946	767.6060	1016.6338	1224.4559 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	456.4091	354.7306	294.9189	167.2050	76.3743	0.0000	0.0000	0.0000	0.0000	154.7151	310.5530	465.9488 (98)
Space heating per m2												2280.8548 (98)
										(98) / (4) =		28.5321 (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													2520.2816 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.4091	354.7306	294.9189	167.2050	76.3743	0.0000	0.0000	0.0000	0.0000	154.7151	310.5530	465.9488	(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)	504.3194	391.9676	325.8772	184.7569	84.3915	0.0000	0.0000	0.0000	0.0000	170.9559	343.1525	514.8605	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.6266	89.5478	89.3929	89.0567	88.4683	87.3000	87.3000	87.3000	87.3000	88.9653	89.4397	89.6580	(216)
Fuel for water heating, kWh/month	184.4121	161.8632	168.3500	148.7954	144.8215	128.2841	120.5010	135.9628	136.9009	154.5943	165.9654	179.0149	(219)
Water heating fuel used												1829.4654	(219)
Annual totals kWh/year													
Space heating fuel - main system												2520.2816	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												3584.1931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2520.2816	3.4800	87.7058 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.4654	3.4800	63.6654 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	378.0032	13.1900	49.8586 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1218.5571	13.1900	-160.7277 (252)
Total energy cost			170.3946 (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] = 0.5728 (257)
SAP value	92.0094
SAP rating (Section 12)	92 (258)
SAP band	A

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	2520.2816	0.2160	544.3808 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.4654	0.2160	395.1645 (264)
Space and water heating			939.5453 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total kg/year			542.2229 (272)
CO2 emissions per m2			6.7800 (273)
EI value			94.1846
EI rating			94 (274)
EI band			A

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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	$3.48 / 0.8861 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8861 = 0.2438$, 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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.4600	
Infiltration rate																0.4232 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.3914 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4110	0.3816	0.3914	0.3718	0.3718	0.3621	0.3523	0.3425	0.3327	0.3621	0.3425	0.3621	(22b)				
Effective ac	0.5845	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	38.5450	37.7778	38.0272	37.5346	37.5346	37.2978	37.0673	36.8432	36.6253	37.2978	36.8432	37.2978 (38)
Heat transfer coeff	85.5713	84.8040	85.0534	84.5609	84.5609	84.3241	84.0936	83.8694	83.6515	84.3241	83.8694	84.3241 (39)
Average = Sum(39)m / 12 =												84.4172 (39)
HLP	1.0704	1.0608	1.0640	1.0578	1.0578	1.0548	1.0520	1.0492	1.0464	1.0548	1.0492	1.0548 (40)
HLP (average)												1.0560 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum(64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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	2.1700				45.1778		0.4600		0.0000		0.7700		34.7243 (77)	
Northwest	3.5300				14.6176		0.4600		0.0000		0.7700		18.2768 (81)	
Southeast	4.5100				45.1778		0.4600		0.0000		0.7700		72.1690 (77)	
Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878	(83)	
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.7040	39.0541	38.9396	39.1664	39.1664	39.2764	39.3841	39.4893	39.5922	39.2764	39.4893	39.2764
util living area	3.5803	3.6036	3.5960	3.6111	3.6111	3.6184	3.6256	3.6326	3.6395	3.6184	3.6326	3.6184
	0.9574	0.9427	0.9055	0.8278	0.7018	0.5145	0.3813	0.3955	0.6229	0.8347	0.9294	0.9623 (86)
MIT	19.7241	19.8795	20.1818	20.5417	20.8118	20.9545	20.9883	20.9869	20.9084	20.6069	20.1478	19.7142 (87)
Th 2	20.0250	20.0329	20.0304	20.0354	20.0354	20.0379	20.0403	20.0426	20.0448	20.0379	20.0426	20.0379 (88)
util rest of house	0.9494	0.9322	0.8880	0.7960	0.6476	0.4374	0.2909	0.3024	0.5481	0.7967	0.9144	0.9551 (89)
MIT 2	18.3575	18.5840	19.0089	19.5045	19.8485	20.0050	20.0349	20.0366	19.9698	19.6032	18.9769	18.3528 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7216	18.9292	19.3214	19.7808	20.1051	20.2580	20.2889	20.2898	20.2199	19.8707	19.2889	18.7155 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5716	18.7792	19.1714	19.6308	19.9551	20.1080	20.1389	20.1398	20.0699	19.7207	19.1389	18.5655 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9338	0.9150	0.8693	0.7808	0.6427	0.4433	0.3004	0.3121	0.5502	0.7823	0.8965	0.9404 (94)
Ext temp.	637.5984	676.8105	698.2328	672.8401	560.7588	392.0033	253.1932	252.2936	419.8301	550.5436	596.0992	608.5636 (95)
Heat loss rate W	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)
Month fracti	1169.8974	1143.0867	1035.2230	856.6717	630.4135	405.4308	255.5556	254.9448	449.1986	701.6316	942.5968	1143.8996 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	396.0304	313.3376	250.7207	132.3588	51.8230	0.0000	0.0000	0.0000	0.0000	112.4095	249.4783	398.2900 (98)
Space heating per m2										(98) / (4) =		23.8235 (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													2104.3627 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	396.0304	313.3376	250.7207	132.3588	51.8230	0.0000	0.0000	0.0000	0.0000	112.4095	249.4783	398.2900	(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)	437.6027	346.2294	277.0395	146.2528	57.2630	0.0000	0.0000	0.0000	0.0000	124.2093	275.6666	440.0994	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.5336	89.4628	89.2726	88.8703	88.1981	87.3000	87.3000	87.3000	87.3000	88.7107	89.2792	89.5571	(217)
Fuel for water heating, kWh/month	184.6036	162.0170	168.5769	149.1075	145.2651	128.2841	120.5010	135.9628	136.9009	155.0381	166.2638	179.2165	(219)
Water heating fuel used												1831.7372	(219)
Annual totals kWh/year													
Space heating fuel - main system												2104.3627	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)
Total delivered energy for all uses												3020.1259	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2104.3627	9.7400	204.9649 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.7372	9.7400	178.4112 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	378.0032	36.8500	139.2942 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1368.9771	36.8500	-504.4681 (252)
Total energy cost			149.8397 (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	2104.3627	0.2160	454.5423 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.7372	0.2160	395.6552 (264)
Space and water heating			850.1976 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			374.8071 (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	2104.3627	1.2200	2567.3225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.7372	1.2200	2234.7193 (264)
Space and water heating			4802.0419 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			1990.0018 (272)

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

Primary energy kWh/m²/year

24.8937 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
Current environmental impact rating: A 94

(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	+ 1.2	-£ 77	-185 kg (49.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.32 kg/m ²	A 93
Total Savings	£77	2.32 kg/m ²	A 96

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 521 TEST (19 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	£167	£185	-£18
Mains gas	£487	£392	£95
Space heating	£337	£337	£0
Water heating	£178	£102	£77
Lighting	£139	£139	£0
Generated (PV)	-£504	-£504	£0
Total cost of fuels	£150	£73	£77
Total cost of uses	£150	£74	£77
Delivered energy	38 kWh/m ²	26 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	25 kWh/m ²	12 kWh/m ²	13 kWh/m ²

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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.2002 (8)				
Pressure test							Yes					
Measured/design AP50								4.4600				
Infiltration rate								0.4232 (18)				
Number of sides sheltered								1 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3914 (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	0.4991	0.4893	0.4795	0.4306	0.4208	0.3718	0.3718	0.3621	0.3914	0.4208	0.4403	0.4599 (22b)
Effective ac	0.6245	0.6197	0.6150	0.5927	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6058 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss					(33) + (36) =		47.0262 (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	41.1879	40.8689	40.5564	39.0881	38.8134	37.5346	37.5346	37.2978	38.0272	38.8134	39.3691	39.9501 (38)
Heat transfer coeff	88.2141	87.8952	87.5826	86.1143	85.8396	84.5609	84.5609	84.3241	85.0534	85.8396	86.3954	86.9763 (39)
Average = Sum(39)m / 12 =												86.1130 (39)
HLP	1.1035	1.0995	1.0956	1.0772	1.0738	1.0578	1.0578	1.0548	1.0640	1.0738	1.0808	1.0880 (40)
HLP (average)												1.0772 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.2439 (H8)
Utilisation factor												0.5524 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-843.6871 (H17)
Solar input	-24.4652	-40.8255	-69.5304	-93.1845	-115.1216	-113.1828	-111.6871	-97.5816	-76.4259	-52.1899	-29.0193	-20.4732 (63)
												-843.6871 (63)
Output from w/h	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279 (64)
												787.2219 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(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				2.1700	36.7938	0.4600	0.0000	0.7700	28.2803 (77)			
Northwest				3.5300	11.2829	0.4600	0.0000	0.7700	14.1074 (81)			
Southeast				4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)			
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	658.7768	729.8854	785.6207	833.6832	858.7930	833.7446	798.1962	761.1899	725.7034	675.8333	636.3430	628.5447 (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	37.5444	37.6807	37.8151	38.4599	38.5830	39.1664	39.1664	39.2764	38.9396	38.5830	38.3348	38.0787
alpha	3.5030	3.5120	3.5210	3.5640	3.5722	3.6111	3.6111	3.6184	3.5960	3.5722	3.5557	3.5386
util living area												
	0.9661	0.9501	0.9206	0.8586	0.7519	0.5937	0.4498	0.4868	0.6930	0.8751	0.9480	0.9706 (86)
MIT	19.5386	19.7382	20.0431	20.4262	20.7314	20.9183	20.9770	20.9693	20.8518	20.4695	19.9496	19.5071 (87)
Th 2	19.9980	20.0012	20.0044	20.0195	20.0223	20.0354	20.0354	20.0379	20.0304	20.0223	20.0166	20.0106 (88)
util rest of house												
	0.9597	0.9409	0.9056	0.8315	0.7045	0.5205	0.3579	0.3939	0.6245	0.8455	0.9368	0.9650 (89)
MIT 2	18.0728	18.3608	18.7963	19.3384	19.7403	19.9690	20.0229	20.0199	19.8980	19.4100	18.6785	18.0361 (90)
Living area fraction												
MIT	18.4634	18.7278	19.1285	19.6283	20.0043	20.2219	20.2771	20.2729	20.1521	19.6923	19.0172	18.4280 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3134	18.5778	18.9785	19.4783	19.8543	20.0719	20.1271	20.1229	20.0021	19.5423	18.8672	18.2780 (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	0.9453	0.9239	0.8866	0.8141	0.6955	0.5234	0.3669	0.4024	0.6223	0.8281	0.9198	0.9517	(94)
Useful gains	622.7247	674.3398	696.5027	678.7103	597.3113	436.4090	292.8571	306.3173	451.6144	559.6556	585.3102	598.1806	(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	1236.1778	1202.2128	1092.8990	910.9394	699.9649	462.7113	298.2552	313.9265	501.9946	767.6060	1016.6338	1224.4559	(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	456.4091	354.7306	294.9189	167.2050	76.3743	0.0000	0.0000	0.0000	0.0000	154.7151	310.5530	465.9488	(98)
Space heating												2280.8548	(98)
Space heating per m2											(98) / (4) =	28.5321	(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													2520.2816	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	456.4091	354.7306	294.9189	167.2050	76.3743	0.0000	0.0000	0.0000	0.0000	154.7151	310.5530	465.9488	(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)	504.3194	391.9676	325.8772	184.7569	84.3915	0.0000	0.0000	0.0000	0.0000	170.9559	343.1525	514.8605	(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	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279	(64)	
Efficiency of water heater	89.7245	89.7535	89.7911	89.8727	90.0201	87.3000	87.3000	87.3000	87.3000	89.3358	89.5879	87.3000	(216)	
Fuel for water heating, kWh/month	156.9437	116.0062	90.1676	43.7595	14.4408	0.0000	0.0000	24.1855	49.3568	95.5333	133.2989	156.0375	(219)	
Water heating fuel used												879.7297	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2520.2816	(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)													378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571			-1218.5571	(233)
Total delivered energy for all uses													2684.4573	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2520.2816	3.4800	87.7058	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.7297	3.4800	30.6146	(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	378.0032	13.1900	49.8586	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1218.5571	13.1900	-160.7277	(252)
Total energy cost			143.9388	(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] =	0.4839	(257)
SAP value		93.2501	
SAP rating (Section 12)		93	(258)
SAP band		A	

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2520.2816	0.2160	544.3808 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.7297	0.2160	190.0216 (264)
Space and water heating			734.4024 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total kg/year			363.0299 (272)
CO2 emissions per m2			4.5400 (273)
EI value			96.1065
EI rating			96 (274)
EI band			A

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.4600	
Infiltration rate																0.4232 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.3914 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4110	0.3816	0.3914	0.3718	0.3718	0.3621	0.3523	0.3425	0.3327	0.3621	0.3425	0.3621	(22b)				
Effective ac	0.5845	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.5450	Feb 37.7778	Mar 38.0272	Apr 37.5346	May 37.5346	Jun 37.2978	Jul 37.0673	Aug 36.8432	Sep 36.6253	Oct 37.2978	Nov 36.8432	Dec 37.2978 (38)
Heat transfer coeff	85.5713	84.8040	85.0534	84.5609	84.5609	84.3241	84.0936	83.8694	83.6515	84.3241	83.8694	84.3241 (39)
Average = Sum(39)m / 12 =												84.4172 (39)
HLP	Jan 1.0704	Feb 1.0608	Mar 1.0640	Apr 1.0578	May 1.0578	Jun 1.0548	Jul 1.0520	Aug 1.0492	Sep 1.0464	Oct 1.0548	Nov 1.0492	Dec 1.0548 (40)
HLP (average)												1.0560 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.3921 (H8)
Utilisation factor												0.5124 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input	-28.5725	-40.6283	-69.8302	-94.2171	-110.6637	-118.2063	-115.7204	-103.5733	-81.0907	-56.0633	-33.7937	-875.8544 (H17)
Solar input (sum of months) = Sum (63)m =												-23.4949 (63)
Output from w/h	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062 (64)
Total per year (kWh/year) = Sum (64)m =												764.1114 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(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	2.1700	45.1778	0.4600	0.0000	0.7700	34.7243 (77)
Northwest	3.5300	14.6176	0.4600	0.0000	0.7700	18.2768 (81)
Southeast	4.5100	45.1778	0.4600	0.0000	0.7700	72.1690 (77)

Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878 (83)
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098 (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	38.7040	39.0541	38.9396	39.1664	39.1664	39.2764	39.3841	39.4893	39.5922	39.2764	39.4893	39.2764
alpha	3.5803	3.6036	3.5960	3.6111	3.6111	3.6184	3.6256	3.6326	3.6395	3.6184	3.6326	3.6184
util living area	0.9574	0.9427	0.9055	0.8278	0.7018	0.5145	0.3813	0.3955	0.6229	0.8347	0.9294	0.9623 (86)
MIT	19.7241	19.8795	20.1818	20.5417	20.8118	20.9545	20.9883	20.9869	20.9084	20.6069	20.1478	19.7142 (87)
Th 2	20.0250	20.0329	20.0304	20.0354	20.0354	20.0379	20.0403	20.0426	20.0448	20.0379	20.0426	20.0379 (88)
util rest of house	0.9494	0.9322	0.8880	0.7960	0.6476	0.4374	0.2909	0.3024	0.5481	0.7967	0.9144	0.9551 (89)
MIT 2	18.3575	18.5840	19.0089	19.5045	19.8485	20.0050	20.0349	20.0366	19.9698	19.6032	18.9769	18.3528 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7216	18.9292	19.3214	19.7808	20.1051	20.2580	20.2889	20.2898	20.2199	19.8707	19.2889	18.7155 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5716	18.7792	19.1714	19.6308	19.9551	20.1080	20.1389	20.1398	20.0699	19.7207	19.1389	18.5655 (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	0.9338	0.9150	0.8693	0.7808	0.6427	0.4433	0.3004	0.3121	0.5502	0.7823	0.8965	0.9404	(94)
Useful gains	637.5984	676.8105	698.2328	672.8401	560.7588	392.0033	253.1932	252.2936	419.8301	550.5436	596.0992	608.5636	(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	1169.8974	1143.0867	1035.2230	856.6717	630.4135	405.4308	255.5556	254.9448	449.1986	701.6316	942.5968	1143.8996	(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	396.0304	313.3376	250.7207	132.3588	51.8230	0.0000	0.0000	0.0000	0.0000	112.4095	249.4783	398.2900	(98)
Space heating												1904.4483	(98)
Space heating per m2											(98) / (4) =	23.8235	(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													2104.3627 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	396.0304	313.3376	250.7207	132.3588	51.8230	0.0000	0.0000	0.0000	0.0000	112.4095	249.4783	398.2900	(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)	437.6027	346.2294	277.0395	146.2528	57.2630	0.0000	0.0000	0.0000	0.0000	124.2093	275.6666	440.0994	(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	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062	(64)
Efficiency of water heater	89.6567	89.6790	89.6997	89.7617	89.6717	87.3000	87.3000	87.3000	87.3000	89.1272	89.4675	87.3000	(216)
(217)m	89.6567	89.6790	89.6997	89.7617	89.6717	87.3000	87.3000	87.3000	87.3000	89.1272	89.4675	87.3000	(217)
Fuel for water heating, kWh/month	152.4815	116.3224	89.9253	42.6631	19.4682	0.0000	0.0000	17.3222	44.0135	91.4110	128.1419	152.8084	(219)
Water heating fuel used												854.5574	(219)
Annual totals kWh/year													
Space heating fuel - main system												2104.3627	(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)													378.0032 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =									-1368.9771			-1368.9771	(233)
Total delivered energy for all uses												2092.9462	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2104.3627	9.7400	204.9649	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.5574	9.7400	83.2339	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	378.0032	36.8500	139.2942	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1368.9771	36.8500	-504.4681	(252)
Total energy cost			73.0874	(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	2104.3627	0.2160	454.5423	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.5574	0.2160	184.5844	(264)
Space and water heating			639.1267	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)

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 saving/generation technologies			
PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			189.6863 (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	2104.3627	1.2200	2567.3225 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	854.5574	1.2200	1042.5600 (264)
Space and water heating			3609.8826 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			951.3425 (272)
Primary energy kWh/m2/year			11.9007 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	149.1 (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	263.80 (P1)
Transmission heat loss coefficient	47.03 (37)
Summer heat loss coefficient	310.83 (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 g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	2.1700	119.9223	0.4600	0.0000	0.9000	107.7358
North West	3.5300	98.8453	0.4600	0.0000	0.9000	144.4545
South East	4.5100	119.9223	0.4600	0.0000	0.9000	223.9118

total: 476.1021

	Jun	Jul	Aug	
Solar gains	504	476	428	(P4)
Internal gains	429	412	420	
Total summer gains	934	888	848	(P5)

Summer gain/loss ratio	3.00	2.86	2.73	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 149.1)	0.96	0.96	0.96	
Threshold temperature	19.96	21.71	21.48	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-654			Issued on Date	11/05/2023
Assessment Reference	As Built	Prop Type Ref	Coiner-CB-As-SEMI		
Property	2, Flycatcher Road , BOTLEY, SO32 2FG				
SAP Rating	92 A	DER	8.47	TER	18.39
Environmental	94 A	% DER<TER	53.95		
CO ₂ Emissions (t/year)	0.38	DFEE	40.68	TFEE	50.72
General Requirements Compliance	Pass	% DFEE<TFEE	19.81		
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk			Assessor ID	Q919-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 80 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) 18.39 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.47 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)40.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.30 (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: 4.77 (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 (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing South East: 6.68 m², No overhang
Windows facing North West: 3.53 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 0.64 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 1.48 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50															4.7700		
Infiltration rate															0.4387 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4058 (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	0.5173	0.5072	0.4970	0.4463	0.4362	0.3855	0.3855	0.3753	0.4058	0.4362	0.4565	0.4768 (22b)					
Effective ac	0.6338	0.6286	0.6235	0.5996	0.5951	0.5743	0.5743	0.5704	0.5823	0.5951	0.6042	0.6136 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	41.8005	41.4578	41.1219	39.5442	39.2490	37.8748	37.8748	37.6203	38.4041	39.2490	39.8461	40.4705 (38)
Heat transfer coeff	88.8267	88.4841	88.1481	86.5704	86.2752	84.9010	84.9010	84.6465	85.4303	86.2752	86.8724	87.4967 (39)
Average = Sum(39)m / 12 =												86.5690 (39)
HLP	1.1112	1.1069	1.1027	1.0829	1.0792	1.0621	1.0621	1.0589	1.0687	1.0792	1.0867	1.0945 (40)
HLP (average)												1.0829 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) =	Sum (64)m =	1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	375.9454	373.6816	359.9393	337.9173	315.6170	294.2333	280.4489	286.5947	298.0240	320.2577	345.7036	364.7281 (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			2.1700		36.7938		0.4600		0.0000		0.7700		28.2803 (77)
Northwest			3.5300		11.2829		0.4600		0.0000		0.7700		14.1074 (81)
Southeast			4.5100		36.7938		0.4600		0.0000		0.7700		58.7760 (77)
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228	(83)
Total gains	477.1091	550.6865	614.5718	674.2816	711.4153	695.5455	663.8709	624.3957	580.7593	519.2418	467.7277	450.7509	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	37.2855	37.4299	37.5725	38.2573	38.3882	39.0095	39.0095	39.1268	39.7678	38.3882	38.1243	37.8523
alpha	3.4857	3.4953	3.5048	3.5505	3.5592	3.6006	3.6006	3.6085	3.5845	3.5592	3.5416	3.5235
util living area	0.9869	0.9776	0.9586	0.9138	0.8250	0.6777	0.5293	0.5754	0.7877	0.9345	0.9784	0.9892 (86)
MIT	19.2351	19.4534	19.7963	20.2424	20.6213	20.8728	20.9608	20.9468	20.7672	20.2755	19.6842	19.2070 (87)
Th 2	19.9917	19.9952	19.9986	20.0148	20.0178	20.0319	20.0319	20.0346	20.0265	20.0178	20.0117	20.0053 (88)
util rest of house	0.9842	0.9729	0.9497	0.8944	0.7840	0.6031	0.4259	0.4725	0.7254	0.9157	0.9732	0.9869 (89)
MIT 2	17.6321	17.9508	18.4475	19.0909	19.6062	19.9241	20.0096	20.0019	19.8069	19.1499	18.2989	17.5997 (90)
Living area fraction	18.0593	18.3512	18.8069	19.3977	19.8767	20.1769	20.2631	20.2537	20.0628	19.4498	18.6680	18.0280 (92)
MIT	18.0593	18.3512	18.8069	19.3977	19.8767	20.1769	20.2631	20.2537	20.0628	19.4498	18.6680	18.0280 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9093	18.2012	18.6569	19.2477	19.7267	20.0269	20.1131	20.1037	19.9128	19.2998	18.5180	17.8780 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	465.6281	529.3808	573.9069	590.4518	547.8094	419.1975	288.8128	299.9435	416.4226	466.2475	449.8929	441.6366 (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	1208.8659	1176.9407	1071.6047	895.8057	692.5019	460.7482	298.2632	313.5020	496.5882	750.5788	991.9101	1196.7785 (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	552.9690	435.1603	370.2872	219.8548	107.6512	0.0000	0.0000	0.0000	0.0000	211.5425	390.2524	561.8255 (98)
Space heating												2849.5428 (98)
Space heating per m2												35.6460 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													3148.6661 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	552.9690	435.1603	370.2872	219.8548	107.6512	0.0000	0.0000	0.0000	0.0000	211.5425	390.2524	561.8255	(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)	611.0155	480.8401	409.1571	242.9335	118.9516	0.0000	0.0000	0.0000	0.0000	233.7486	431.2181	620.8017	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.7430	89.6787	89.5514	89.2694	88.7326	87.3000	87.3000	87.3000	87.3000	89.2116	89.5950	89.7689	(216)
Fuel for water heating, kWh/month	184.1729	161.6271	168.0519	148.4408	144.3902	128.2841	120.5010	135.9628	136.9009	154.1676	165.6777	178.7938	(219)
Water heating fuel used												1826.9706	(219)
Annual totals kWh/year													
Space heating fuel - main system												3148.6661	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												4210.0828	(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	3148.6661	0.2160	680.1119	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.9706	0.2160	394.6257	(264)
Space and water heating			1074.7375	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total CO2, kg/year			677.4151	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4700	(273)

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

DER			8.4700	ZC1
Total Floor Area		TFA	79.9400	
Assumed number of occupants		N	2.4617	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.2574	ZC2
CO2 emissions from cooking, equation (L16)			2.2277	ZC3
Total CO2 emissions			26.9551	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			26.9551	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.8500 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1501 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3701 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349	(22b)				
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	0.0000	(57)
Combi loss	50.9589	45.2108	48.1660	44.7843	44.3882	41.1284	42.4994	44.3882	44.7843	48.1660	48.4401	50.9589	(61)	
Total heat required for water heating calculated for each month	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521	(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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
Heat gains from water heating, kWh/month	63.0014	55.2619	57.4034	50.7437	49.0440	43.0274	40.9682	45.9165	46.4313	53.1048	56.9338	61.4155	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	84.6793	82.2349	77.1551	70.4774	65.9193	59.7603	55.0647	61.7157	64.4880	71.3774	79.0748	82.5477	(72)
Total internal gains	388.3243	385.7626	371.3976	348.7549	325.8298	303.8231	290.0457	296.8140	308.8714	331.7259	357.7903	377.1108	(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					6.6800	36.7938		0.6300		0.7000		0.7700		75.1144 (77)	
Northwest					3.5300	11.2829		0.6300		0.7000		0.7700		12.1722 (81)	
Solar gains	87.2866	152.7245	219.7036	290.2239	341.5051	346.2626	330.8265	291.4636	243.9513	171.6887	105.2855	74.2227 (83)			
Total gains	475.6109	538.4871	591.1012	638.9788	667.3349	650.0857	620.8722	588.2776	552.8228	503.4146	463.0758	451.3335 (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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642	
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976	
util living area	0.9981	0.9960	0.9902	0.9704	0.9094	0.7641	0.5915	0.6421	0.8709	0.9791	0.9960	0.9986 (86)	
MIT	19.7989	19.9398	20.1704	20.4807	20.7581	20.9360	20.9867	20.9798	20.8632	20.5089	20.1018	19.7788 (87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984 (88)	
util rest of house	0.9974	0.9946	0.9867	0.9587	0.8721	0.6775	0.4690	0.5198	0.8064	0.9687	0.9944	0.9981 (89)	
MIT 2	18.3840	18.5916	18.9291	19.3837	19.7616	19.9756	20.0154	20.0140	19.9016	19.4307	18.8386	18.3627 (90)	
Living area fraction	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (91)	
MIT	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (92)	
Temperature adjustment	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (93)	
adjusted MIT	18.7610	18.9508	19.2598	19.6760	20.0271	20.2315	20.2742	20.2713	20.1578	19.7180	19.1752	18.7401 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	473.8443	534.4919	581.1112	609.3748	582.5490	453.6100	311.6262	325.0148	451.7580	485.5611	459.5804	450.0446	(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	1290.9905	1250.3691	1131.9155	941.7879	725.7184	484.3510	316.0075	332.1431	523.6887	794.6401	1058.3680	1281.9593	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	607.9567	481.0695	409.7984	239.3375	106.5180	0.0000	0.0000	0.0000	0.0000	229.9548	431.1271	618.9445	(98)
Space heating												3124.7064	(98)
Space heating per m2												39.0881	(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												3345.5101 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	607.9567	481.0695	409.7984	239.3375	106.5180	0.0000	0.0000	0.0000	0.0000	229.9548	431.1271	618.9445 (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)	650.9173	515.0637	438.7563	256.2500	114.0450	0.0000	0.0000	0.0000	0.0000	246.2043	461.5921	662.6815 (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	202.1218	177.4189	184.5928	163.7245	158.5142	139.6105	133.7575	149.1082	150.7550	171.6646	183.2486	197.3521 (64)
Efficiency of water heater (217)m	87.6493	87.4369	87.0016	86.0058	84.0752	80.3000	80.3000	80.3000	80.3000	85.7879	87.1312	80.3000 (216)
Fuel for water heating, kWh/month	230.6029	202.9108	212.1718	190.3644	188.5385	173.8611	166.5722	185.6890	187.7397	200.1035	210.3133	224.9484 (219)
Water heating fuel used												2373.8157 (219)
Annual totals kWh/year												
Space heating fuel - main system												3345.5101 (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)												378.0032 (232)
Total delivered energy for all uses												6172.3289 (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	3345.5101	0.2160	722.6302 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2373.8157	0.2160	512.7442 (264)
Space and water heating			1235.3744 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/m2/year			1470.4830 (272)
Emissions per m2 for space and water heating			15.4538 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4541 (272b)
Emissions per m2 for pumps and fans			0.4869 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4538 * 1.00) + 2.4541 + 0.4869, rounded to 2 d.p.			18.3900 (273)

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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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1501 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3886 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3595 (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	0.4583	0.4493	0.4403	0.3954	0.3864	0.3415	0.3415	0.3325	0.3595	0.3864	0.4044	0.4224 (22b)
Effective ac	0.6050	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss							(33) + (36) = 47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.9019	39.6330	39.3693	38.1310	37.8993	36.8207	36.8207	36.6210	37.2362	37.8993	38.3680	38.8580 (38)
Average = Sum(39)m / 12 =	86.9282	86.6592	86.3955	85.1572	84.9255	83.8470	83.8470	83.6472	84.2624	84.9255	85.3942	85.8842 (39)
	85.1561 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0874	1.0841	1.0808	1.0653	1.0624	1.0489	1.0489	1.0464	1.0541	1.0624	1.0682	1.0744 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

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Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	31.1086 (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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(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				2.1700	36.7938	0.4600	0.0000	0.7700	28.2803 (77)			
Northwest				3.5300	11.2829	0.4600	0.0000	0.7700	14.1074 (81)			
Southeast				4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)			
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	444.9835	519.3395	584.8410	646.7458	685.3052	671.4408	641.4679	599.8093	555.3948	491.6061	437.5268	419.3985 (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	38.0998	38.2181	38.3347	38.8922	38.9983	39.4999	39.4999	39.5942	39.3052	38.9983	38.7842	38.5629	
alpha	3.5400	3.5479	3.5556	3.5928	3.5999	3.6333	3.6333	3.6396	3.6203	3.5999	3.5856	3.5709	
util living area	0.9894	0.9809	0.9633	0.9208	0.8344	0.6892	0.5396	0.5891	0.8011	0.9423	0.9822	0.9914	(86)
MIT	19.2257	19.4447	19.7885	20.2325	20.6150	20.8690	20.9596	20.9443	20.7584	20.2582	19.6646	19.1918	(87)
Th 2	20.0111	20.0139	20.0166	20.0293	20.0317	20.0428	20.0428	20.0449	20.0385	20.0317	20.0269	20.0218	(88)
util rest of house	0.9872	0.9770	0.9554	0.9027	0.7949	0.6154	0.4361	0.4860	0.7410	0.9255	0.9778	0.9896	(89)
MIT 2	18.3859	18.6050	18.9463	19.3870	19.7441	19.9663	20.0269	20.0212	19.8812	19.4205	18.8347	18.3602	(90)
Living area fraction										fLA = Living area / (4) =		0.2664	(91)
MIT	18.6096	18.8288	19.1707	19.6123	19.9762	20.2068	20.2755	20.2671	20.1149	19.6437	19.0558	18.5818	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6096	18.8288	19.1707	19.6123	19.9762	20.2068	20.2755	20.2671	20.1149	19.6437	19.0558	18.5818	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9830	0.9708	0.9468	0.8935	0.7924	0.6290	0.4624	0.5115	0.7464	0.9171	0.9720	0.9859	(94)
Useful gains	437.4021	504.1650	553.7329	577.8467	543.0286	422.3516	296.6291	306.7759	414.5377	450.8692	425.2952	413.5032	(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	1243.9101	1207.0542	1094.6895	912.2296	702.8586	470.1158	308.1763	323.4754	506.8341	768.0415	1020.9559	1235.1680	(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	600.0419	472.3415	402.4717	240.7557	118.9135	0.0000	0.0000	0.0000	0.0000	235.9762	428.8757	611.3186	(98)
Space heating												3110.6948	(98)
Space heating per m2										(98) / (4) =		38.9129	(99)

8c. Space cooling requirement

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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	788.1615	620.4676	635.7190	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8241	0.8849	0.8619	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	649.5333	549.0552	547.9548	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	877.3940	840.5269	793.6348	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	164.0597	216.8549	182.7859	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												563.7006 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.0149	54.2137	45.6965	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												140.9251 (107)
Space cooling per m2												1.7629 (108)
Energy for space heating												38.9129 (99)
Energy for space cooling												1.7629 (108)
Total												40.6758 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.7 (109)

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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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1501 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4001 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3701 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4719	0.4626	0.4534	0.4071	0.3979	0.3516	0.3516	0.3423	0.3701	0.3979	0.4164	0.4349	(22b)				
Effective ac	0.6113	0.6070	0.6028	0.5829	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5867	0.5946	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.2100	1.3258	13.5360			(27)					
GF B&B J150 P/A=0.40			39.9700	0.1300	5.1961			(28a)					
EW Brick AAC011	80.0500	7.8500	72.2000	0.1800	12.9960			(29a)					
EW Brick AAC018	9.7500	4.5100	5.2400	0.1800	0.9432			(29a)					
PR 400mm MW044	39.9700		39.9700	0.1300	5.1961			(30)					
Total net area of external elements Aum(A, m2)			169.7400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0174		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9387	(36)					
Total fabric heat loss						(33) + (36) =	48.9561	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.3180	Feb 40.0328	Mar 39.7534	Apr 38.4406	May 38.1950	Jun 37.0517	Jul 37.0517	Aug 36.8400	Sep 37.4921	Oct 38.1950	Nov 38.6919	Dec 39.2113	(38)
Heat transfer coeff	89.2740	88.9889	88.7094	87.3967	87.1511	86.0078	86.0078	85.7961	86.4482	87.1511	87.6480	88.1674	(39)
Average = Sum(39)m / 12 =												87.3956	(39)
HLP	Jan 1.1168	Feb 1.1132	Mar 1.1097	Apr 1.0933	May 1.0902	Jun 1.0759	Jul 1.0759	Aug 1.0733	Sep 1.0814	Oct 1.0902	Nov 1.0964	Dec 1.1029	(40)
HLP (average)												1.0933	(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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Daily hot water use	Jan 101.9325	Feb 98.2258	Mar 94.5192	Apr 90.8126	May 87.1059	Jun 83.3993	Jul 83.3993	Aug 87.1059	Sep 90.8126	Oct 94.5192	Nov 98.2258	Dec 101.9325 (44)
Energy conte	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Energy content (annual)										Total = Sum(45)m =		1457.9953 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	32.1221	28.0942	28.9907	25.2748	24.2518	20.9274	19.3923	22.2530	22.5188	26.2435	28.6468	(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	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	123.0861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4041	19.0109	15.4607	11.7048	8.7495	7.3867	7.9815	10.3747	13.9249	17.6809	20.6362	21.9990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.3151	221.5909	215.8559	203.6469	188.2352	173.7504	164.0736	161.7978	167.5327	179.7418	195.1535	209.6383	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	35.3086	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	43.1749	41.8069	38.9660	35.1039	32.5965	29.0659	26.0650	29.9100	31.2761	35.2735	39.7872	41.8126	(72)
Total internal gains	343.8199	342.3345	330.2085	310.3814	289.5069	270.1287	258.0459	262.0083	272.6596	292.6219	315.5027	333.3757	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast												6.6800	36.7938	0.6300	0.7000	0.7700	75.1144	(77)
Northwest												3.5300	11.2829	0.6300	0.7000	0.7700	12.1722	(81)
Solar gains	87.2866	152.7245	219.7036	290.2239	341.5051	346.2626	330.8265	291.4636	243.9513	171.6887	105.2855	74.2227	(83)					
Total gains	431.1065	495.0590	549.9121	600.6053	631.0120	616.3913	588.8724	553.4718	516.6109	464.3106	420.7883	407.5984	(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	62.1837	62.3829	62.5795	63.5194	63.6984	64.5452	64.5452	64.7045	64.2164	63.6984	63.3373	62.9642		
alpha	5.1456	5.1589	5.1720	5.2346	5.2466	5.3030	5.3030	5.3136	5.2811	5.2466	5.2225	5.1976		
util living area	0.9988	0.9973	0.9929	0.9770	0.9247	0.7902	0.6192	0.6746	0.8946	0.9852	0.9975	0.9991	(86)	
MIT	19.7468	19.8894	20.1239	20.4412	20.7304	20.9245	20.9835	20.9746	20.8402	20.4668	20.0525	19.7273	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0206	20.0206	20.0227	20.0160	20.0088	20.0038	19.9984	(88)	
util rest of house	0.9984	0.9963	0.9902	0.9675	0.8917	0.7057	0.4932	0.5498	0.8365	0.9774	0.9964	0.9988	(89)	
MIT 2	18.8406	18.9852	19.2208	19.5438	19.8171	19.9834	20.0161	20.0150	19.9217	19.5739	19.1594	18.8303	(90)	
Living area fraction									fLA = Living area / (4) =			0.2664	(91)	
MIT	19.0820	19.2261	19.4614	19.7829	20.0604	20.2342	20.2739	20.2707	20.1665	19.8118	19.3974	19.0693	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0820	19.2261	19.4614	19.7829	20.0604	20.2342	20.2739	20.2707	20.1665	19.8118	19.3974	19.0693	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.1879	492.7514	543.5204	579.4503	563.9615	447.5166	310.4781	322.9230	437.5911	452.8683	418.8958	406.9502	(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	(95)
Heat loss rate W	1319.6520	1274.8647	1149.7995	951.1340	728.6200	484.5818	315.9808	332.0880	524.4340	802.8199	1077.8385	1310.9886	(96)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	661.7613	525.5801	451.0717	267.6123	122.5059	0.0000	0.0000	0.0000	0.0000	260.3640	474.4388	672.6046	(98)
Space heating												3435.9387	(98)
Space heating per m2												42.9815	(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	808.4733	636.4577	652.0501	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8437	0.9130	0.8895	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.1177	581.1004	579.9800	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	813.0504	779.0516	739.4741	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	94.2715	147.2757	118.6636	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												360.2108	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.5679	36.8189	29.6659	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												90.0527 (107)
Space cooling per m2												1.1265 (108)
Energy for space heating												42.9815 (99)
Energy for space cooling												1.1265 (108)
Total												44.1080 (109)
Target Fabric Energy Efficiency (TFEE)												50.7 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50															4.7700		
Infiltration rate															0.4387 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4058 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4260	0.3956	0.4058	0.3855	0.3855	0.3753	0.3652	0.3550	0.3449	0.3753	0.3550	0.3753	(22b)				
Effective ac	0.5908	0.5783	0.5823	0.5743	0.5743	0.5704	0.5667	0.5630	0.5595	0.5704	0.5630	0.5704	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss							(33) + (36) = 47.0262 (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	38.9606	38.1361	38.4041	37.8748	37.8748	37.6203	37.3726	37.1317	36.8976	37.6203	37.1317	37.6203 (38)
Heat transfer coeff	85.9868	85.1623	85.4303	84.9010	84.9010	84.6465	84.3988	84.1579	83.9238	84.6465	84.1579	84.6465 (39)
Average = Sum(39)m / 12 =												84.7466 (39)
HLP	1.0756	1.0653	1.0687	1.0621	1.0621	1.0589	1.0558	1.0528	1.0498	1.0589	1.0528	1.0589 (40)
HLP (average)												1.0601 (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	2.4617 (42)
Average daily hot water use (litres/day)	92.6659 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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				2.1700	45.1778	0.4600	0.0000			0.7700			34.7243 (77)
Northwest				3.5300	14.6176	0.4600	0.0000			0.7700			18.2768 (81)
Southeast				4.5100	45.1778	0.4600	0.0000			0.7700			72.1690 (77)
Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878	(83)
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098	(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	38.5169	38.8898	38.7678	39.0095	39.0095	39.1268	39.2416	39.3540	39.4637	39.1268	39.3540	39.1268
alpha	3.5678	3.5927	3.5845	3.6006	3.6006	3.6085	3.6161	3.6236	3.6309	3.6085	3.6236	3.6085
util living area	0.9576	0.9430	0.9060	0.8287	0.7031	0.5159	0.3825	0.3967	0.6241	0.8355	0.9297	0.9624 (86)
MIT	19.7143	19.8713	20.1743	20.5367	20.8090	20.9536	20.9880	20.9866	20.9071	20.6029	20.1423	19.7066 (87)
Th 2	20.0208	20.0292	20.0265	20.0319	20.0319	20.0346	20.0371	20.0396	20.0420	20.0346	20.0396	20.0346 (88)
util rest of house	0.9496	0.9325	0.8885	0.7969	0.6488	0.4386	0.2916	0.3031	0.5491	0.7976	0.9147	0.9552 (89)
MIT 2	18.3407	18.5697	18.9956	19.4951	19.8422	20.0011	20.0317	20.0335	19.9659	19.5954	18.9670	18.3397 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7067	18.9165	19.3097	19.7726	20.0998	20.2549	20.2865	20.2874	20.2167	19.8638	19.2802	18.7039 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5567	18.7665	19.1597	19.6226	19.9498	20.1049	20.1365	20.1374	20.0667	19.7138	19.1302	18.5539 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9340	0.9152	0.8697	0.7816	0.6438	0.4444	0.3012	0.3129	0.5512	0.7830	0.8968	0.9405 (94)
Useful gains	637.7066	676.9750	698.5899	673.4998	561.7627	393.0122	253.8574	252.9153	420.5928	551.0412	596.2643	608.6319 (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	1174.2949	1146.8405	1038.8061	859.4186	632.4932	406.7152	256.2753	255.6244	450.3938	703.7377	945.1080	1147.2925 (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	399.2217	315.7496	253.1209	133.8615	52.6235	0.0000	0.0000	0.0000	0.0000	113.6062	251.1675	400.7634 (98)
Space heating												1920.1142 (98)
RHI space heating demand												1920 (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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50															4.7700		
Infiltration rate															0.4387 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4058 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.5173	0.5072	0.4970	0.4463	0.4362	0.3855	0.3855	0.3753	0.4058	0.4362	0.4565	0.4768	(22b)				
Effective ac	0.6338	0.6286	0.6235	0.5996	0.5951	0.5743	0.5743	0.5704	0.5823	0.5951	0.6042	0.6136	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	41.8005	41.4578	41.1219	39.5442	39.2490	37.8748	37.8748	37.6203	38.4041	39.2490	39.8461	40.4705 (38)
Heat transfer coeff	88.8267	88.4841	88.1481	86.5704	86.2752	84.9010	84.9010	84.6465	85.4303	86.2752	86.8724	87.4967 (39)
Average = Sum(39)m / 12 =												86.5690 (39)
HLP	1.1112	1.1069	1.1027	1.0829	1.0792	1.0621	1.0621	1.0589	1.0687	1.0792	1.0867	1.0945 (40)
HLP (average)												1.0829 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (73)

6. Solar gains

[Jan]												
			Area	Solar flux		g		FF		Access		Gains
			m2	Table 6a	Table 6b	Specific data	Specific data	Specific data	Specific data	factor	W	
				W/m2		or Table 6b	or Table 6c	or Table 6c	or Table 6c	Table 6d		
Southeast			2.1700	36.7938		0.4600		0.0000		0.7700	28.2803 (77)	
Northwest			3.5300	11.2829		0.4600		0.0000		0.7700	14.1074 (81)	
Southeast			4.5100	36.7938		0.4600		0.0000		0.7700	58.7760 (77)	
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	658.7768	729.8854	785.6207	833.6832	858.7930	833.7446	798.1962	761.1899	725.7034	675.8333	636.3430	628.5447 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.2855	37.4299	37.5725	38.2573	38.3882	39.0095	39.0095	39.1268	38.7678	38.3882	38.1243	37.8523
util living area	3.4857	3.4953	3.5048	3.5505	3.5592	3.6006	3.6006	3.6085	3.5845	3.5592	3.5416	3.5235
	0.9663	0.9505	0.9212	0.8596	0.7534	0.5953	0.4513	0.4882	0.6945	0.8759	0.9482	0.9707 (86)
MIT	19.5239	19.7246	20.0314	20.4188	20.7269	20.9168	20.9765	20.9686	20.8493	20.4632	19.9400	19.4945 (87)
Th 2	19.9917	19.9952	19.9986	20.0148	20.0178	20.0319	20.0319	20.0346	20.0265	20.0178	20.0117	20.0053 (88)
util rest of house	0.9599	0.9413	0.9063	0.8325	0.7059	0.5218	0.3588	0.3949	0.6258	0.8463	0.9371	0.9651 (89)
MIT 2	18.0478	18.3373	18.7758	19.3248	19.7311	19.9643	20.0191	20.0162	19.8919	19.3983	18.6616	18.0146 (90)
Living area fraction	18.4411	18.7069	19.1103	19.6163	19.9964	20.2181	20.2742	20.2700	20.1470	19.6821	19.0022	0.2664 (91)
MIT	18.4411	18.7069	19.1103	19.6163	19.9964	20.2181	20.2742	20.2700	20.1470	19.6821	19.0022	18.4089 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2911	18.5569	18.9603	19.4663	19.8464	20.0681	20.1242	20.1200	19.9970	19.5321	18.8522	18.2589 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9454	0.9242	0.8871	0.8149	0.6968	0.5247	0.3679	0.4035	0.6236	0.8288	0.9200	0.9518 (94)
Ext temp.	622.8138	674.5328	696.8939	679.3889	598.4094	437.4449	293.6822	307.1125	452.5290	560.1246	585.4656	598.2373 (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	1242.7831	1208.4211	1098.3564	914.7312	702.8313	464.2459	299.2077	314.8842	503.7816	770.6166	1020.9430	1230.1071 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	461.2572	358.7729	298.6881	169.4464	77.6899	0.0000	0.0000	0.0000	0.0000	156.6061	313.5437	470.1111 (98)
Space heating per m2												2306.1155 (98)
										(98) / (4) =		28.8481 (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													2548.1939 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	461.2572	358.7729	298.6881	169.4464	77.6899	0.0000	0.0000	0.0000	0.0000	156.6061	313.5437	470.1111	(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)	509.6764	396.4342	330.0421	187.2336	85.8452	0.0000	0.0000	0.0000	0.0000	173.0454	346.4571	519.4598	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater (217)m	89.6333	89.5554	89.4021	89.0673	88.4810	87.3000	87.3000	87.3000	87.3000	88.9750	89.4465	89.6635	(216)
Fuel for water heating, kWh/month	184.3983	161.8495	168.3327	148.7777	144.8008	128.2841	120.5010	135.9628	136.9009	154.5775	165.9528	179.0039	(219)
Water heating fuel used												1829.3419	(219)
Annual totals kWh/year													
Space heating fuel - main system												2548.1939	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)
Total delivered energy for all uses												3611.9819	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2548.1939	3.4800	88.6771 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.3419	3.4800	63.6611 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	378.0032	13.1900	49.8586 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1218.5571	13.1900	-160.7277 (252)
Total energy cost			171.3617 (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] = 0.5761 (257)
SAP value	91.9641
SAP rating (Section 12)	92 (258)
SAP band	A

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	2548.1939	0.2160	550.4099 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.3419	0.2160	395.1378 (264)
Space and water heating			945.5477 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1218.5571	0.5190	-632.4311 (269)
Total kg/year			548.2252 (272)
CO2 emissions per m2			6.8600 (273)
EI value			94.1202
EI rating			94 (274)
EI band			A

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Calculation Type: New Build (As Built)

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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	$3.48 / 0.8862 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8862 = 0.2437$, 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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.7700	
Infiltration rate																0.4387 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.4058 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4260	0.3956	0.4058	0.3855	0.3855	0.3753	0.3652	0.3550	0.3449	0.3753	0.3550	0.3753	(22b)				
Effective ac	0.5908	0.5783	0.5823	0.5743	0.5743	0.5704	0.5667	0.5630	0.5595	0.5704	0.5630	0.5704	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	38.9606	38.1361	38.4041	37.8748	37.8748	37.6203	37.3726	37.1317	36.8976	37.6203	37.1317	37.6203 (38)
Heat transfer coeff	85.9868	85.1623	85.4303	84.9010	84.9010	84.6465	84.3988	84.1579	83.9238	84.6465	84.1579	84.6465 (39)
Average = Sum(39)m / 12 =												84.7466 (39)
HLP	1.0756	1.0653	1.0687	1.0621	1.0621	1.0589	1.0558	1.0528	1.0498	1.0589	1.0528	1.0589 (40)
HLP (average)												1.0601 (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	2.4617 (42)
Average daily hot water use (litres/day)	92.6659 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (65)
										Total per year (kWh/year) = Sum (64)m =		1623.2284 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321 (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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689 (71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649 (72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219 (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	2.1700				45.1778		0.4600		0.0000		0.7700		34.7243 (77)	
Northwest	3.5300				14.6176		0.4600		0.0000		0.7700		18.2768 (81)	
Southeast	4.5100				45.1778		0.4600		0.0000		0.7700		72.1690 (77)	
Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878	(83)	
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.5169	38.8898	38.7678	39.0095	39.0095	39.1268	39.2416	39.3540	39.4637	39.1268	39.3540	39.1268
util living area	3.5678	3.5927	3.5845	3.6006	3.6006	3.6085	3.6161	3.6236	3.6309	3.6085	3.6236	3.6085
	0.9576	0.9430	0.9060	0.8287	0.7031	0.5159	0.3825	0.3967	0.6241	0.8355	0.9297	0.9624 (86)
MIT	19.7143	19.8713	20.1743	20.5367	20.8090	20.9536	20.9880	20.9866	20.9071	20.6029	20.1423	19.7066 (87)
Th 2	20.0208	20.0292	20.0265	20.0319	20.0319	20.0346	20.0371	20.0396	20.0420	20.0346	20.0396	20.0346 (88)
util rest of house	0.9496	0.9325	0.8885	0.7969	0.6488	0.4386	0.2916	0.3031	0.5491	0.7976	0.9147	0.9552 (89)
MIT 2	18.3407	18.5697	18.9956	19.4951	19.8422	20.0011	20.0317	20.0335	19.9659	19.5954	18.9670	18.3397 (90)
Living area fraction	18.7067	18.9165	19.3097	19.7726	20.0998	20.2549	20.2865	20.2874	20.2167	19.8638	19.2802	18.7039 (92)
MIT												0.2664 (91)
Temperature adjustment												-0.1500
adjusted MIT	18.5567	18.7665	19.1597	19.6226	19.9498	20.1049	20.1365	20.1374	20.0667	19.7138	19.1302	18.5539 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9340	0.9152	0.8697	0.7816	0.6438	0.4444	0.3012	0.3129	0.5512	0.7830	0.8968	0.9405 (94)
Ext temp.	637.7066	676.9750	698.5899	673.4998	561.7627	393.0122	253.8574	252.9153	420.5928	551.0412	596.2643	608.6319 (95)
Heat loss rate W	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)
Month fracti	1174.2949	1146.8405	1038.8061	859.4186	632.4932	406.7152	256.2753	255.6244	450.3938	703.7377	945.1080	1147.2925 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	399.2217	315.7496	253.1209	133.8615	52.6235	0.0000	0.0000	0.0000	0.0000	113.6062	251.1675	400.7634 (98)
Space heating per m2												1920.1142 (98)
										(98) / (4) =		24.0194 (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												2121.6732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	399.2217	315.7496	253.1209	133.8615	52.6235	0.0000	0.0000	0.0000	0.0000	113.6062	251.1675	400.7634	(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)	441.1289	348.8946	279.6916	147.9132	58.1475	0.0000	0.0000	0.0000	0.0000	125.5317	277.5331	442.8325	(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	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011	(64)
Efficiency of water heater	89.5390	89.4682	89.2798	88.8793	88.2081	87.3000	87.3000	87.3000	87.3000	88.7191	89.2843	89.5612	(216)
(217)m													(217)
Fuel for water heating, kWh/month	184.5924	162.0073	168.5633	149.0924	145.2488	128.2841	120.5010	135.9628	136.9009	155.0234	166.2543	179.2083	(219)
Water heating fuel used												1831.6389	(219)
Annual totals kWh/year													
Space heating fuel - main system												2121.6732	(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)												378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =										-1368.9771		-1368.9771	(233)
Total delivered energy for all uses												3037.3381	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2121.6732	9.7400	206.6510 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.6389	9.7400	178.4016 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	378.0032	36.8500	139.2942 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1368.9771	36.8500	-504.4681 (252)
Total energy cost			151.5162 (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	2121.6732	0.2160	458.2814 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.6389	0.2160	395.6340 (264)
Space and water heating			853.9154 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			378.5249 (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	2121.6732	1.2200	2588.4413 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.6389	1.2200	2234.5994 (264)
Space and water heating			4823.0407 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			2011.0006 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

25.1564 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
Current environmental impact rating: A 94

(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	+ 1.2	-£ 77	-185 kg (48.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.32 kg/m ²	A 93
Total Savings	£77	2.32 kg/m ²	A 96

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£167	£185	-£18
Mains gas	£489	£394	£95
Space heating	£338	£338	£0
Water heating	£178	£102	£77
Lighting	£139	£139	£0
Generated (PV)	-£504	-£504	£0
Total cost of fuels	£152	£75	£77
Total cost of uses	£151	£75	£77
Delivered energy	38 kWh/m ²	26 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m ²	5 kg/m ²	2 kg/m ²	2 kg/m ²
Primary energy	25 kWh/m ²	12 kWh/m ²	13 kWh/m ²

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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50															4.7700		
Infiltration rate															0.4387 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.4058 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.5173	0.5072	0.4970	0.4463	0.4362	0.3855	0.3855	0.3753	0.4058	0.4362	0.4565	0.4768	(22a)				
Effective ac	0.6338	0.6286	0.6235	0.5996	0.5951	0.5743	0.5743	0.5704	0.5823	0.5951	0.6042	0.6136	(22b)				
													(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018	9.7500	4.5100	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (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	41.8005	41.4578	41.1219	39.5442	39.2490	37.8748	37.8748	37.6203	38.4041	39.2490	39.8461	40.4705 (38)
Heat transfer coeff	88.8267	88.4841	88.1481	86.5704	86.2752	84.9010	84.9010	84.6465	85.4303	86.2752	86.8724	87.4967 (39)
Average = Sum(39)m / 12 =												86.5690 (39)
HLP	1.1112	1.1069	1.1027	1.0829	1.0792	1.0621	1.0621	1.0589	1.0687	1.0792	1.0867	1.0945 (40)
HLP (average)												1.0829 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.2439 (H8)
Utilisation factor												0.5524 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-843.6871 (H17)
Solar input	-24.4652	-40.8255	-69.5304	-93.1845	-115.1216	-113.1828	-111.6871	-97.5816	-76.4259	-52.1899	-29.0193	-20.4732 (63)
												-843.6871 (63)
Output from w/h	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279 (64)
												787.2219 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(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				2.1700	36.7938	0.4600	0.0000	0.7700	28.2803 (77)			
Northwest				3.5300	11.2829	0.4600	0.0000	0.7700	14.1074 (81)			
Southeast				4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)			
Solar gains	101.1636	177.0050	254.6325	336.3644	395.7983	401.3121	383.4220	337.8011	282.7352	198.9841	122.0240	86.0228 (83)
Total gains	658.7768	729.8854	785.6207	833.6832	858.7930	833.7446	798.1962	761.1899	725.7034	675.8333	636.3430	628.5447 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	37.2855	37.4299	37.5725	38.2573	38.3882	39.0095	39.0095	39.1268	38.7678	38.3882	38.1243	37.8523	
util living area	3.4857	3.4953	3.5048	3.5505	3.5592	3.6006	3.6006	3.6085	3.5845	3.5592	3.5416	3.5235	
	0.9663	0.9505	0.9212	0.8596	0.7534	0.5953	0.4513	0.4882	0.6945	0.8759	0.9482	0.9707 (86)	
MIT	19.5239	19.7246	20.0314	20.4188	20.7269	20.9168	20.9765	20.9686	20.8493	20.4632	19.9400	19.4945 (87)	
Th 2	19.9917	19.9952	19.9986	20.0148	20.0178	20.0319	20.0319	20.0346	20.0265	20.0178	20.0117	20.0053 (88)	
util rest of house	0.9599	0.9413	0.9063	0.8325	0.7059	0.5218	0.3588	0.3949	0.6258	0.8463	0.9371	0.9651 (89)	
MIT 2	18.0478	18.3373	18.7758	19.3248	19.7311	19.9643	20.0191	20.0162	19.8919	19.3983	18.6616	18.0146 (90)	
Living area fraction	18.4411	18.7069	19.1103	19.6163	19.9964	20.2181	20.2742	20.2700	20.1470	19.6821	19.0022	18.4089 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.2911	18.5569	18.9603	19.4663	19.8464	20.0681	20.1242	20.1200	19.9970	19.5321	18.8522	18.2589 (93)	

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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	0.9454	0.9242	0.8871	0.8149	0.6968	0.5247	0.3679	0.4035	0.6236	0.8288	0.9200	0.9518	(94)
Useful gains	622.8138	674.5328	696.8939	679.3889	598.4094	437.4449	293.6822	307.1125	452.5290	560.1246	585.4656	598.2373	(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	1242.7831	1208.4211	1098.3564	914.7312	702.8313	464.2459	299.2077	314.8842	503.7816	770.6166	1020.9430	1230.1071	(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	461.2572	358.7729	298.6881	169.4464	77.6899	0.0000	0.0000	0.0000	0.0000	156.6061	313.5437	470.1111	(98)
Space heating												2306.1155	(98)
Space heating per m2											(98) / (4) =	28.8481	(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													2548.1939	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	461.2572	358.7729	298.6881	169.4464	77.6899	0.0000	0.0000	0.0000	0.0000	156.6061	313.5437	470.1111	(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)	509.6764	396.4342	330.0421	187.2336	85.8452	0.0000	0.0000	0.0000	0.0000	173.0454	346.4571	519.4598	(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	140.8170	104.1195	80.9625	39.3278	12.9996	0.0000	0.0000	21.1139	43.0885	85.3454	119.4197	140.0279	(64)	
Efficiency of water heater	89.7307	89.7599	89.7981	89.8794	90.0270	87.3000	87.3000	87.3000	87.3000	89.3448	89.5942	87.3000	(216)	
(217)m	89.7307	89.7599	89.7981	89.8794	90.0270	87.3000	87.3000	87.3000	87.3000	89.3448	89.5942	87.3000	(217)	
Fuel for water heating, kWh/month	156.9329	115.9978	90.1606	43.7562	14.4396	0.0000	0.0000	24.1855	49.3568	95.5237	133.2896	156.0286	(219)	
Water heating fuel used												879.6713	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2548.1939	(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)													378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1029 * 1.00) =										-1218.5571		-1218.5571	(233)	
Total delivered energy for all uses												2712.3113	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2548.1939	3.4800	88.6771	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.6713	3.4800	30.6126	(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	378.0032	13.1900	49.8586	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1218.5571	13.1900	-160.7277	(252)
Total energy cost			144.9081	(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] =	0.4871	(257)
SAP value		93.2046	
SAP rating (Section 12)		93	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2548.1939	0.2160	550.4099	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	879.6713	0.2160	190.0090	(264)
Space and water heating			740.4189	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)
Energy saving/generation technologies				
PV Unit	-1218.5571	0.5190	-632.4311	(269)
Total kg/year			369.0464	(272)
CO2 emissions per m2			4.6200	(273)
EI value			96.0419	
EI rating			96	(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	39.9700 (1b)	x 2.3900 (2b)	= 95.5283 (1b) - (3b)
First floor	39.9700 (1c)	x 2.6100 (2c)	= 104.3217 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.8500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.2002 (8)	
Pressure test															Yes		
Measured/design AP50																4.7700	
Infiltration rate																0.4387 (18)	
Number of sides sheltered																1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =	0.4058 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4260	0.3956	0.4058	0.3855	0.3855	0.3753	0.3652	0.3550	0.3449	0.3753	0.3550	0.3753	(22b)				
Effective ac	0.5908	0.5783	0.5823	0.5743	0.5743	0.5704	0.5667	0.5630	0.5595	0.5704	0.5630	0.5704	(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			2.1500	0.6400	1.3760		(26)
Window (Uw = 1.30)			5.7000	1.2357	7.0437		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.40			39.9700	0.1200	4.7964	75.0000	2997.7500 (28a)
EW Brick AAC011	80.0500	7.8500	72.2000	0.2400	17.3280	42.1000	3039.6200 (29a)
EW Brick AAC018		9.7500	5.2400	0.2600	1.3624	60.0000	314.4000 (29a)
PR 400mm MW044	39.9700		39.9700	0.1100	4.3967	9.0000	359.7300 (30)
Total net area of external elements Aum(A, m ²)			169.7400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8764		(33)
E-WM-30			49.0000	0.0000	0.0000	45.0000	2205.0000 (32)
GF Masonry			14.8700			39.0000	579.9300 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			75.9100			9.0000	683.1900 (32c)
Internal Floor			39.9700			18.0000	719.4600 (32d)
Internal Ceiling			39.9700			9.0000	359.7300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11923.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.1495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1498 (36)
Total fabric heat loss						(33) + (36) =	47.0262 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.9606	Feb 38.1361	Mar 38.4041	Apr 37.8748	May 37.8748	Jun 37.6203	Jul 37.3726	Aug 37.1317	Sep 36.8976	Oct 37.6203	Nov 37.1317	Dec 37.6203 (38)
Heat transfer coeff	85.9868	85.1623	85.4303	84.9010	84.9010	84.6465	84.3988	84.1579	83.9238	84.6465	84.1579	84.6465 (39)
Average = Sum(39)m / 12 =												84.7466 (39)
HLP	Jan 1.0756	Feb 1.0653	Mar 1.0687	Apr 1.0621	May 1.0621	Jun 1.0589	Jul 1.0558	Aug 1.0528	Sep 1.0498	Oct 1.0589	Nov 1.0528	Dec 1.0589 (40)
HLP (average)												1.0601 (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												2.4617 (42)
Average daily hot water use (litres/day)												92.6659 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	101.9325	98.2258	94.5192	90.8126	87.1059	83.3993	83.3993	87.1059	90.8126	94.5192	98.2258	101.9325 (44)
Energy content (annual)	151.1629	132.2081	136.4269	118.9403	114.1260	98.4821	91.2581	104.7200	105.9707	123.4986	134.8084	146.3932 (45)
Distribution loss (46)m = 0.15 x (45)m												1457.9953 (45)
	22.6744	19.8312	20.4640	17.8410	17.1189	14.7723	13.6887	15.7080	15.8956	18.5248	20.2213	21.9590 (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	14.1194	12.7369	14.0660	13.5720	13.9951	13.5099	13.9392	13.9755	13.5438	14.0367	13.6306	14.1079 (61)
Total heat required for water heating calculated for each month	165.2823	144.9450	150.4929	132.5123	128.1212	111.9920	105.1973	118.6955	119.5145	137.5354	148.4390	160.5011 (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												1.3921 (H8)
Utilisation factor												0.5124 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.6659 (H14)
Volume ratio Veff/V												0.8094 (H15)
Solar storage volume factor												0.9577 (H16)
Solar input												-875.8544 (H17)
Solar input	-28.5725	-40.6283	-69.8302	-94.2171	-110.6637	-118.2063	-115.7204	-103.5733	-81.0907	-56.0633	-33.7937	-23.4949 (63)
												-875.8544 (63)
Output from w/h	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062 (64)
												764.1114 (64)
Heat gains from water heating, kWh/month	53.7915	47.1434	48.8784	42.9406	41.4457	36.1228	33.8281	38.3133	38.6212	44.5725	48.2315	52.2027 (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	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	147.7033	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.5103	47.5273	38.6518	29.2619	21.8736	18.4666	19.9539	25.9368	34.8123	44.2022	51.5905	54.9975	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.3360	330.7327	322.1731	303.9506	280.9481	259.3289	244.8860	241.4892	250.0489	268.2713	291.2739	312.8930	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	52.2321	(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)	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	-98.4689	(71)
Water heating gains (Table 5)	72.3004	70.1539	65.6968	59.6398	55.7066	50.1705	45.4679	51.4963	53.6406	59.9092	66.9881	70.1649	(72)
Total internal gains	557.6131	552.8804	530.9882	497.3188	462.9947	432.4325	414.7742	423.3888	442.9682	476.8492	514.3190	542.5219	(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				2.1700	45.1778	0.4600	0.0000	0.7700	34.7243 (77)			
Northwest				3.5300	14.6176	0.4600	0.0000	0.7700	18.2768 (81)			
Southeast				4.5100	45.1778	0.4600	0.0000	0.7700	72.1690 (77)			
Solar gains	125.1701	186.7897	272.2362	364.3686	409.5434	451.9030	428.0468	384.9720	320.1389	226.9124	150.5633	104.5878 (83)
Total gains	682.7832	739.6701	803.2244	861.6874	872.5381	884.3355	842.8210	808.3609	763.1071	703.7616	664.8823	647.1098 (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	38.5169	38.8898	38.7678	39.0095	39.0095	39.1268	39.2416	39.3540	39.4637	39.1268	39.3540	39.1268	
alpha	3.5678	3.5927	3.5845	3.6006	3.6006	3.6085	3.6161	3.6236	3.6309	3.6085	3.6236	3.6085	
util living area	0.9576	0.9430	0.9060	0.8287	0.7031	0.5159	0.3825	0.3967	0.6241	0.8355	0.9297	0.9624	(86)
MIT	19.7143	19.8713	20.1743	20.5367	20.8090	20.9536	20.9880	20.9866	20.9071	20.6029	20.1423	19.7066	(87)
Th 2	20.0208	20.0292	20.0265	20.0319	20.0319	20.0346	20.0371	20.0396	20.0420	20.0346	20.0396	20.0346	(88)
util rest of house	0.9496	0.9325	0.8885	0.7969	0.6488	0.4386	0.2916	0.3031	0.5491	0.7976	0.9147	0.9552	(89)
MIT 2	18.3407	18.5697	18.9956	19.4951	19.8422	20.0011	20.0317	20.0335	19.9659	19.5954	18.9670	18.3397	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.7067	18.9165	19.3097	19.7726	20.0998	20.2549	20.2865	20.2874	20.2167	19.8638	19.2802	18.7039	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5567	18.7665	19.1597	19.6226	19.9498	20.1049	20.1365	20.1374	20.0667	19.7138	19.1302	18.5539	(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	0.9340	0.9152	0.8697	0.7816	0.6438	0.4444	0.3012	0.3129	0.5512	0.7830	0.8968	0.9405	(94)
Useful gains	637.7066	676.9750	698.5899	673.4998	561.7627	393.0122	253.8574	252.9153	420.5928	551.0412	596.2643	608.6319	(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	1174.2949	1146.8405	1038.8061	859.4186	632.4932	406.7152	256.2753	255.6244	450.3938	703.7377	945.1080	1147.2925	(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	399.2217	315.7496	253.1209	133.8615	52.6235	0.0000	0.0000	0.0000	0.0000	113.6062	251.1675	400.7634	(98)
Space heating												1920.1142	(98)
Space heating per m2											(98) / (4) =	24.0194	(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													2121.6732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	399.2217	315.7496	253.1209	133.8615	52.6235	0.0000	0.0000	0.0000	0.0000	113.6062	251.1675	400.7634	(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)	441.1289	348.8946	279.6916	147.9132	58.1475	0.0000	0.0000	0.0000	0.0000	125.5317	277.5331	442.8325	(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	136.7098	104.3167	80.6627	38.2952	17.4575	0.0000	0.0000	15.1222	38.4238	81.4720	114.6453	137.0062	(64)	
Efficiency of water heater	89.6616	89.6836	89.7054	89.7681	89.6811	87.3000	87.3000	87.3000	87.3000	89.1355	89.4722	89.6627	(216)	
Fuel for water heating, kWh/month	152.4730	116.3164	89.9196	42.6601	19.4662	0.0000	0.0000	17.3222	44.0135	91.4025	128.1351	152.8018	(219)	
Water heating fuel used												854.5103	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2121.6732	(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)													378.0032	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.48 * 1156 * 1.00) =													-1368.9771	(233)
Total delivered energy for all uses													2110.2095	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2121.6732	9.7400	206.6510	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.5103	9.7400	83.2293	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	378.0032	36.8500	139.2942	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1368.9771	36.8500	-504.4681	(252)
Total energy cost			74.7689	(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	2121.6732	0.2160	458.2814	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.5103	0.2160	184.5742	(264)
Space and water heating			642.8556	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)

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 saving/generation technologies			
PV Unit	-1368.9771	0.5190	-710.4991 (269)
Total kg/year			193.4151 (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	2121.6732	1.2200	2588.4413 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	854.5103	1.2200	1042.5026 (264)
Space and water heating			3630.9438 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Energy saving/generation technologies			
PV Unit	-1368.9771	3.0700	-4202.7598 (269)
Primary energy kWh/year			972.4037 (272)
Primary energy kWh/m2/year			12.1642 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	149.1 (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	263.80 (P1)
Transmission heat loss coefficient	47.03 (37)
Summer heat loss coefficient	310.83 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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 g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	2.1700	127.3119	0.4600	0.0000	0.9000	114.3744
North West	3.5300	106.0502	0.4600	0.0000	0.9000	154.9839
South East	4.5100	127.3119	0.4600	0.0000	0.9000	237.7091

total: 507.0674

	Jun	Jul	Aug	
Solar gains	544	507	455	(P4)
Internal gains	429	412	420	
Total summer gains	974	919	875	(P5)

Summer gain/loss ratio	3.13	2.96	2.81	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 149.1)	0.96	0.96	0.96	
Threshold temperature	19.49	21.21	21.07	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-657				Issued on Date	31/05/2023
Assessment Reference	As Built	Prop Type Ref	Fuller-CB-Opp-DET			
Property	4, Kittiwake Place, BOTLEY, SO32 2ZB					
SAP Rating	89 B	DER	12.54	TER	18.72	
Environmental	90 B	% DER<TER	33.02			
CO ₂ Emissions (t/year)	0.88	DFEE	52.26	TFEE	61.59	
General Requirements Compliance	Pass	% DFEE<TFEE	15.15			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.72 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.54 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.30 (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: 4.59 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H12

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.26 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 9.24 m², No overhang
Windows facing South West: 12.91 m², No overhang
Windows facing North West: 4.10 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 0.64 W/m²K
Photovoltaic array 1.48 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	240.7000 (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) =	0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.4372 (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) =		0.4372 (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	0.5575	0.5465	0.5356	0.4810	0.4700	0.4154	0.4154	0.4044	0.4372	0.4700	0.4919	0.5137 (22b)
Effective ac	0.6554	0.6493	0.6434	0.6157	0.6105	0.5863	0.5863	0.5818	0.5956	0.6105	0.6210	0.6320 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.0578	51.5785	51.1087	48.9022	48.4894	46.5676	46.5676	46.2117	47.3078	48.4894	49.3245	50.1977 (38)
Average = Sum(39)m / 12 =	140.5569	140.0777	139.6079	137.4014	136.9885	135.0667	135.0667	134.7108	135.8070	136.9885	137.8237	138.6968 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4599	1.4549	1.4500	1.4271	1.4228	1.4029	1.4029	1.3992	1.4105	1.4228	1.4315	1.4406 (40)
HLP (average)												1.4271 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6804 (55)
Total storage loss												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (56)
If cylinder contains dedicated solar storage												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Heat gains from water heating, kWh/month												
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611 (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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	22.3028	19.8092	16.1099	12.1962	9.1168	7.6968	8.3167	10.8103	14.5096	18.4233	21.5027	22.9227 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains												
	458.4225	456.2522	441.2920	417.0359	392.2113	368.4036	353.0002	359.2851	371.7956	396.2764	424.4339	445.7411 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	9.2400	11.2829	0.4600		0.0000	0.7700	36.9269 (75)					
Southwest	2.9400	36.7938	0.4600		0.0000	0.7700	38.3152 (79)					
Northwest	4.1000	11.2829	0.4600		0.0000	0.7700	16.3853 (81)					
Southwest	9.9700	36.7938	0.4600		0.0000	0.7700	129.9328 (79)					
Solar gains	221.5602	395.1071	587.6388	806.9526	975.8153	1000.4120	951.3313	820.5129	662.8254	449.3597	268.6028	187.5226 (83)
Total gains	679.9827	851.3593	1028.9308	1223.9885	1368.0266	1368.8156	1304.3315	1179.7981	1034.6210	845.6360	693.0368	633.2638 (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	26.4450	26.5355	26.6248	27.0524	27.1339	27.5200	27.5200	27.5927	27.3700	27.1339	26.9695	26.7997
alpha	2.7630	2.7690	2.7750	2.8035	2.8089	2.8347	2.8347	2.8395	2.8247	2.8089	2.7980	2.7866
util living area	0.9766	0.9570	0.9185	0.8375	0.7107	0.5552	0.4275	0.4815	0.7010	0.8912	0.9621	0.9806 (86)
MIT	18.6724	19.0054	19.5037	20.1110	20.5787	20.8533	20.9486	20.9275	20.7033	20.0630	19.2601	18.6246 (87)
Th 2	19.7177	19.7215	19.7252	19.7426	19.7459	19.7611	19.7611	19.7640	19.7553	19.7459	19.7393	19.7324 (88)
util rest of house	0.9717	0.9482	0.9018	0.8046	0.6535	0.4694	0.3179	0.3681	0.6211	0.8612	0.9529	0.9765 (89)
MIT 2	16.6669	17.1482	17.8602	18.7113	19.3203	19.6489	19.7359	19.7250	19.4980	18.6731	17.5324	16.6060 (90)
Living area fraction										fLA = Living area / (4) =		0.1598 (91)
MIT	16.9875	17.4451	18.1229	18.9350	19.5214	19.8414	19.9297	19.9172	19.6906	18.8953	17.8086	16.9286 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8375	17.2951	17.9729	18.7850	19.3714	19.6914	19.7797	19.7672	19.5406	18.7453	17.6586	16.7786 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9545	0.9240	0.8710	0.7741	0.6342	0.4641	0.3197	0.3684	0.6052	0.8296	0.9301	0.9613 (94)
Useful gains	649.0570	786.6423	896.2052	947.5396	867.6457	635.3192	416.9422	434.6220	626.1729	701.5337	644.5954	608.7871 (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	1762.2258	1736.2739	1601.7130	1358.2119	1050.8977	687.6775	429.4760	453.6049	738.8746	1115.8064	1455.2262	1744.6167 (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												

	828.1976	638.1524	524.8978	295.6840	136.3395	0.0000	0.0000	0.0000	0.0000	308.2189	583.6542	845.0572 (98)
Space heating												4160.2015 (98)
Space heating per m2										(98) / (4) =		43.2094 (99)

Not applicable

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4601.9928	(211)

[illegible][illegible]

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)	393.8748 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =	-1074.8994	-1074.8994 (233)
Total delivered energy for all uses		6438.8190 (238)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4601.9928	0.2160	994.0304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2442.8509	0.2160	527.6558	(264)
Space and water heating			1521.6862	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	393.8748	0.5190	204.4210	(268)
Energy saving/generation technologies				
PV Unit	-1074.8994	0.5190	-557.8728	(269)
Total CO2, kg/year			1207.1594	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5400	(273)

Total Floor Area	TFA	12.5400	ZC1
Assumed number of occupants	N	96.2800	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	2.7023	
CO2 emissions from appliances, equation (L14)		0.5190	
CO2 emissions from cooking, equation (L16)		15.3973	ZC2
Total CO2 emissions		1.9096	ZC3
Residual CO2 emissions offset from biofuel CHP		29.8469	ZC4
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC5
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC6
Net CO2 emissions		0.0000	ZC7
		29.8469	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1246 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3746 (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) =					0.3746	(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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402	(22b)				
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969	(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			2.0300	1.0000	2.0300		(26)					
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)					
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)					
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)					
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)					
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)					
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)					
Total net area of external elements Aum(A, m2)			252.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3163		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6334 (36)					
Total fabric heat loss						(33) + (36) =	79.9497 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.7770	Feb 48.4251	Mar 48.0802	Apr 46.4602	May 46.1571	Jun 44.7462	Jul 44.7462	Aug 44.4849	Sep 45.2897	Oct 46.1571	Nov 46.7703	Dec 47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)
HLP	Jan 1.3370	Feb 1.3333	Mar 1.3298	Apr 1.3129	May 1.3098	Jun 1.2951	Jul 1.2951	Aug 1.2924	Sep 1.3008	Oct 1.3098	Nov 1.3162	Dec 1.3228 (40)
HLP (average)												1.3129 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9009 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum (63)m = 0.0000 (63)					
Output from w/h	207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153 (64)
							Total per year (kWh/year) = Sum (64)m = 2096.5183 (64)					
Heat gains from water heating, kWh/month												
90.6369	80.3384	85.4351	78.0598	77.5628	70.8380	69.4903	74.2424	73.4815	80.8713	83.6613	88.9532	(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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3829	19.8803	16.1678	12.2400	9.1496	7.7245	8.3465	10.8492	14.5617	18.4894	21.5799	23.0050 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	121.8238	119.5513	114.8321	108.4163	104.2510	98.3861	93.4010	99.7882	102.0576	108.6980	116.1962	119.5608 (72)
Total internal gains	460.9113	458.7321	443.7586	419.4884	394.6527	370.8400	355.4388	361.7327	374.2564	398.7513	426.9199	448.2322 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.0300				11.2829		0.6300		0.7000		0.7700		24.2409 (75)	
Southwest	9.8400				36.7938		0.6300		0.7000		0.7700		110.6476 (79)	
Northwest	3.1200				11.2829		0.6300		0.7000		0.7700		10.7584 (81)	
Solar gains	145.6470	259.7160	386.2339	530.3205	641.2456	657.3887	625.1451	539.2131	435.6310	295.3673	176.5686	123.2735	(83)	
Total gains	606.5583	718.4481	829.9924	949.8090	1035.8983	1028.2287	980.5839	900.9458	809.8874	694.1186	603.4884	571.5057	(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	51.9404	52.0827	52.2230	52.8923	53.0194	53.6193	53.7319	53.3867	53.0194	52.7629	52.4973	52.4973	
alpha	4.4627	4.4722	4.4815	4.5262	4.5346	4.5746	4.5821	4.5591	4.5346	4.5175	4.4998	4.4998	
util living area	0.9975	0.9942	0.9848	0.9527	0.8662	0.7041	0.5415	0.6038	0.8456	0.9729	0.9948	0.9981	(86)
MIT	19.5428	19.7233	20.0186	20.4083	20.7389	20.9296	20.9832	20.9730	20.8298	20.3970	19.9007	19.5160	(87)
Th 2	19.8120	19.8148	19.8176	19.8307	19.8332	19.8446	19.8446	19.8468	19.8402	19.8332	19.8282	19.8230	(88)
util rest of house	0.9966	0.9922	0.9792	0.9344	0.8152	0.6043	0.4084	0.4676	0.7681	0.9590	0.9926	0.9974	(89)
MIT 2	17.8883	18.1532	18.5832	19.1450	19.5817	19.7992	19.8388	19.8362	19.7056	19.1408	18.4222	17.8565	(90)
Living area fraction									fLA = Living area / (4)			0.1598	(91)
MIT	18.1528	18.4042	18.8126	19.3469	19.7666	19.9799	20.0218	20.0179	19.8853	19.3416	18.6585	18.1218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1528	18.4042	18.8126	19.3469	19.7666	19.9799	20.0218	20.0179	19.8853	19.3416	18.6585	18.1218	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9885	0.9725	0.9246	0.8118	0.6170	0.4296	0.4891	0.7717	0.9507	0.9892	0.9958	(94)
Useful gains	603.2962	710.1944	807.1378	878.2262	840.9447	634.4256	421.2711	440.6154	624.9732	659.9219	596.9767	569.1273	(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													
	1783.2214	1733.5966	1576.3859	1320.5940	1017.2587	670.8492	426.6797	450.1910	724.5443	1102.3754	1464.6981	1773.0937	(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													
	877.8643	687.7263	572.3206	318.5048	131.1776	0.0000	0.0000	0.0000	0.0000	329.1854	624.7594	895.7510	(98)
Space heating												4437.2895	(98)
Space heating per m2												(98) / (4) =	46.0873 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4745.7641 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	877.8643	687.7263	572.3206	318.5048	131.1776	0.0000	0.0000	0.0000	0.0000	329.1854	624.7594	895.7510	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	938.8924	735.5361	612.1076	340.6468	140.2969	0.0000	0.0000	0.0000	0.0000	352.0699	668.1919	958.0225	(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	207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153	(64)
Efficiency of water heater (217)m	88.2417	88.0253	87.5573	86.4452	84.1667	79.8000	79.8000	79.8000	79.8000	86.4368	87.7752	79.8000	(216)
Fuel for water heating, kWh/month	234.6727	207.2656	218.6389	198.2370	199.3167	187.5272	179.7999	197.7097	197.4901	205.5942	214.4261	228.7293	(219)
Water heating fuel used												2469.4073	(219)
Annual totals kWh/year													
Space heating fuel - main system												4745.7641	(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)												395.2898	(232)
Total delivered energy for all uses												7685.4612	(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	4745.7641	0.2160	1025.0851	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2469.4073	0.2160	533.3920	(264)
Space and water heating			1558.4770	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.2898	0.5190	205.1554	(268)
Total CO2, kg/m2/year			1802.5574	(272)
Emissions per m2 for space and water heating			16.1869	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1308	(272b)
Emissions per m2 for pumps and fans			0.4043	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1869 * 1.00) + 2.1308 + 0.4043, rounded to 2 d.p.			18.7200	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3541 (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) =	0.3541 (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	0.4515	0.4427	0.4338	0.3896	0.3807	0.3364	0.3364	0.3276	0.3541	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6019	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	47.8125	47.4980	47.1899	45.7423	45.4715	44.2107	44.2107	43.9772	44.6963	45.4715	46.0194	46.5922 (38)
Average = Sum(39)m / 12 =	136.3116	135.9972	135.6890	134.2415	133.9706	132.7099	132.7099	132.4764	133.1955	133.9706	134.5185	135.0913 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4158	1.4125	1.4093	1.3943	1.3915	1.3784	1.3784	1.3759	1.3834	1.3915	1.3972	1.4031 (40)
HLP (average)												1.3943 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3028	19.8092	16.1099	12.1962	9.1168	7.6968	8.3167	10.8103	14.5096	18.4233	21.5027	22.9227	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	(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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	(71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909	(72)
Total internal gains	381.8446	380.4945	367.2374	345.2968	321.9754	300.2845	286.6802	290.6600	302.3514	324.4356	349.8870	369.9800	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	9.2400	11.2829	0.4600	0.0000	0.7700	36.9269 (75)
Southwest	2.9400	36.7938	0.4600	0.0000	0.7700	38.3152 (79)
Northwest	4.1000	11.2829	0.4600	0.0000	0.7700	16.3853 (81)
Southwest	9.9700	36.7938	0.4600	0.0000	0.7700	129.9328 (79)

Solar gains	221.5602	395.1071	587.6388	806.9526	975.8153	1000.4120	951.3313	820.5129	662.8254	449.3597	268.6028	187.5226 (83)
Total gains	603.4048	775.6016	954.8763	1152.2494	1297.7908	1300.6965	1238.0115	1111.1729	965.1768	773.7953	618.4899	557.5026 (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	27.2687	27.3317	27.3938	27.6892	27.7451	28.0087	28.0087	28.0581	27.9066	27.7451	27.6321	27.5150	
alpha	2.8179	2.8221	2.8263	2.8459	2.8497	2.8672	2.8672	2.8705	2.8604	2.8497	2.8421	2.8343	
util living area	0.9825	0.9648	0.9288	0.8508	0.7250	0.5703	0.4411	0.4995	0.7226	0.9071	0.9707	0.9858 (86)	
MIT	18.6450	18.9823	19.4859	20.0941	20.5705	20.8481	20.9466	20.9231	20.6873	20.0268	19.2157	18.5862 (87)	
Th 2	19.7513	19.7537	19.7562	19.7677	19.7699	19.7800	19.7800	19.7818	19.7761	19.7699	19.7655	19.7610 (88)	
util rest of house	0.9788	0.9576	0.9140	0.8200	0.6694	0.4848	0.3304	0.3849	0.6450	0.8807	0.9635	0.9828 (89)	
MIT 2	17.6313	17.9655	18.4588	19.0445	19.4709	19.6996	19.7617	19.7531	19.5878	18.9999	18.2083	17.5797 (90)	
Living area fraction	17.7933	18.1280	18.6230	19.2123	19.6467	19.8832	19.9511	19.9401	19.7636	19.1640	18.3694	17.7406 (92)	
Temperature adjustment	17.7933	18.1280	18.6230	19.2123	19.6467	19.8832	19.9511	19.9401	19.7636	19.1640	18.3694	17.7406 (93)	
adjusted MIT	17.7933	18.1280	18.6230	19.2123	19.6467	19.8832	19.9511	19.9401	19.7636	19.1640	18.3694	17.7406 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9705	0.9448	0.8969	0.8036	0.6632	0.4925	0.3468	0.4008	0.6441	0.8642	0.9522	0.9758 (94)
Useful gains	585.6157	732.8183	856.4748	925.9043	860.7000	640.6355	429.2977	445.3595	621.7101	668.7360	588.8985	544.0009 (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	1839.2961	1798.9706	1644.9595	1384.3395	1064.6216	701.1271	444.7249	468.9836	754.3615	1147.3269	1515.9368	1829.2178 (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	932.7383	716.4544	586.6326	330.0733	151.7177	0.0000	0.0000	0.0000	0.0000	356.0717	667.4676	956.2014 (98)
Space heating												4697.3568 (98)
Space heating per m2												48.7885 (99)
										(98) / (4) =		

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1247.4727	982.0530	1006.8205	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8297	0.8802	0.8490	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1034.9692	864.3929	854.8093	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1623.1885	1547.7103	1401.2473	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	423.5180	508.3881	406.5499	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1338.4560	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	105.8795	127.0970	101.6375	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												334.6140	(107)
Energy for space heating												3.4754	(108)
Energy for space cooling												48.7885	(99)
Total												3.4754	(108)
Dwelling Fabric Energy Efficiency (DFEE)												52.2639	(109)
												52.3	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3746 (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) =	0.3746 (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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402 (22b)
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969 (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			2.0300	1.0000	2.0300		(26)
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3163		(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)							12.6334 (36)
Total fabric heat loss						(33) + (36) =	79.9497 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.7770	48.4251	48.0802	46.4602	46.1571	44.7462	44.7462	44.4849	45.2897	46.1571	46.7703	47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)
HLP	1.3370	1.3333	1.3298	1.3129	1.3098	1.2951	1.2951	1.2924	1.3008	1.3098	1.3162	1.3228 (40)
HLP (average)												1.3129 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9009 (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												

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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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3829	19.8803	16.1678	12.2400	9.1496	7.7245	8.3465	10.8492	14.5617	18.4894	21.5799	23.0050 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909 (72)
Total internal gains	381.9247	380.5657	367.2953	345.3406	322.0082	300.3121	286.7101	290.6988	302.4035	324.5018	349.9643	370.0623 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					7.0300	11.2829	0.6300	0.7000	0.7700	24.2409 (75)		
Southwest					9.8400	36.7938	0.6300	0.7000	0.7700	110.6476 (79)		
Northwest					3.1200	11.2829	0.6300	0.7000	0.7700	10.7584 (81)		
Solar gains	145.6470	259.7160	386.2339	530.3205	641.2456	657.3887	625.1451	539.2131	435.6310	295.3673	176.5686	123.2735 (83)
Total gains	527.5717	640.2817	753.5292	875.6612	963.2537	957.7008	911.8552	829.9119	738.0345	619.8691	526.5329	493.3359 (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	51.9404	52.0827	52.2230	52.8923	53.0194	53.6193	53.6193	53.7319	53.3867	53.0194	52.7629	52.4973
alpha	4.4627	4.4722	4.4815	4.5262	4.5346	4.5746	4.5746	4.5821	4.5591	4.5346	4.5175	4.4998
util living area	0.9986	0.9963	0.9895	0.9641	0.8897	0.7388	0.5768	0.6451	0.8783	0.9821	0.9970	0.9990 (86)
MIT	19.4691	19.6512	19.9508	20.3508	20.7007	20.9140	20.9784	20.9648	20.7950	20.3339	19.8293	19.4426 (87)
Th 2	19.8120	19.8148	19.8176	19.8307	19.8332	19.8446	19.8446	19.8468	19.8402	19.8332	19.8282	19.8230 (88)
util rest of house	0.9981	0.9950	0.9855	0.9495	0.8440	0.6399	0.4376	0.5044	0.8092	0.9723	0.9957	0.9986 (89)
MIT 2	18.4250	18.6089	18.9085	19.3094	19.6316	19.8056	19.8394	19.8370	19.7247	19.3008	18.7975	18.4072 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	18.5919	18.7755	19.0751	19.4758	19.8025	19.9827	20.0215	20.0172	19.8958	19.4659	18.9624	18.5727 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5919	18.7755	19.0751	19.4758	19.8025	19.9827	20.0215	20.0172	19.8958	19.4659	18.9624	18.5727 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9973	0.9934	0.9820	0.9437	0.8426	0.6530	0.4601	0.5268	0.8132	0.9681	0.9943	0.9980 (94)
Ext temp.	526.1425	636.0425	739.9730	826.4000	811.6521	625.3955	419.5062	437.2023	600.1893	600.0747	523.5314	492.3479 (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	1839.7530	1781.2618	1609.9918	1336.8888	1021.7834	671.2052	426.6415	450.1092	725.8577	1118.0566	1503.2050	1830.5230 (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	977.3262	769.5874	647.2940	367.5520	156.3377	0.0000	0.0000	0.0000	0.0000	385.3786	705.3650	995.6023 (98)
										(98) / (4) =		5004.4431 (98)
												51.9780 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1172.1413	922.7495	945.7029	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8374	0.9020	0.8684	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	981.5219	832.2782	821.2209	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1222.3213	1166.5283	1072.5524	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)

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	173.3756	248.6821	186.9906	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												609.0483 (104)
Intermittency factor (Table 10b)												1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	43.3439	62.1705	46.7477	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												152.2621 (107)
Space cooling per m2												1.5815 (108)
Energy for space heating												51.9780 (99)
Energy for space cooling												1.5815 (108)
Total												53.5595 (109)
Target Fabric Energy Efficiency (TFEE)												61.6 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.4372 (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) =	0.4372 (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	0.4591	0.4263	0.4372	0.4154	0.4154	0.4044	0.3935	0.3826	0.3716	0.4044	0.3826	0.4044 (22b)
Effective ac	0.6054	0.5909	0.5956	0.5863	0.5863	0.5818	0.5774	0.5732	0.5691	0.5818	0.5732	0.5818 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.0860	46.9330	47.3078	46.5676	46.5676	46.2117	45.8653	45.5284	45.2010	46.2117	45.5284	46.2117 (38)
Average = Sum(39)m / 12 =	136.5852	135.4321	135.8070	135.0667	135.0667	134.7108	134.3644	134.0275	133.7001	134.7108	134.0275	134.7108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4186	1.4066	1.4105	1.4029	1.4029	1.3992	1.3956	1.3921	1.3887	1.3992	1.3921	1.3992 (40)
HLP (average)												1.4006 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6804 (55)
Total storage loss												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (56)
If cylinder contains dedicated solar storage												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
												Total per year (kWh/year) = Sum (64)m =
												2070.1429 (64)
RHI water heating demand												2070 (64)
Heat gains from water heating, kWh/month												
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611 (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	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Northeast				9.2400	14.6176		0.4600	0.0000		0.7700	47.8408 (75)	
Southwest				2.9400	45.1778		0.4600	0.0000		0.7700	47.0458 (79)	
Northwest				4.1000	14.6176		0.4600	0.0000		0.7700	21.2280 (81)	
Southwest				9.9700	45.1778		0.4600	0.0000		0.7700	159.5398 (79)	
Solar gains	275.6544	419.8582	633.5050	881.1868	1016.4018	1132.9879	1068.5756	942.1481	756.8704	516.3347	333.4017	229.1568 (83)
Total gains	935.1769	1074.7486	1264.6641	1475.3599	1572.4724	1654.9828	1570.6602	1452.9795	1288.9832	1085.6582	944.1607	871.4910 (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	27.2140	27.4457	27.3700	27.5200	27.5200	27.5927	27.6638	27.7334	27.8013	27.5927	27.7334	27.5927
alpha	2.8143	2.8297	2.8247	2.8347	2.8347	2.8395	2.8443	2.8489	2.8534	2.8395	2.8489	2.8395
util living area	0.9461	0.9226	0.8660	0.7579	0.6148	0.4343	0.3237	0.3470	0.5700	0.8004	0.9131	0.9530 (86)
MIT	19.1631	19.4090	19.8709	20.3894	20.7456	20.9311	20.9780	20.9739	20.8485	20.4039	19.7422	19.1388 (87)
Th 2	19.7491	19.7582	19.7553	19.7611	19.7611	19.7640	19.7667	19.7694	19.7720	19.7640	19.7694	19.7640 (88)
util rest of house	0.9356	0.9081	0.8414	0.7157	0.5501	0.3500	0.2255	0.2428	0.4825	0.7531	0.8938	0.9437 (89)
MIT 2	17.3883	17.7414	18.3845	19.0827	19.5232	19.7186	19.7582	19.7591	19.6562	19.1280	18.2296	17.3638 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.6720	18.0080	18.6221	19.2916	19.7186	19.9124	19.9532	19.9533	19.8468	19.3319	18.4714	17.6475 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5220	17.8580	18.4721	19.1416	19.5686	19.7624	19.8032	19.8033	19.6968	19.1819	18.3214	17.4975 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	850.4412	944.3189	1024.3549	1020.2282	847.7849	579.1013	358.8590	357.0897	614.4752	788.6986	815.3763	801.0625 (94)
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	1723.9784	1700.7545	1557.9882	1302.2563	954.7335	601.1337	363.2119	362.3164	668.0702	1048.3102	1396.7515	1683.5520 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	649.9117	508.3248	397.0231	203.0603	79.5698	0.0000	0.0000	0.0000	0.0000	193.1510	418.5901	656.5722 (98)
Space heating												3106.2030 (98)
RHI space heating demand												3106 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.4372 (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) =	0.4372 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.5575	0.5465	0.5356	0.4810	0.4700	0.4154	0.4154	0.4044	0.4372	0.4700	0.4919	0.5137 (22b)
Effective ac	0.6554	0.6493	0.6434	0.6157	0.6105	0.5863	0.5863	0.5818	0.5956	0.6105	0.6210	0.6320 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	52.0578	51.5785	51.1087	48.9022	48.4894	46.5676	46.5676	46.2117	47.3078	48.4894	49.3245	50.1977 (38)
Heat transfer coeff												
	140.5569	140.0777	139.6079	137.4014	136.9885	135.0667	135.0667	134.7108	135.8070	136.9885	137.8237	138.6968 (39)
Average = Sum(39)m / 12 =												137.3994 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.4599	1.4549	1.4500	1.4271	1.4228	1.4029	1.4029	1.3992	1.4105	1.4228	1.4315	1.4406 (40)
HLP (average)												1.4271 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

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	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)
Energy content (annual)										Total =	Sum(45)m =	1547.9009	(45)
Distribution loss	(46)m =	0.15 x	(45)m										
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												150.0000	(47)
Temperature factor from Table 2b												1.2600	(48)
Enter (49) or (54) in (55)												0.5400	(49)
Total storage loss												0.6804	(55)
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)
If cylinder contains dedicated solar storage													
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(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													
	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)
								Total per year (kWh/year) =	Sum(64)m =			2070.1429	(64)
Heat gains from water heating, kWh/month													
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(66)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF factor Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	9.2400	11.2829	0.4600	0.0000	0.7700	36.9269 (75)
Southwest	2.9400	36.7938	0.4600	0.0000	0.7700	38.3152 (79)
Northwest	4.1000	11.2829	0.4600	0.0000	0.7700	16.3853 (81)
Southwest	9.9700	36.7938	0.4600	0.0000	0.7700	129.9328 (79)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.4450	26.5355	26.6248	27.0524	27.1339	27.5200	27.5200	27.5927	27.3700	27.1339	26.9695	26.7997
alpha	2.7630	2.7690	2.7750	2.8035	2.8089	2.8347	2.8347	2.8395	2.8247	2.8089	2.7980	2.7866
util living area	0.9573	0.9318	0.8858	0.7965	0.6663	0.5121	0.3891	0.4355	0.6435	0.8460	0.9354	0.9630 (86)
MIT	18.9204	19.2321	19.6903	20.2377	20.6463	20.8810	20.9596	20.9440	20.7645	20.2141	19.4771	18.8723 (87)
Th 2	19.7177	19.7215	19.7252	19.7426	19.7459	19.7611	19.7611	19.7640	19.7553	19.7459	19.7393	19.7324 (88)
util rest of house	0.9489	0.9190	0.8644	0.7593	0.6075	0.4293	0.2873	0.3297	0.5620	0.8083	0.9210	0.9557 (89)
MIT 2	17.0219	17.4679	18.1153	18.8725	19.3950	19.6718	19.7417	19.7347	19.5572	18.8677	17.8374	16.9617 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.3254	17.7499	18.3671	19.0907	19.5950	19.8651	19.9364	19.9280	19.7502	19.0829	18.0995	17.2671 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1754	17.5999	18.2171	18.9407	19.4450	19.7151	19.7864	19.7780	19.6002	18.9329	17.9495	17.1171 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9248	0.8897	0.9320	0.7314	0.5919	0.4261	0.2894	0.3309	0.5506	0.7779	0.8924	0.9335 (94)
Useful gains	814.7852	934.1985	1014.0781	1024.7193	906.6482	648.6514	420.6669	440.6076	657.9280	792.4087	784.7559	774.6921 (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												
Space fract _i	1809.7254	1778.9685	1635.7949	1379.6098	1060.9741	690.8803	430.3769	455.0503	746.9678	1141.5113	1495.3220	1791.5567 (97)
Month heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

740.2355	567.6855	462.5573	255.5212	114.8185	0.0000	0.0000	0.0000	0.0000	259.7323	511.6077	756.5473 (98)
Space heating											3668.7053 (98)
Space heating per m2											(98) / (4) = 38.1045 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.4000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4058.3023 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	740.2355	567.6855	462.5573	255.5212	114.8185	0.0000	0.0000	0.0000	0.0000	259.7323	511.6077	756.5473 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	818.8446	627.9706	511.6784	282.6562	127.0116	0.0000	0.0000	0.0000	0.0000	287.3145	565.9377	836.8886 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.8439	87.5648	87.0091	85.8106	83.7606	79.7000	79.7000	79.7000	79.7000	85.7580	87.2754	79.7000 (216)
Fuel for water heating, kWh/month	233.1853	206.0450	217.4420	197.1769	197.6088	185.0425	177.2149	195.1471	195.0179	204.6094	213.1703	227.1880 (219)
Water heating fuel used												2448.8481 (219)
Annual totals kWh/year												
Space heating fuel - main system												4058.3023 (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)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994 (233)
Total delivered energy for all uses												5901.1258 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4058.3023	3.4800	141.2289 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2448.8481	3.4800	85.2199 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.8748	13.1900	51.9521 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1074.8994	13.1900	-141.7792 (252)
Total energy cost			266.5142 (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] = 0.7923 (257)
SAP value	88.9474
SAP rating (Section 12)	89 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4058.3023	0.2160	876.5933 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2448.8481	0.2160	528.9512 (264)
Space and water heating			1405.5445 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			1091.0177 (272)
CO2 emissions per m2			11.3300 (273)
EI value			89.6520

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating
EI band

90 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8431 = 4.127$, stars = 4
Water heating environmental impact	$0.216 / 0.8431 = 0.2562$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.4372 (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) =	0.4372 (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	0.4591	0.4263	0.4372	0.4154	0.4154	0.4044	0.3935	0.3826	0.3716	0.4044	0.3826	0.4044 (22b)
Effective ac	0.6054	0.5909	0.5956	0.5863	0.5863	0.5818	0.5774	0.5732	0.5691	0.5818	0.5732	0.5818 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.0860	46.9330	47.3078	46.5676	46.5676	46.2117	45.8653	45.5284	45.2010	46.2117	45.5284	46.2117 (38)
Average = Sum(39)m / 12 =	136.5852	135.4321	135.8070	135.0667	135.0667	134.7108	134.3644	134.0275	133.7001	134.7108	134.0275	134.7108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4186	1.4066	1.4105	1.4029	1.4029	1.3992	1.3956	1.3921	1.3887	1.3992	1.3921	1.3992 (40)
HLP (average)												1.4006 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

AES
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Consultants

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)	
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1547.9009	(45)	
Water storage loss:	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)	
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2600	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.6804	(55)
Total storage loss	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)	
If cylinder contains dedicated solar storage	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)	
Heat gains from water heating, kWh/month	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(65)	
										Total per year (kWh/year) = Sum(64)m =		2070.1429	(64)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (73)

[Jan	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	9.2400	14.6176	0.4600	0.0000	0.7700	47.8408 (75)
Southwest	2.9400	45.1778	0.4600	0.0000	0.7700	47.0458 (79)
Northwest	4.1000	14.6176	0.4600	0.0000	0.7700	21.2280 (81)
Southwest	9.9700	45.1778	0.4600	0.0000	0.7700	159.5398 (79)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.2140	27.4457	27.3700	27.5200	27.5200	27.5927	27.6638	27.7334	27.8013	27.5927	27.7334	27.5927
alpha	2.8143	2.8297	2.8247	2.8347	2.8347	2.8395	2.8443	2.8489	2.8534	2.8395	2.8489	2.8395
util living area												
	0.9461	0.9226	0.8660	0.7579	0.6148	0.4343	0.3237	0.3470	0.5700	0.8004	0.9131	0.9530 (86)
MIT	19.1631	19.4090	19.8709	20.3894	20.7456	20.9311	20.9780	20.9739	20.8485	20.4039	19.7422	19.1388 (87)
Th 2	19.7491	19.7582	19.7553	19.7611	19.7611	19.7640	19.7667	19.7694	19.7720	19.7640	19.7694	19.7640 (88)
util rest of house												
	0.9356	0.9081	0.8414	0.7157	0.5501	0.3500	0.2255	0.2428	0.4825	0.7531	0.8938	0.9437 (89)
MIT 2	17.3883	17.7414	18.3845	19.0827	19.5232	19.7186	19.7582	19.7591	19.6562	19.1280	18.2296	17.3638 (90)
Living area fraction												
MIT	17.6720	18.0080	18.6221	19.2916	19.7186	19.9124	19.9532	19.9533	19.8468	19.3319	18.4714	17.6475 (91)
Temperature adjustment												
adjusted MIT	17.5220	17.8580	18.4721	19.1416	19.5686	19.7624	19.8032	19.8033	19.6968	19.1819	18.3214	17.4975 (93)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating	649.9117	508.3248	397.0231	203.0603	79.5698	0.0000	0.0000	0.0000	0.0000	193.1510	418.5901	656.5722 (98)
Space heating per m2												3106.2030 (98)
											(98) / (4) =	32.2622 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3436.0652 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	649.9117	508.3248	397.0231	203.0603	79.5698	0.0000	0.0000	0.0000	0.0000	193.1510	418.5901	656.5722 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	718.9288	562.3062	439.1849	224.6242	88.0197	0.0000	0.0000	0.0000	0.0000	213.6626	463.0422	726.2967 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.5822	87.3288	86.6458	85.2010	82.8851	79.7000	79.7000	79.7000	79.7000	84.9699	86.8138	79.7000 (216)
Fuel for water heating, kWh/month	233.8821	206.6020	218.3538	198.5876	199.6961	185.0425	177.2149	195.1471	195.0179	206.5072	214.3038	227.9116 (219)
Water heating fuel used												2458.2665 (219)
Annual totals kWh/year												
Space heating fuel - main system												3436.0652 (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)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =										-1220.7247		-1220.7247 (233)
Total delivered energy for all uses												5142.4819 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3436.0652	9.7400	334.6728 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2458.2665	9.7400	239.4352 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	393.8748	36.8500	145.1428 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1220.7247	36.8500	-449.8370 (252)
Total energy cost			401.0512 (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	3436.0652	0.2160	742.1901 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2458.2665	0.2160	530.9856 (264)
Space and water heating			1273.1757 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			882.9656 (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	3436.0652	1.2200	4191.9996 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2458.2665	1.2200	2999.0851 (264)
Space and water heating			7191.0847 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			4882.9056 (272)
Primary energy kWh/m2/year			50.7157 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 109	-256 kg (29.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£109 2.66 kg/m²	B 90	A 92
Total Savings	£109 2.66 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£173	£191	-£18
Mains gas	£678	£551	£127
Space heating	£466	£468	-£2
Water heating	£239	£129	£111
Lighting	£145	£145	£0
Generated (PV)	-£450	-£450	£0
Total cost of fuels	£401	£292	£109
Total cost of uses	£400	£292	£109
Delivered energy	53 kWh/m²	40 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.6 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	3 kg/m²
Primary energy	51 kWh/m²	36 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.7000 (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																5 * 10 =	50.0000 (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) =					50.0000	/ (5) =	0.2077 (8)
Pressure test										Yes							
Measured/design AP50										4.5900							
Infiltration rate										0.4372 (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) =					0.4372 (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	0.5575	0.5465	0.5356	0.4810	0.4700	0.4154	0.4154	0.4044	0.4372	0.4700	0.4919	0.5137	(22b)				
Effective ac	0.6554	0.6493	0.6434	0.6157	0.6105	0.5863	0.5863	0.5818	0.5956	0.6105	0.6210	0.6320	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.0300	0.6400	1.2992			(26)					
Half Glaze			2.0300	1.3000	2.6390			(26a)					
Window (Uw = 1.30)			16.2800	1.2357	20.1179			(27)					
French Door (Uw = 1.30)			9.9700	1.2357	12.3203			(27)					
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000	(28a)					
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060	(29a)					
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000	(29a)					
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600	(30)					
Total net area of external elements Aum(A, m2)			252.7300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692			(33)					
GF Masonry			24.1800			39.0000	943.0200	(32c)					
GF Timber			73.8000			9.0000	664.2000	(32c)					
1F Timber			98.0400			9.0000	882.3600	(32c)					
Internal Floor			48.1400			18.0000	866.5200	(32d)					
Internal Ceiling			48.1400			9.0000	433.2600	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								138.9834 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.0300 (36)					
Total fabric heat loss							(33) + (36) =	88.4992 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 52.0578	Feb 51.5785	Mar 51.1087	Apr 48.9022	May 48.4894	Jun 46.5676	Jul 46.5676	Aug 46.2117	Sep 47.3078	Oct 48.4894	Nov 49.3245	Dec 50.1977	(38)
Heat transfer coeff	140.5569	140.0777	139.6079	137.4014	136.9885	135.0667	135.0667	134.7108	135.8070	136.9885	137.8237	138.6968	(39)
Average = Sum(39)m / 12 =												137.3994	(39)
HLP	Jan 1.4599	Feb 1.4549	Mar 1.4500	Apr 1.4271	May 1.4228	Jun 1.4029	Jul 1.4029	Aug 1.3992	Sep 1.4105	Oct 1.4228	Nov 1.4315	Dec 1.4406	(40)
HLP (average)												1.4271	(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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (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												1.1717 (H8)
Utilisation factor												0.5741 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-915.4729 (H17)
Solar input	-26.5469	-44.2991	-75.4465	-101.1132	-124.9168	-122.8131	-121.1901	-105.8844	-82.9287	-56.6305	-31.4884	-22.2152 (63)
												-915.4729 (63)
Output from w/h												
	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131 (64)
												1016.8234 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast					9.2400	11.2829		0.4600	0.0000	0.7700	36.9269 (75)	
Southwest					2.9400	36.7938		0.4600	0.0000	0.7700	38.3152 (79)	
Northwest					4.1000	11.2829		0.4600	0.0000	0.7700	16.3853 (81)	
Southwest					9.9700	36.7938		0.4600	0.0000	0.7700	129.9328 (79)	

Solar gains	221.5602	395.1071	587.6388	806.9526	975.8153	1000.4120	951.3313	820.5129	662.8254	449.3597	268.6028	187.5226 (83)
Total gains	874.4731	1043.3879	1210.6877	1387.0123	1511.5191	1501.7900	1432.7990	1311.7279	1182.3255	1010.5729	872.7523	823.2473 (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	26.4450	26.5355	26.6248	27.0524	27.1339	27.5200	27.5200	27.5927	27.3700	27.1339	26.9695	26.7997
alpha	2.7630	2.7690	2.7750	2.8035	2.8089	2.8347	2.8347	2.8395	2.8247	2.8089	2.7980	2.7866
util living area	0.9580	0.9327	0.8873	0.7998	0.6716	0.5176	0.3940	0.4410	0.6478	0.8482	0.9365	0.9637 (86)
MIT	18.9125	19.2248	19.6828	20.2284	20.6387	20.8777	20.9583	20.9421	20.7603	20.2076	19.4698	18.8642 (87)
Th 2	19.7177	19.7215	19.7252	19.7426	19.7459	19.7611	19.7611	19.7640	19.7553	19.7459	19.7393	19.7324 (88)
util rest of house												
	0.9497	0.9200	0.8660	0.7628	0.6130	0.4344	0.2912	0.3342	0.5663	0.8108	0.9222	0.9565 (89)
MIT 2	17.0107	17.4578	18.1051	18.8607	19.3866	19.6691	19.7410	19.7336	19.5532	18.8594	17.8272	16.9501 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.3147	17.7402	18.3573	19.0793	19.5867	19.8623	19.9356	19.9268	19.7462	19.0749	18.0898	17.2561 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1647	17.5902	18.2073	18.9293	19.4367	19.7123	19.7856	19.7768	19.5962	18.9249	17.9398	17.1061 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9258	0.8909	0.8337	0.7347	0.5969	0.4309	0.2933	0.3354	0.5546	0.7803	0.8938	0.9345	(94)
Useful gains	809.5860	929.5450	1009.3501	1019.0223	902.2304	647.0671	420.2228	439.9470	655.7482	788.5129	780.0703	769.3539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month fracti	1808.2249	1777.6182	1634.4323	1378.0454	1059.8446	690.5021	430.2696	454.8913	746.4194	1140.4190	1493.9768	1790.0348	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	742.9873	569.9052	465.0612	258.4966	117.2649	0.0000	0.0000	0.0000	0.0000	261.8181	514.0127	759.3866	(98)
Space heating per m2												3688.9326	(98)
												(98) / (4) =	38.3146 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4080.6776 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	742.9873	569.9052	465.0612	258.4966	117.2649	0.0000	0.0000	0.0000	0.0000	261.8181	514.0127	759.3866	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	821.8886	630.4261	514.4482	285.9476	129.7178	0.0000	0.0000	0.0000	0.0000	289.6218	568.5981	840.0294	(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	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131	(64)
Efficiency of water heater (217)m	88.1732	88.1929	88.1986	88.3081	88.5466	79.7000	79.7000	79.7000	79.7000	86.9192	87.7577	79.7000	(216)
Fuel for water heating, kWh/month	195.2353	148.0524	120.4159	62.7159	24.4620	7.6668	1.0996	39.4035	76.7241	128.0450	169.3393	194.3043	(219)
Water heating fuel used												1167.4643	(219)
Annual totals kWh/year													
Space heating fuel - main system												4080.6776	(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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												4692.1173	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4080.6776	3.4800	142.0076	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.4643	3.4800	40.6278	(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	393.8748	13.1900	51.9521	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1074.8994	13.1900	-141.7792	(252)
Total energy cost			229.2957	(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] =	0.6817 (257)
SAP value		90.4909
SAP rating (Section 12)		90 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4080.6776	0.2160	881.4264 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.4643	0.2160	252.1723 (264)
Space and water heating			1133.5987 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			845.0219 (272)
CO2 emissions per m2			8.7800 (273)
EI value			91.9852
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.4372 (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) =	0.4372 (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	0.4591	0.4263	0.4372	0.4154	0.4154	0.4044	0.3935	0.3826	0.3716	0.4044	0.3826	0.4044 (22b)
Effective ac	0.6054	0.5909	0.5956	0.5863	0.5863	0.5818	0.5774	0.5732	0.5691	0.5818	0.5732	0.5818 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.0860	46.9330	47.3078	46.5676	46.5676	46.2117	45.8653	45.5284	45.2010	46.2117	45.5284	46.2117 (38)
Average = Sum(39)m / 12 =	136.5852	135.4321	135.8070	135.0667	135.0667	134.7108	134.3644	134.0275	133.7001	134.7108	134.0275	134.7108 (39)
	134.8508 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4186	1.4066	1.4105	1.4029	1.4029	1.3992	1.3956	1.3921	1.3887	1.3992	1.3921	1.3992 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (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												1.3113 (H8)
Utilisation factor												0.5336 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-952.2442 (H17)
Solar input	-31.0645	-44.1718	-75.9206	-102.4345	-120.3155	-128.5159	-125.8132	-112.6067	-88.1632	-60.9530	-36.7411	-25.5441 (63)
												-952.2442 (63)
Output from w/h												
	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843 (64)
												983.7989 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (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	
Northeast				9.2400	14.6176			0.4600	0.0000		0.7700	47.8408 (75)
Southwest				2.9400	45.1778			0.4600	0.0000		0.7700	47.0458 (79)
Northwest				4.1000	14.6176			0.4600	0.0000		0.7700	21.2280 (81)
Southwest				9.9700	45.1778			0.4600	0.0000		0.7700	159.5398 (79)

Solar gains	275.6544	419.8582	633.5050	881.1868	1016.4018	1132.9879	1068.5756	942.1481	756.8704	516.3347	333.4017	229.1568 (83)
Total gains	928.5674	1068.1390	1256.5538	1461.2464	1552.1055	1634.3658	1550.0432	1433.3631	1276.3705	1077.5479	937.5512	864.8815 (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	27.2140	27.4457	27.3700	27.5200	27.5200	27.5927	27.6638	27.7334	27.8013	27.5927	27.7334	27.5927
alpha	2.8143	2.8297	2.8247	2.8347	2.8347	2.8395	2.8443	2.8489	2.8534	2.8395	2.8489	2.8395
util living area	0.9470	0.9236	0.8676	0.7614	0.6202	0.4390	0.3277	0.3513	0.5741	0.8028	0.9143	0.9538 (86)
MIT	19.1554	19.4019	19.8638	20.3814	20.7396	20.9291	20.9773	20.9730	20.8456	20.3984	19.7353	19.1309 (87)
Th 2	19.7491	19.7582	19.7553	19.7611	19.7611	19.7640	19.7667	19.7694	19.7720	19.7640	19.7694	19.7640 (88)
util rest of house												
	0.9366	0.9093	0.8432	0.7194	0.5554	0.3540	0.2284	0.2460	0.4864	0.7558	0.8953	0.9446 (89)
MIT 2	17.3775	17.7316	18.3751	19.0730	19.5172	19.7172	19.7579	19.7588	19.6538	19.1214	18.2203	17.3527 (90)

FULL SAP CALCULATION PRINTOUT

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Living area fraction									fLA = Living area / (4) =	0.1598 (91)		
MIT	17.6617	17.9986	18.6131	19.2821	19.7126	19.9110	19.9528	19.9529	19.8443	19.3255	18.4624	17.6369 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5117	17.8486	18.4631	19.1321	19.5626	19.7610	19.8028	19.8029	19.6943	19.1755	18.3124	17.4869 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9105	0.8799	0.8117	0.6949	0.5441	0.3538	0.2314	0.2490	0.4804	0.7290	0.8652	0.9203	(94)
Useful gains	845.5017	939.8496	1020.0001	1015.4217	844.4977	578.2739	358.6633	356.8508	613.1066	785.5162	811.1279	795.9738	(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													
Month fracti	1722.5733	1699.4866	1556.7647	1300.9783	953.9213	600.9392	363.1636	362.2575	667.7389	1047.4477	1395.5546	1682.1212	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	652.5412	510.4760	399.3529	205.6007	81.4111	0.0000	0.0000	0.0000	0.0000	194.8770	420.7872	659.2937	(98)
Space heating per m2												3124.3399	(98)
												(98) / (4) =	32.4506 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3456.1282 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	652.5412	510.4760	399.3529	205.6007	81.4111	0.0000	0.0000	0.0000	0.0000	194.8770	420.7872	659.2937	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	721.8376	564.6859	441.7620	227.4345	90.0566	0.0000	0.0000	0.0000	0.0000	215.5719	465.4726	729.3072	(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	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843	(64)
Efficiency of water heater (217)m	87.9858	87.9920	87.9289	87.9419	87.5337	79.7000	79.7000	79.7000	79.7000	86.2943	87.4177	79.7000	(216)
Fuel for water heating, kWh/month	190.5168	148.5354	120.2461	61.4746	30.0017	0.5114	0.0000	30.9690	70.1563	123.9633	163.9891	191.0051	(219)
Water heating fuel used												1131.3688	(219)
Annual totals kWh/year													
Space heating fuel - main system												3456.1282	(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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =									-1220.7247			-1220.7247	(233)
Total delivered energy for all uses												3885.6471	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3456.1282	9.7400	336.6269	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1131.3688	9.7400	110.1953	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	393.8748	36.8500	145.1428	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1220.7247	36.8500	-449.8370	(252)
Total energy cost			292.1905	(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	3456.1282	0.2160	746.5237	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	1131.3688	0.2160	244.3757 (264)
Space and water heating			990.8993 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			626.6393 (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	3456.1282	1.2200	4216.4764 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1131.3688	1.2200	1380.2699 (264)
Space and water heating			5596.7463 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			3442.0671 (272)
Primary energy kWh/m2/year			35.7506 (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	North East
Overshading	Average or unknown
Thermal mass parameter	139.0 (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	317.72 (P1)
Transmission heat loss coefficient	88.50 (P7)
Summer heat loss coefficient	406.22 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	9.2400	98.8453	0.4600	0.0000	0.9000	378.1187
South West	2.9400	119.9223	0.4600	0.0000	0.9000	145.9647
North West	4.1000	98.8453	0.4600	0.0000	0.9000	167.7800
South West	9.9700	119.9223	0.4600	0.0000	0.9000	494.9891

total: 1186.8525

	Jun	Jul	Aug	
Solar gains	1262	1187	1045	(P4)
Internal gains	519	499	508	
Total summer gains	1781	1686	1552	(P5)

Summer gain/loss ratio	4.38	4.15	3.82	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 139.0)	1.03	1.03	1.03	
Threshold temperature	21.41	23.08	22.65	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	

Assessment of likelihood of high internal temperature: Medium

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-658				Issued on Date	31/05/2023
Assessment Reference	As Built	Prop Type Ref	Fuller-CB-As-DET			
Property	6, Kittiwake Place, BOTLEY, SO32 2ZB					
SAP Rating	89 B	DER	12.25	TER	18.42	
Environmental	90 B	% DER<TER	33.50			
CO ₂ Emissions (t/year)	0.86	DFEE	50.97	TFEE	60.04	
General Requirements Compliance	Pass	% DFEE<TFEE	15.10			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)60.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.30 (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 HEAT H12

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.26 kWh/day	
Permitted by DBSCG 1.89	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:	Average
Windows facing North East:	9.24 m ² , No overhang
Windows facing South East:	4.10 m ² , No overhang
Windows facing South West:	12.91 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Door U-value	0.64 W/m ² K
Photovoltaic array	1.48 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (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	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
Effective ac	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.4275	51.9339	51.4500	49.1774	48.7522	46.7728	46.7728	46.4063	47.5352	48.7522	49.6124	50.5116 (38)
Average = Sum(39)m / 12 =	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4637	1.4586	1.4536	1.4300	1.4255	1.4050	1.4050	1.4012	1.4129	1.4255	1.4345	1.4438 (40)
HLP (average)												1.4299 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)
Energy content (annual)										Total =	Sum(45)m =	1547.9009	(45)
Distribution loss	(46)m =	0.15 x	(45)m										
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												150.0000	(47)
Temperature factor from Table 2b												1.2600	(48)
Enter (49) or (54) in (55)												0.5400	(49)
Total storage loss												0.6804	(55)
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)
If cylinder contains dedicated solar storage													
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(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													
	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)
								Total per year (kWh/year) =	Sum(64)m =			2070.1429	(64)
Heat gains from water heating, kWh/month													
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(66)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	813.7677	618.9490	504.8027	283.5761	131.3598	0.0000	0.0000	0.0000	0.0000	291.4793	567.5959	832.0042 (98)
Space heating												4043.5346 (98)
Space heating per m2										(98) / (4) =		41.9977 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4472.9365 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	813.7677	618.9490	504.8027	283.5761	131.3598	0.0000	0.0000	0.0000	0.0000	291.4793	567.5959	832.0042 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	900.1855	684.6781	558.4100	313.6904	145.3095	0.0000	0.0000	0.0000	0.0000	322.4329	627.8716	920.3586 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	88.0235	87.7413	87.2082	86.0813	84.1047	79.7000	79.7000	79.7000	79.7000	86.0584	87.5001	79.7000 (216)
Fuel for water heating, kWh/month	232.7094	205.6306	216.9455	196.5566	196.8002	185.0425	177.2149	195.1471	195.0179	203.8951	212.6230	226.7348 (219)
Water heating fuel used												2444.3174 (219)
Annual totals kWh/year												
Space heating fuel - main system												4472.9365 (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)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =												-1074.8994 (233)
Total delivered energy for all uses												6311.2293 (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	4472.9365	0.2160	966.1543 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2444.3174	0.2160	527.9726 (264)
Space and water heating			1494.1268 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total CO2, kg/year			1179.6000 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2500 (273)

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

DER		12.2500 ZC1
Total Floor Area	TFA	96.2800
Assumed number of occupants	N	2.7023
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.3973 ZC2
CO2 emissions from cooking, equation (L16)		1.9096 ZC3
Total CO2 emissions		29.5569 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		29.5569 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys										0	+	0	+	0 = 0 * 40 = 0.0000 (6a)
Number of open flues										0	+	0	+	0 = 0 * 20 = 0.0000 (6b)
Number of intermittent fans														3 * 10 = 30.0000 (7a)
Number of passive vents														0 * 10 = 0.0000 (7b)
Number of flueless gas fires														0 * 40 = 0.0000 (7c)
										Air changes per hour				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) = 0.1246 (8)				
Pressure test										Yes				
Measured/design AP50										5.0000				
Infiltration rate										0.3746 (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) = 0.3746 (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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402 (22b)		
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969 (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			2.0300	1.0000	2.0300		(26)					
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)					
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)					
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)					
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)					
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)					
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)					
Total net area of external elements Aum(A, m2)			252.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3163		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6334 (36)					
Total fabric heat loss						(33) + (36) =	79.9497 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.7770	Feb 48.4251	Mar 48.0802	Apr 46.4602	May 46.1571	Jun 44.7462	Jul 44.7462	Aug 44.4849	Sep 45.2897	Oct 46.1571	Nov 46.7703	Dec 47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)
HLP	Jan 1.3370	Feb 1.3333	Mar 1.3298	Apr 1.3129	May 1.3098	Jun 1.2951	Jul 1.2951	Aug 1.2924	Sep 1.3008	Oct 1.3098	Nov 1.3162	Dec 1.3228 (40)
HLP (average)												1.3129 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9009 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m = 0.0000 (63)					
Output from w/h	207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153 (64)
							Total per year (kWh/year) = Sum(64)m = 2096.5183 (64)					
Heat gains from water heating, kWh/month												
90.6369	80.3384	85.4351	78.0598	77.5628	70.8380	69.4903	74.2424	73.4815	80.8713	83.6613	88.9532	(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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3829	19.8803	16.1678	12.2400	9.1496	7.7245	8.3465	10.8492	14.5617	18.4894	21.5799	23.0050 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	121.8238	119.5513	114.8321	108.4163	104.2510	98.3861	93.4010	99.7882	102.0576	108.6980	116.1962	119.5608 (72)
Total internal gains	460.9113	458.7321	443.7586	419.4884	394.6527	370.8400	355.4388	361.7327	374.2564	398.7513	426.9199	448.2322 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				7.0300	11.2829	0.6300	0.7000	0.7700	24.2409 (75)			
Southeast				3.1200	36.7938	0.6300	0.7000	0.7700	35.0834 (77)			
Southwest				9.8400	36.7938	0.6300	0.7000	0.7700	110.6476 (79)			
Solar gains	169.9719	297.5769	428.5449	566.8361	667.6242	677.1890	646.8929	569.5000	476.0897	334.6524	205.0535	144.5117 (83)
Total gains	630.8832	756.3090	872.3035	986.3245	1062.2769	1048.0290	1002.3317	931.2327	850.3461	733.4037	631.9734	592.7439 (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	51.9404	52.0827	52.2230	52.8923	53.0194	53.6193	53.7319	53.3867	53.0194	52.7629	52.4973	52.4973
alpha	4.4627	4.4722	4.4815	4.5262	4.5346	4.5746	4.5746	4.5821	4.5591	4.5346	4.5175	4.4998
util living area	0.9970	0.9929	0.9817	0.9465	0.8574	0.6946	0.5311	0.5874	0.8267	0.9671	0.9937	0.9978 (86)
MIT	19.5655	19.7579	20.0554	20.4354	20.7516	20.9334	20.9845	20.9759	20.8470	20.4292	19.9269	19.5359 (87)
Th 2	19.8120	19.8148	19.8176	19.8307	19.8332	19.8446	19.8446	19.8468	19.8402	19.8332	19.8282	19.8230 (88)
util rest of house	0.9960	0.9904	0.9751	0.9263	0.8047	0.5948	0.3998	0.4534	0.7453	0.9507	0.9911	0.9970 (89)
MIT 2	17.9213	18.2033	18.6356	19.1813	19.5959	19.8020	19.8393	19.8374	19.7218	19.1847	18.4601	17.8855 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	18.1841	18.4518	18.8625	19.3817	19.7807	19.9828	20.0224	20.0194	19.9016	19.3836	18.6946	18.1493 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1841	18.4518	18.8625	19.3817	19.7807	19.9828	20.0224	20.0194	19.9016	19.3836	18.6946	18.1493 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9938	0.9862	0.9677	0.9165	0.8019	0.6077	0.4208	0.4745	0.7503	0.9420	0.9873	0.9952 (94)
Useful gains	626.9555	745.8957	844.1138	903.9230	851.8254	636.9251	421.7823	441.8946	638.0244	690.8565	623.9307	589.9096 (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												
1787.2539	1739.7134	1582.7746	1324.9940	1019.0279	671.2185	426.7549	450.3776	726.5945	1107.6702	1469.2658	1776.6008	1776.6008 (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	863.2620	667.8455	549.5637	303.1712	124.3987	0.0000	0.0000	0.0000	0.0000	310.1094	608.6413	882.8983 (98)
Space heating												4309.8899 (98)
Space heating per m2												(98) / (4) = 44.7641 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4609.5080 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	863.2620	667.8455	549.5637	303.1712	124.3987	0.0000	0.0000	0.0000	0.0000	310.1094	608.6413	882.8983	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	923.2749	714.2732	587.7686	324.2472	133.0467	0.0000	0.0000	0.0000	0.0000	331.6678	650.9532	944.2763	(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	207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153	(64)
Efficiency of water heater (217)m	88.2117	87.9691	87.4700	86.3203	84.0303	79.8000	79.8000	79.8000	79.8000	86.2853	87.7218	79.8000	(216)
Fuel for water heating, kWh/month	234.7526	207.3981	218.8572	198.5240	199.6403	187.5272	179.7999	197.7097	197.4901	205.9551	214.5567	228.7945	(219)
Water heating fuel used												2471.0055	(219)
Annual totals kWh/year													
Space heating fuel - main system												4609.5080	(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)												395.2898	(232)
Total delivered energy for all uses												7550.8032	(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	4609.5080	0.2160	995.6537	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2471.0055	0.2160	533.7372	(264)
Space and water heating			1529.3909	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.2898	0.5190	205.1554	(268)
Total CO2, kg/m2/year			1773.4713	(272)
Emissions per m2 for space and water heating			15.8848	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1308	(272b)
Emissions per m2 for pumps and fans			0.4043	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8848 * 1.00) + 2.1308 + 0.4043, rounded to 2 d.p.			18.4200	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.3606 (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) =	0.3606 (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	0.4598	0.4508	0.4418	0.3967	0.3877	0.3426	0.3426	0.3336	0.3606	0.3877	0.4057	0.4237 (22b)
Effective ac	0.6057	0.6016	0.5976	0.5787	0.5751	0.5587	0.5587	0.5556	0.5650	0.5751	0.5823	0.5898 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.1124	47.7864	47.4667	45.9656	45.6847	44.3772	44.3772	44.1351	44.8808	45.6847	46.2529	46.8469 (38)
Average = Sum(39)m / 12 =	136.6116	136.2855	135.9659	134.4647	134.1839	132.8764	132.8764	132.6343	133.3800	134.1839	134.7521	135.3461 (39)
	134.4634 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4189	1.4155	1.4122	1.3966	1.3937	1.3801	1.3801	1.3776	1.3853	1.3937	1.3996	1.4058 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3028	19.8092	16.1099	12.1962	9.1168	7.6968	8.3167	10.8103	14.5096	18.4233	21.5027	22.9227	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	(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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	(71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909	(72)
Total internal gains	381.8446	380.4945	367.2374	345.2968	321.9754	300.2845	286.6802	290.6600	302.3514	324.4356	349.8870	369.9800	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	9.2400	11.2829	0.4600	0.0000	0.7700	36.9269 (75)
Southeast	4.1000	36.7938	0.4600	0.0000	0.7700	53.4327 (77)
Southwest	2.9400	36.7938	0.4600	0.0000	0.7700	38.3152 (79)
Southwest	9.9700	36.7938	0.4600	0.0000	0.7700	129.9328 (79)

Solar gains	258.6076	452.7700	652.0794	862.5666	1015.9906	1030.5683	984.4537	866.6406	724.4449	509.1917	311.9860	219.8689 (83)
Total gains	640.4522	833.2646	1019.3169	1207.8634	1337.9660	1330.8527	1271.1339	1157.3005	1026.7963	833.6273	661.8730	589.8488 (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	27.2088	27.2739	27.3380	27.6432	27.7011	27.9736	27.9736	28.0247	27.8680	27.7011	27.5843	27.4632	
alpha	2.8139	2.8183	2.8225	2.8429	2.8467	2.8649	2.8649	2.8683	2.8579	2.8467	2.8390	2.8309	
util living area	0.9797	0.9585	0.9184	0.8380	0.7137	0.5613	0.4317	0.4838	0.6990	0.8923	0.9656	0.9837	(86)
MIT	18.6883	19.0478	19.5504	20.1356	20.5878	20.8540	20.9493	20.9291	20.7143	20.0831	19.2667	18.6248	(87)
Th 2	19.7489	19.7515	19.7540	19.7659	19.7682	19.7786	19.7786	19.7806	19.7746	19.7682	19.7637	19.7589	(88)
util rest of house	0.9754	0.9501	0.9019	0.8055	0.6575	0.4761	0.3227	0.3714	0.6200	0.8628	0.9573	0.9802	(89)
MIT 2	17.6723	18.0275	18.5181	19.0797	19.4827	19.7017	19.7614	19.7543	19.6050	19.0493	18.2566	17.6165	(90)
Living area fraction	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(91)
MIT	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(92)
Temperature adjustment	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(93)
adjusted MIT	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9663	0.9362	0.8842	0.7896	0.6520	0.4841	0.3389	0.3872	0.6205	0.8464	0.9448	0.9724	(94)
Ext temp.	618.8833	780.0786	901.2935	953.7603	872.3159	644.3059	430.7239	448.1165	637.1367	705.5411	625.3652	573.5886	(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	1848.9986	1811.3189	1656.4846	1391.5091	1068.0142	702.3705	445.3090	469.8035	757.9030	1155.9386	1525.1296	1837.6818	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	915.2057	692.9935	561.8622	315.1791	145.5995	0.0000	0.0000	0.0000	0.0000	335.0957	647.8304	940.4853	(98)
Space heating per m2												4554.2515	(98)
										(98) / (4) =		47.3022	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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FULL SAP CALCULATION PRINTOUT

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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	1249.0380	983.2853	1008.0204	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8354	0.8854	0.8586	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1043.4443	870.5866	865.5198	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1658.4361	1586.4248	1455.1627	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	442.7941	532.5836	438.6943	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1414.0720	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	110.6985	133.1459	109.6736	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												353.5180	(107)
Energy for space heating												3.6718	(108)
Energy for space cooling												47.3022	(99)
Total												3.6718	(108)
Dwelling Fabric Energy Efficiency (DFEE)												50.9739	(109)
												51.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3746 (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) =	0.3746 (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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402 (22b)
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969 (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			2.0300	1.0000	2.0300		(26)
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3163		(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)							12.6334 (36)
Total fabric heat loss						(33) + (36) =	79.9497 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.7770	48.4251	48.0802	46.4602	46.1571	44.7462	44.7462	44.4849	45.2897	46.1571	46.7703	47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3370	1.3333	1.3298	1.3129	1.3098	1.2951	1.2951	1.2924	1.3008	1.3098	1.3162	1.3228 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9009 (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												

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	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (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	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3829	19.8803	16.1678	12.2400	9.1496	7.7245	8.3465	10.8492	14.5617	18.4894	21.5799	23.0050 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909 (72)
Total internal gains	381.9247	380.5657	367.2953	345.3406	322.0082	300.3121	286.7101	290.6988	302.4035	324.5018	349.9643	370.0623 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					7.0300	11.2829	0.6300	0.7000	0.7700		24.2409 (75)	
Southeast					3.1200	36.7938	0.6300	0.7000	0.7700		35.0834 (77)	
Southwest					9.8400	36.7938	0.6300	0.7000	0.7700		110.6476 (79)	
Solar gains	169.9719	297.5769	428.5449	566.8361	667.6242	677.1890	646.8929	569.5000	476.0897	334.6524	205.0535	144.5117 (83)
Total gains	551.8966	678.1426	795.8402	912.1767	989.6324	977.5011	933.6030	860.1988	778.4932	659.1542	555.0178	514.5740 (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	51.9404	52.0827	52.2230	52.8923	53.0194	53.6193	53.7319	53.3867	53.0194	52.7629	52.4973	
alpha	4.4627	4.4722	4.4815	4.5262	4.5346	4.5746	4.5746	4.5821	4.5591	4.5346	4.5175	4.4998
util living area	0.9983	0.9954	0.9870	0.9587	0.8813	0.7289	0.5652	0.6270	0.8601	0.9775	0.9963	0.9988 (86)
MIT	19.4918	19.6862	19.9885	20.3795	20.7151	20.9187	20.9801	20.9686	20.8153	20.3676	19.8558	19.4626 (87)
Th 2	19.8120	19.8148	19.8176	19.8307	19.8332	19.8446	19.8446	19.8468	19.8402	19.8332	19.8282	19.8230 (88)
util rest of house	0.9977	0.9938	0.9822	0.9423	0.8336	0.6296	0.4280	0.4881	0.7860	0.9657	0.9947	0.9983 (89)
MIT 2	18.4477	18.6436	18.9454	19.3360	19.6430	19.8080	19.8398	19.8382	19.7386	19.3328	18.8238	18.4271 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	18.6146	18.8103	19.1122	19.5028	19.8144	19.9856	20.0221	20.0189	19.9107	19.4982	18.9888	18.5926 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6146	18.8103	19.1122	19.5028	19.8144	19.9856	20.0221	20.0189	19.9107	19.4982	18.9888	18.5926 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9918	0.9783	0.9365	0.8327	0.6430	0.4501	0.5103	0.7914	0.9610	0.9930	0.9976 (94)
Ext temp.	550.1133	672.5767	778.5434	854.2115	824.1059	628.5024	420.1914	438.9491	616.1087	633.4368	551.1508	513.3549 (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	1842.6760	1785.7275	1614.7348	1340.3003	1023.2759	671.5586	426.7227	450.3119	727.7326	1122.1297	1506.5442	1833.0614 (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	961.6667	748.0373	622.1264	349.9839	148.1825	0.0000	0.0000	0.0000	0.0000	363.5875	687.8832	981.8616 (98)
Space heating per m2												4863.3292 (98)
										(98) / (4) =		50.5124 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1172.1413	922.7495	945.7029	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8446	0.9079	0.8792	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	989.9662	837.7295	831.4640	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1245.4645	1191.9479	1107.9527	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	183.9587	263.5384	205.7076	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												653.2047 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			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	45.9897	65.8846	51.4269	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												163.3012 (107)
Energy for space heating												1.6961 (108)
Energy for space cooling												50.5124 (99)
Total												1.6961 (108)
Target Fabric Energy Efficiency (TFEE)												52.2085 (109)
												60.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) =	0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =		0.4437 (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												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6804 (55)
Total storage loss												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (56)
If cylinder contains dedicated solar storage												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
												Total per year (kWh/year) = Sum (64)m =
												2070.1429 (64)
RHI water heating demand												2070 (64)
Heat gains from water heating, kWh/month												
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611 (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	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	(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)													
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	(71)
Water heating gains (Table 5)													
	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520	(72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast				9.2400	14.6176		0.4600	0.0000	0.7700	47.8408 (75)		
Southeast				4.1000	45.1778		0.4600	0.0000	0.7700	65.6081 (77)		
Southwest				2.9400	45.1778		0.4600	0.0000	0.7700	47.0458 (79)		
Southwest				9.9700	45.1778		0.4600	0.0000	0.7700	159.5398 (79)		

Solar gains	320.0345	477.9111	697.3622	934.6518	1051.5316	1160.7343	1099.2813	987.9314	820.5284	580.8094	385.0301	267.3648 (83)
Total gains	979.5570	1132.8015	1328.5213	1528.8249	1607.6022	1682.7292	1601.3659	1498.7628	1352.6412	1150.1330	995.7891	909.6990 (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	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529	
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369	
util living area	0.9404	0.9137	0.8536	0.7454	0.6062	0.4287	0.3183	0.3376	0.5506	0.7815	0.9031	0.9483	(86)
MIT	19.2095	19.4661	19.9214	20.4164	20.7541	20.9331	20.9789	20.9756	20.8612	20.4436	19.7920	19.1804	(87)
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624	(88)
util rest of house	0.9290	0.8980	0.8275	0.7023	0.5415	0.3451	0.2215	0.2358	0.4642	0.7322	0.8822	0.9381	(89)
MIT 2	17.4524	17.8195	18.4503	19.1141	19.5304	19.7185	19.7571	19.7585	19.6657	19.1742	18.2964	17.4218	(90)
Living area fraction													
MIT	17.7333	18.0827	18.6855	19.3223	19.7261	19.9127	19.9524	19.9530	19.8568	19.3771	18.5355	17.7029	(92)
Temperature adjustment													
adjusted MIT	17.5833	17.9327	18.5355	19.1723	19.5761	19.7627	19.8024	19.8030	19.7068	19.2271	18.3855	17.5529	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9016	0.8677	0.7963	0.6791	0.5311	0.3451	0.2245	0.2388	0.4593	0.7070	0.8515	0.9125	(94)
Useful gains	883.1809	982.8820	1057.9409	1038.2476	853.8247	580.6854	359.4293	357.8814	621.2881	813.1505	847.8890	830.1391	(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	1735.5302	1713.6074	1569.2220	1308.3923	957.1914	602.0386	363.6033	362.7489	670.2310	1055.9215	1407.1664	1693.4544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating												3002.6054 (98)
RHI space heating demand												3003 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (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												
Effective ac	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.4275	51.9339	51.4500	49.1774	48.7522	46.7728	46.7728	46.4063	47.5352	48.7522	49.6124	50.5116 (38)
Average = Sum(39)m / 12 =	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
												137.6745 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4637	1.4586	1.4536	1.4300	1.4255	1.4050	1.4050	1.4012	1.4129	1.4255	1.4345	1.4438 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	727.4579	550.7498	445.0780	245.2858	110.8126	0.0000	0.0000	0.0000	0.0000	245.8419	497.6161	744.9094 (98)
Space heating												3567.7514 (98)
Space heating per m2											(98) / (4) =	37.0560 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3946.6277 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	727.4579	550.7498	445.0780	245.2858	110.8126	0.0000	0.0000	0.0000	0.0000	245.8419	497.6161	744.9094 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	804.7100	609.2365	492.3429	271.3339	122.5803	0.0000	0.0000	0.0000	0.0000	271.9490	550.4603	824.0148 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.8098	87.5012	86.9192	85.7031	83.6715	79.7000	79.7000	79.7000	79.7000	85.6130	87.2137	79.7000 (216)
Fuel for water heating, kWh/month	233.2757	206.1947	217.6667	197.4241	197.8192	185.0425	177.2149	195.1471	195.0179	204.9558	213.3211	227.2644 (219)
Water heating fuel used												2450.3441 (219)
Annual totals kWh/year												
Space heating fuel - main system												3946.6277 (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)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994 (233)
Total delivered energy for all uses												5790.9471 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3946.6277	3.4800	137.3426 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2450.3441	3.4800	85.2720 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.8748	13.1900	51.9521 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1074.8994	13.1900	-141.7792 (252)
Total energy cost			262.6800 (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] =	0.7809 (257)
SAP value		89.1064
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3946.6277	0.2160	852.4716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2450.3441	0.2160	529.2743 (264)
Space and water heating			1381.7459 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			1067.2191 (272)
CO2 emissions per m2			11.0800 (273)
EI value			89.8777

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating
EI band

90 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8426 = 4.130$, stars = 4
Water heating environmental impact	$0.216 / 0.8426 = 0.2563$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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)	=	0.4437 (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												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018		12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Energy conte	108.2180	104.2828	104.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)
Distribution loss	(46)m =	0.15 x	(45)m							Total =	Sum(45)m =	1547.9009	(45)
Water storage loss:	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												150.0000	(47)
Temperature factor from Table 2b												1.2600	(48)
Enter (49) or (54) in (55)												0.5400	(49)
Total storage loss												0.6804	(55)
If cylinder contains dedicated solar storage	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)
Primary loss	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Solar input (sum of months) =	Sum(63)m =	0.0000	0.0000	0.0000	(63)
Heat gains from water heating, kWh/month	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)
Total per year (kWh/year) =								Sum(64)m =				2070.1429	(64)
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (73)

[Jan	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	9.2400	14.6176	0.4600	0.0000	0.7700	47.8408 (75)
Southeast	4.1000	45.1778	0.4600	0.0000	0.7700	65.6081 (77)
Southwest	2.9400	45.1778	0.4600	0.0000	0.7700	47.0458 (79)
Southwest	9.9700	45.1778	0.4600	0.0000	0.7700	159.5398 (79)

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	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529		
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369		
util living area														
	0.9404	0.9137	0.8536	0.7454	0.6062	0.4287	0.3183	0.3376	0.5506	0.7815	0.9031	0.9483	(86)	
MIT	19.2095	19.4661	19.9214	20.4164	20.7541	20.9331	20.9789	20.9756	20.8612	20.4436	19.7920	19.1804	(87)	
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624	(88)	
util rest of house														
	0.9290	0.8980	0.8275	0.7023	0.5415	0.3451	0.2215	0.2358	0.4642	0.7322	0.8822	0.9381	(89)	
MIT 2	17.4524	17.8195	18.4503	19.1141	19.5304	19.7185	19.7571	19.7585	19.6657	19.1742	18.2964	17.4218	(90)	
Living area fraction									fLA = Living area / (4) =			0.1598	(91)	
MIT	17.7333	18.0827	18.6855	19.3223	19.7261	19.9127	19.9524	19.9530	19.8568	19.3771	18.5355	17.7029	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.5833	17.9327	18.5355	19.1723	19.5761	19.7627	19.8024	19.8030	19.7068	19.2271	18.3855	17.5529	(93)	

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating per m2												3002.6054 (98)
											(98) / (4) =	31.1862 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3321.4661 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	701.4910	543.1941	420.7888	215.1595	85.0717	0.0000	0.0000	0.0000	0.0000	199.8027	445.4421	710.5161 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.5309	87.2525	86.5408	85.0859	82.8094	79.7000	79.7000	79.7000	79.7000	84.7906	86.7208	79.7000 (216)
Fuel for water heating, kWh/month	234.0191	206.7826	218.6185	198.8563	199.8786	185.0425	177.2149	195.1471	195.0179	206.9436	214.5336	228.0289 (219)
Water heating fuel used												2460.0835 (219)
Annual totals kWh/year												
Space heating fuel - main system												3321.4661 (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)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =										-1220.7247		-1220.7247 (233)
Total delivered energy for all uses												5029.6997 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3321.4661	9.7400	323.5108 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2460.0835	9.7400	239.6121 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	393.8748	36.8500	145.1428 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1220.7247	36.8500	-449.8370 (252)
Total energy cost			390.0662 (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	3321.4661	0.2160	717.4367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2460.0835	0.2160	531.3780 (264)
Space and water heating			1248.8147 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			858.6046 (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	3321.4661	1.2200	4052.1887 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2460.0835	1.2200	3001.3019 (264)
Space and water heating			7053.4906 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			4745.3114 (272)
Primary energy kWh/m2/year			49.2866 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 109	-257 kg (29.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£109 2.67 kg/m²	B 91	A 92
Total Savings	£109 2.67 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 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	£173	£191	-£18
Mains gas	£667	£540	£127
Space heating	£455	£457	-£2
Water heating	£240	£129	£111
Lighting	£145	£145	£0
Generated (PV)	-£450	-£450	£0
Total cost of fuels	£390	£281	£109
Total cost of uses	£390	£281	£109
Delivered energy	52 kWh/m²	39 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.6 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	6 kg/m²	3 kg/m²
Primary energy	49 kWh/m²	34 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.7000 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							5 * 10 =	50.0000 (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) =						50.0000 / (5) =	0.2077 (8)				
Pressure test							Yes					
Measured/design AP50								4.7200				
Infiltration rate								0.4437 (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) =	0.4437 (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	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
Effective ac	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.4275	Feb 51.9339	Mar 51.4500	Apr 49.1774	May 48.7522	Jun 46.7728	Jul 46.7728	Aug 46.4063	Sep 47.5352	Oct 48.7522	Nov 49.6124	Dec 50.5116 (38)
Heat transfer coeff	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
Average = Sum(39)m / 12 =												137.6745 (39)
HLP	Jan 1.4637	Feb 1.4586	Mar 1.4536	Apr 1.4300	May 1.4255	Jun 1.4050	Jul 1.4050	Aug 1.4012	Sep 1.4129	Oct 1.4255	Nov 1.4345	Dec 1.4438 (40)
HLP (average)												1.4299 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (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												1.1717 (H8)
Utilisation factor												0.5741 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-915.4729 (H17)
Solar input	-26.5469	-44.2991	-75.4465	-101.1132	-124.9168	-122.8131	-121.1901	-105.8844	-82.9287	-56.6305	-31.4884	-22.2152 (63)
												-915.4729 (63)
Output from w/h												
	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131 (64)
												1016.8234 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (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	
Northeast				9.2400	11.2829		0.4600		0.0000		0.7700	36.9269 (75)
Southeast				4.1000	36.7938		0.4600		0.0000		0.7700	53.4327 (77)
Southwest				2.9400	36.7938		0.4600		0.0000		0.7700	38.3152 (79)
Southwest				9.9700	36.7938		0.4600		0.0000		0.7700	129.9328 (79)

Solar gains	258.6076	452.7700	652.0794	862.5666	1015.9906	1030.5683	984.4537	866.6406	724.4449	509.1917	311.9860	219.8689 (83)
Total gains	911.5206	1101.0509	1275.1282	1442.6262	1551.6944	1531.9462	1465.9213	1357.8555	1243.9450	1070.4049	916.1354	855.5935 (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	26.3757	26.4684	26.5599	26.9983	27.0820	27.4782	27.4782	27.5529	27.3242	27.0820	26.9133	26.7392
alpha	2.7584	2.7646	2.7707	2.7999	2.8055	2.8319	2.8319	2.8369	2.8216	2.8055	2.7942	2.7826
util living area	0.9539	0.9248	0.8759	0.7873	0.6617	0.5101	0.3866	0.4287	0.6276	0.8324	0.9296	0.9604 (86)
MIT	18.9500	19.2809	19.7363	20.2613	20.6517	20.8818	20.9601	20.9460	20.7790	20.2516	19.5132	18.8981 (87)
Th 2	19.7148	19.7187	19.7225	19.7404	19.7438	19.7595	19.7595	19.7624	19.7535	19.7438	19.7370	19.7299 (88)
util rest of house	0.9450	0.9109	0.8531	0.7492	0.6027	0.4274	0.2852	0.3240	0.5460	0.7927	0.9141	0.9526 (89)
MIT 2	17.0622	17.5343	18.1754	18.9002	19.3989	19.6709	19.7404	19.7343	19.5691	18.9132	17.8861	16.9969 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =	0.1598 (91)		
MIT	17.3640	17.8135	18.4249	19.1178	19.5991	19.8645	19.9353	19.9280	19.7625	19.1272	18.1461	17.3008 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2140	17.6635	18.2749	18.9678	19.4491	19.7145	19.7853	19.7780	19.6125	18.9772	17.9961	17.1508 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9199	0.8807	0.8207	0.7219	0.5874	0.4242	0.2874	0.3254	0.5357	0.7630	0.8847	0.9296	(94)
Useful gains	838.5327	969.6583	1046.4379	1041.4853	911.4959	649.9081	421.3082	441.8235	666.4132	816.7073	810.5082	795.3268	(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	1819.9251	1792.4214	1647.8841	1386.0991	1063.5783	691.8440	430.8882	455.7105	749.8918	1149.7773	1504.8838	1800.3013	(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	730.1559	552.8968	447.4760	248.1220	113.1493	0.0000	0.0000	0.0000	0.0000	247.8040	499.9504	747.7010	(98)
Space heating												3587.2555	(98)
Space heating per m2												(98) / (4) =	37.2586 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3968.2030 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	730.1559	552.8968	447.4760	248.1220	113.1493	0.0000	0.0000	0.0000	0.0000	247.8040	499.9504	747.7010	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	807.6946	611.6115	494.9956	274.4712	125.1651	0.0000	0.0000	0.0000	0.0000	274.1195	553.0425	827.1029	(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	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131	(64)
Efficiency of water heater (217)m	88.1424	88.1394	88.1305	88.2383	88.4912	79.7000	79.7000	79.7000	79.7000	86.7888	87.7021	79.7000	(216)
Fuel for water heating, kWh/month	195.3037	148.1424	120.5091	62.7655	24.4774	7.6668	1.0996	39.4035	76.7241	128.2374	169.4466	194.3639	(219)
Water heating fuel used												1168.1400	(219)
Annual totals kWh/year													
Space heating fuel - main system												3968.2030	(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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												4580.3183	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3968.2030	3.4800	138.0935	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1168.1400	3.4800	40.6513	(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	393.8748	13.1900	51.9521	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1074.8994	13.1900	-141.7792	(252)
Total energy cost			225.4051	(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] =	0.6701 (257)
SAP value		90.6523
SAP rating (Section 12)		91 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	3968.2030	0.2160	857.1318 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1168.1400	0.2160	252.3182 (264)
Space and water heating			1109.4501 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			820.8733 (272)
CO2 emissions per m2			8.5300 (273)
EI value			92.2143
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (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) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =		0.4437 (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												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018		12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss						(33) + (36) =	88.4992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (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												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (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												1.3113 (H8)
Utilisation factor												0.5336 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-952.2442 (H17)
Solar input	-31.0645	-44.1718	-75.9206	-102.4345	-120.3155	-128.5159	-125.8132	-112.6067	-88.1632	-60.9530	-36.7411	-25.5441 (63)
												-952.2442 (63)
Output from w/h												
	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843 (64)
												983.7989 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (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)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (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		
Northeast				9.2400		14.6176	0.4600		0.0000	0.7700		47.8408 (75)
Southeast				4.1000		45.1778	0.4600		0.0000	0.7700		65.6081 (77)
Southwest				2.9400		45.1778	0.4600		0.0000	0.7700		47.0458 (79)
Southwest				9.9700		45.1778	0.4600		0.0000	0.7700		159.5398 (79)

Solar gains	320.0345	477.9111	697.3622	934.6518	1051.5316	1160.7343	1099.2813	987.9314	820.5284	580.8094	385.0301	267.3648 (83)
Total gains	972.9475	1126.1920	1320.4110	1514.7114	1587.2354	1662.1122	1580.7489	1479.1463	1340.0285	1142.0226	989.1796	903.0895 (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	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369
util living area												
	0.9413	0.9147	0.8552	0.7488	0.6115	0.4332	0.3222	0.3417	0.5545	0.7839	0.9044	0.9491 (86)
MIT	19.2020	19.4593	19.9147	20.4089	20.7485	20.9313	20.9782	20.9748	20.8587	20.4386	19.7854	19.1727 (87)
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624 (88)
util rest of house												
	0.9300	0.8992	0.8293	0.7059	0.5467	0.3490	0.2243	0.2388	0.4678	0.7348	0.8837	0.9391 (89)
MIT 2	17.4419	17.8101	18.4414	19.1050	19.5247	19.7172	19.7568	19.7581	19.6636	19.1682	18.2875	17.4109 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Living area fraction									fLA = Living area / (4) =			0.1598 (91)	
MIT	17.7232	18.0737	18.6769	19.3134	19.7203	19.9113	19.9521	19.9526	19.8546	19.3713	18.5269	17.6925 (92)	
Temperature adjustment													-0.1500
adjusted MIT	17.5732	17.9237	18.5269	19.1634	19.5703	19.7613	19.8021	19.8026	19.7046	19.2213	18.3769	17.5425 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8689	0.7981	0.6824	0.5360	0.3489	0.2273	0.2418	0.4627	0.7095	0.8530	0.9137	(94)
Useful gains	878.3614	978.5697	1053.7903	1033.6879	850.6841	579.8940	359.2449	357.6648	620.0722	810.2091	843.8083	825.1564	(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	1734.1556	1712.3831	1568.0599	1307.1867	956.4177	601.8527	363.5577	362.6955	669.9384	1055.1312	1406.0174	1692.0497	(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	636.7109	493.1227	382.6166	196.9191	78.6658	0.0000	0.0000	0.0000	0.0000	182.2220	404.7906	644.9686	(98)
Space heating												3020.0162	(98)
Space heating per m2										(98) / (4) =		31.3670	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3340.7259 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	636.7109	493.1227	382.6166	196.9191	78.6658	0.0000	0.0000	0.0000	0.0000	182.2220	404.7906	644.9686	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	704.3262	545.4897	423.2484	217.8309	87.0197	0.0000	0.0000	0.0000	0.0000	201.5730	447.7772	713.4609	(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	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843	(64)
Efficiency of water heater (217)m	87.9395	87.9268	87.8466	87.8592	87.4612	79.7000	79.7000	79.7000	79.7000	86.1231	87.3336	87.9587	(216)
Fuel for water heating, kWh/month	190.6169	148.6454	120.3588	61.5324	30.0266	0.5114	0.0000	30.9690	70.1563	124.2097	164.1470	191.0944	(219)
Water heating fuel used												1132.2679	(219)
Annual totals kWh/year													
Space heating fuel - main system												3340.7259	(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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =									-1220.7247			-1220.7247	(233)
Total delivered energy for all uses												3771.1440	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3340.7259	9.7400	325.3867	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1132.2679	9.7400	110.2829	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	393.8748	36.8500	145.1428	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1220.7247	36.8500	-449.8370	(252)
Total energy cost			281.0379	(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	3340.7259	0.2160	721.5968	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	1132.2679	0.2160	244.5699 (264)
Space and water heating			966.1667 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			601.9066 (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	3340.7259	1.2200	4075.6856 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1132.2679	1.2200	1381.3669 (264)
Space and water heating			5457.0525 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			3302.3733 (272)
Primary energy kWh/m2/year			34.2997 (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	North East
Overshading	Average or unknown
Thermal mass parameter	139.0 (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	317.72 (P1)
Transmission heat loss coefficient	88.50 (37)
Summer heat loss coefficient	406.22 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	9.2400	98.8453	0.4600	0.0000	0.9000	378.1187
South East	4.1000	119.9223	0.4600	0.0000	0.9000	203.5562
South West	2.9400	119.9223	0.4600	0.0000	0.9000	145.9647
South West	9.9700	119.9223	0.4600	0.0000	0.9000	494.9891

total: 1222.6287

	Jun	Jul	Aug	
Solar gains	1295	1223	1097	(P4)
Internal gains	519	499	508	
Total summer gains	1814	1722	1605	(P5)
Summer gain/loss ratio	4.46	4.24	3.95	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 139.0)	1.03	1.03	1.03	
Threshold temperature	21.49	23.17	22.78	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			