

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-650				Issued on Date	19/10/2022	
Assessment Reference	Plot 650		Prop Type Ref	Bowyer-CB-As-DET			
Property	Plot 650, 4 Bed, K, WC, U, B, ES, Country Brick						
SAP Rating			85 B	DER	15.83	TER	16.55
Environmental			86 B	% DER<TER	4.37		
CO ₂ Emissions (t/year)			1.66	DFEE	46.39	TFEE	56.58
General Requirements Compliance			Pass	% DFEE<TFEE	18.00		
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk					Assessor ID	P637-0001
Client							

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Property Reference	4907-P637-6633-651				Issued on Date	19/10/2022
Assessment Reference	Plot 651	Prop Type Ref	Coiner-CB-Opp-SEMI			
Property	Plot 651, 2 Bed, K, WC, B, ES					
SAP Rating	84 B	DER	16.84	TER	18.80	
Environmental	87 B	% DER<TER	10.42			
CO ₂ Emissions (t/year)	1.11	DFEE	42.59	TFEE	52.77	
General Requirements Compliance	Pass	% DFEE<TFEE	19.28			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

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) 16.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 42.6 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:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESPl 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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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

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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)
Water storage loss:	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)
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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
	0.9892	0.9825	0.9674	0.9271	0.8408	0.6940	0.5479	0.6032	0.8199	0.9489	0.9827	0.9909 (86)
MIT	19.1767	19.3716	19.7125	20.1819	20.5901	20.8615	20.9559	20.9376	20.7284	20.2066	19.6228	19.1556 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9869	0.9788	0.9601	0.9100	0.8017	0.6195	0.4421	0.4980	0.7618	0.9336	0.9784	0.9890 (89)
MIT 2	17.5443	17.8298	18.3256	19.0059	19.5652	19.9106	20.0038	19.9929	19.7617	19.0532	18.2081	17.5225 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	17.9792	18.2406	18.6951	19.3192	19.8383	20.1640	20.2575	20.2446	20.0193	19.3605	18.5850	17.9576 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8292	18.0906	18.5451	19.1692	19.6883	20.0140	20.1075	20.0946	19.8693	19.2105	18.4350	17.8076 (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	0.8915	0.7866	0.6183	0.4512	0.5054	0.7510	0.9167	0.9685	0.9827 (94)
Ext temp.	439.4935	490.5898	534.4392	563.0535	535.3285	415.7129	288.0261	297.6301	400.6089	433.8725	420.7279	418.5325 (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	1208.3801	1173.3670	1067.1997	892.7516	691.9679	461.1242	298.7397	313.6905	494.6079	745.8693	989.0208	1196.2795 (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	572.0516	458.8263	396.3738	237.3827	116.5398	0.0000	0.0000	0.0000	0.0000	232.1256	409.1709	578.6437 (98)
Space heating per m2												3001.1144 (98)
										(98) / (4) =		37.5421 (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													3316.1485 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	572.0516	458.8263	396.3738	237.3827	116.5398	0.0000	0.0000	0.0000	0.0000	232.1256	409.1709	578.6437	(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)	632.1012	506.9904	437.9821	262.3013	128.7732	0.0000	0.0000	0.0000	0.0000	256.4924	452.1226	639.3853	(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	89.7624	89.7106	89.5962	89.3270	88.7956	87.3000	87.3000	87.3000	87.3000	89.2824	89.6254	89.7854	(216)
Fuel for water heating, kWh/month	184.1330	161.5696	167.9679	148.3452	144.2878	128.2841	120.5010	135.9628	136.9009	154.0453	165.6215	178.7609	(219)
Water heating fuel used												1826.3799	(219)
Annual totals kWh/year													
Space heating fuel - main system													3316.1485 (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													5595.5315 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3316.1485	0.2160	716.2881 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.3799	0.2160	394.4981 (264)
Space and water heating			1110.7861 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO ₂ , kg/year			1345.8948 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8400 (273)

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

DER			16.8400 ZC1
Total Floor Area		TFA	79.9400
Assumed number of occupants		N	2.4617
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO ₂ emissions from appliances, equation (L14)			16.2574 ZC2
CO ₂ emissions from cooking, equation (L16)			2.2277 ZC3
Total CO ₂ emissions			35.3251 ZC4
Residual CO ₂ emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO ₂ emissions			35.3251 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

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Calculation Type: New Build (As Designed)

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	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]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		or Table 6b		or Table 6c		factor		
					W/m2						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									fLA = Living area / (4) =			0.2664	(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 Designed)

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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4006 (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) =	0.3706 (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	0.4725	0.4632	0.4539	0.4076	0.3984	0.3520	0.3520	0.3428	0.3706	0.3984	0.4169	0.4354 (22b)
Effective ac	0.6116	0.6073	0.6030	0.5831	0.5793	0.5620	0.5620	0.5587	0.5687	0.5793	0.5869	0.5948 (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	40.3363	40.0505	39.7703	38.4543	38.2081	37.0619	37.0619	36.8496	37.5034	38.2081	38.7062	39.2269 (38)
Average = Sum(39)m / 12 =	87.3625	87.0767	86.7965	85.4805	85.2343	84.0881	84.0881	83.8759	84.5296	85.2343	85.7324	86.2531 (39)
	85.4794 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0893	1.0858	1.0693	1.0662	1.0519	1.0519	1.0492	1.0574	1.0662	1.0725	1.0790 (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 Designed)

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	37.9104	38.0348	38.1576	38.7450	38.8570	39.3866	39.3866	39.4863	39.1809	38.8570	38.6312	38.3980	
alpha	3.5274	3.5357	3.5438	3.5830	3.5905	3.6258	3.6258	3.6324	3.6121	3.5905	3.5754	3.5599	
util living area	0.9914	0.9855	0.9716	0.9338	0.8502	0.7058	0.5589	0.6181	0.8337	0.9560	0.9861	0.9929	(86)
MIT	19.1677	19.3627	19.7041	20.1709	20.5831	20.8572	20.9545	20.9344	20.7176	20.1877	19.6030	19.1409	(87)
Th 2	20.0067	20.0096	20.0125	20.0260	20.0285	20.0403	20.0403	20.0425	20.0358	20.0285	20.0234	20.0180	(88)
util rest of house	0.9896	0.9824	0.9653	0.9180	0.8128	0.6324	0.4530	0.5130	0.7783	0.9425	0.9826	0.9914	(89)
MIT 2	18.3251	18.5209	18.8610	19.3269	19.7145	19.9561	20.0222	20.0141	19.8477	19.3517	18.7713	18.3068	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5496	18.7452	19.0856	19.5518	19.9460	20.1962	20.2706	20.2593	20.0794	19.5744	18.9929	18.5291	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5496	18.7452	19.0856	19.5518	19.9460	20.1962	20.2706	20.2593	20.0794	19.5744	18.9929	18.5291	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9859	0.9772	0.9576	0.9087	0.8092	0.6453	0.4798	0.5384	0.7812	0.9345	0.9776	0.9882	(94)
Useful gains	410.6513	464.1856	512.6455	548.8870	529.5459	418.3314	295.5490	303.8671	396.8675	416.4591	395.1402	389.9109	(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	1244.8793	1205.5970	1092.3884	910.5193	702.8379	470.5764	308.6559	323.7040	505.4403	764.9281	1019.6097	1235.9282	(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	620.6657	498.2284	431.3287	260.3753	128.9292	0.0000	0.0000	0.0000	0.0000	259.2610	449.6180	629.4369	(98)
Space heating												3277.8431	(98)
Space heating per m2										(98) / (4) =		41.0038	(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 Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	790.4284	622.2521	637.4566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8115	0.8738	0.8439	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	641.4193	543.7487	537.9199	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	150.4039	198.6734	159.4333	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												508.5106	(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	37.6010	49.6684	39.8583	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												127.1277	(107)
Space cooling per m2												1.5903	(108)
Energy for space heating												41.0038	(99)
Energy for space cooling												1.5903	(108)
Total												42.5941	(109)
Dwelling Fabric Energy Efficiency (DFEE)												42.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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		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	(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										(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 Type: New Build (As Designed)



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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	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 Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
												84.7627 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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 Designed)

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)
										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)
RHI water heating demand												1623 (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	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	12.9236	0.4600	0.0000	0.7700	9.9332 (75)				
Southwest			3.5300	40.4699	0.4600	0.0000	0.7700	50.6006 (79)				
Northeast			4.5100	12.9236	0.4600	0.0000	0.7700	20.6446 (75)				
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811 (83)
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area												
	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house												
	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction												
									fLA = Living area / (4) =			0.2664 (91)
MIT	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.0753	19.6789	19.0558	18.4799 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9419	0.9253	0.8839	0.7934	0.6349	0.4011	0.2354	0.2586	0.5472	0.8063	0.9113	0.9478 (94)
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066 (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												
	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (98)
Space heating												1993.5322 (98)
RHI space heating demand												1994 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =		0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
	86.9332 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
	0.9704	0.9584	0.9335	0.8754	0.7694	0.6093	0.4657	0.5098	0.7251	0.8949	0.9555	0.9740 (86)
MIT	19.4688	19.6495	19.9576	20.3694	20.7039	20.9096	20.9737	20.9637	20.8245	20.4078	19.8843	19.4458 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9647	0.9504	0.9203	0.8503	0.7229	0.5352	0.3707	0.4135	0.6576	0.8683	0.9456	0.9690 (89)
MIT 2	17.9655	18.2277	18.6703	19.2572	19.7013	19.9552	20.0147	20.0104	19.8641	19.3235	18.5807	17.9418 (90)
Living area fraction	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	fLA = Living area / (4) =	19.6124	18.9280	18.3425 (92)
MIT	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	20.1200	19.6124	18.9280	18.3425 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2161	18.4566	18.8633	19.4036	19.8184	20.0595	20.1203	20.1144	19.9700	19.4624	18.7780	18.1925 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9510	0.9344	0.9017	0.8320	0.7126	0.5376	0.3800	0.4221	0.6535	0.8501	0.9294	0.9564 (94)
Ext temp.	599.4261	640.6038	663.7160	658.0874	590.0131	435.7943	293.6322	306.3039	443.2832	535.4609	560.4345	577.3859 (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	1242.9292	1205.9167	1095.3920	913.1234	703.2434	464.9994	299.8300	315.3703	503.2409	767.6873	1018.9493	1230.1160 (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	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312 (98)
Space heating per m2												2436.2311 (98)
										(98) / (4) =		30.4757 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2691.9681 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(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)	529.0235	419.7683	354.8807	202.9016	93.0866	0.0000	0.0000	0.0000	0.0000	190.9132	364.7853	536.6090	(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	89.6566	89.5930	89.4538	89.1306	88.5420	87.3000	87.3000	87.3000	87.3000	89.0532	89.4826	89.6834	(216)
Fuel for water heating, kWh/month	184.3503	161.7816	168.2354	148.6721	144.7011	128.2841	120.5010	135.9628	136.9009	154.4417	165.8858	178.9641	(217)
Water heating fuel used												1828.6808	(219)
Annual totals kWh/year													
Space heating fuel - main system												2691.9681	(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												4973.6521	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2691.9681	3.4800	93.6805 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.6808	3.4800	63.6381 (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)
Total energy cost			337.0697 (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] = 1.1331 (257)
SAP value	84.1933
SAP rating (Section 12)	84 (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	2691.9681	0.2160	581.4651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.6808	0.2160	394.9951 (264)
Space and water heating			976.4602 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1211.5688 (272)
CO2 emissions per m2			15.1600 (273)
EI value			87.0057
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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															5.0100		
Infiltration rate															0.4507 (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) =					0.4169 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)					
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (40)
HLP (average)												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)

	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)
	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				12.9236		0.4600		0.0000		0.7700		9.9332 (75)	
Southwest	3.5300				40.4699		0.4600		0.0000		0.7700		50.6006 (79)	
Northeast	4.5100				12.9236		0.4600		0.0000		0.7700		20.6446 (75)	
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811	(83)	
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030	(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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
util living area	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	fLA = Living area / (4) =	19.8289	19.2058	0.2664 (91)
MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.0753	19.6789	19.0558	18.4799 (93)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066 (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	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (98)
Space heating												1993.5322 (98)
Space heating per m2										(98) / (4) =		24.9379 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	2202.7980 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (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)	456.0163	362.4048	290.3853	149.8458	51.9625	0.0000	0.0000	0.0000	0.0000	134.9436	295.7520	461.4877 (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	89.5612	89.4946	89.3080	88.8897	88.1367	87.3000	87.3000	87.3000	87.3000	88.7764	89.3319	87.3000 (216)
Fuel for water heating, kWh/month	184.5467	161.9595	168.5100	149.0750	145.3663	128.2841	120.5010	135.9628	136.9009	154.9234	166.1658	179.1540 (219)
Water heating fuel used												1831.3495 (219)
Annual totals kWh/year												
Space heating fuel - main system												2202.7980 (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												4487.1507 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2202.7980	3.9200	86.3497 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.3495	3.9200	71.7889 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	378.0032	16.9600	64.1093 (250)
Additional standing charges			88.0000 (251)
Total energy cost			322.9679 (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	2202.7980	0.2160	475.8044 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3495	0.2160	395.5715 (264)
Space and water heating			871.3759 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1106.4845 (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	2202.7980	1.2200	2687.4136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3495	1.2200	2234.2464 (264)
Space and water heating			4921.6600 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Primary energy kWh/year			6312.3797 (272)
Primary energy kWh/m2/year			78.9640 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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	-£ 29	-182 kg (16.4%)
U Solar photovoltaic panels	+ 10.7	-£ 309	-947 kg (102.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.27 kg/m²	B 85
Solar photovoltaic panels	£309	11.84 kg/m²	A 96
Total Savings	£339	14.12 kg/m²	A 99

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
 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	£77	£85	-£8
Mains gas	£246	£208	£38
Space heating	£187	£187	£0
Water heating	£72	£43	£29
Lighting	£64	£64	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£323	-£16	£339
Total cost of uses	£323	-£15	£338
Delivered energy	56 kWh/m²	22 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	14 kg/m²
Primary energy	79 kWh/m²	-4 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733	
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116	
util living area	0.9704	0.9584	0.9335	0.8754	0.7694	0.6093	0.4657	0.5098	0.7251	0.8949	0.9555	0.9740	(86)
MIT	19.4688	19.6495	19.9576	20.3694	20.7039	20.9096	20.9737	20.9637	20.8245	20.4078	19.8843	19.4458	(87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011	(88)
util rest of house	0.9647	0.9504	0.9203	0.8503	0.7229	0.5352	0.3707	0.4135	0.6576	0.8683	0.9456	0.9690	(89)
MIT 2	17.9655	18.2277	18.6703	19.2572	19.7013	19.9552	20.0147	20.0104	19.8641	19.3235	18.5807	17.9418	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	20.1200	19.6124	18.9280	18.3425	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2161	18.4566	18.8633	19.4036	19.8184	20.0595	20.1203	20.1144	19.9700	19.4624	18.7780	18.1925	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9344	0.9017	0.8320	0.7126	0.5376	0.3800	0.4221	0.6535	0.8501	0.9294	0.9564	(94)
Useful gains	599.4261	640.6038	663.7160	658.0874	590.0131	435.7943	293.6322	306.3039	443.2832	535.4609	560.4345	577.3859	(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	1242.9292	1205.9167	1095.3920	913.1234	703.2434	464.9994	299.8300	315.3703	503.2409	767.6873	1018.9493	1230.1160	(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	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(98)
Space heating												2436.2311	(98)
Space heating per m2											(98) / (4) =	30.4757	(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													2691.9681	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(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)	529.0235	419.7683	354.8807	202.9016	93.0866	0.0000	0.0000	0.0000	0.0000	190.9132	364.7853	536.6090	(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	89.7523	89.7920	89.8370	89.9186	90.0587	87.3000	87.3000	87.3000	87.3000	89.4163	89.6273	87.3000	(216)	
Fuel for water heating, kWh/month	156.8952	115.9564	90.1215	43.7371	14.4346	0.0000	0.0000	24.1855	49.3568	95.4473	133.2404	155.9963	(219)	
Water heating fuel used												879.3711	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2691.9681	(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 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses												2347.1029	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2691.9681	3.4800	93.6805	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.3711	3.4800	30.6021	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			82.8058	(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] =	0.2784	(257)
SAP value		96.1169	
SAP rating (Section 12)		96	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2691.9681	0.2160	581.4651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.3711	0.2160	189.9441 (264)
Space and water heating			771.4093 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			136.0307 (272)
CO2 emissions per m2			1.7000 (273)
EI value			98.5411
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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										5.0100							
Infiltration rate										0.4507 (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) =					0.4169 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)					
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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 39.2925	Feb 38.7052	Mar 38.7052	Apr 37.8779	May 37.8779	Jun 36.8752	Jul 37.1151	Aug 36.6424	Sep 36.8752	Oct 37.3622	Nov 37.3622	Dec 38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	Jan 1.0798	Feb 1.0724	Mar 1.0724	Apr 1.0621	May 1.0621	Jun 1.0496	Jul 1.0526	Aug 1.0466	Sep 1.0496	Oct 1.0556	Nov 1.0556	Dec 1.0655 (40)
HLP (average)												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)
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 Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3137 (H8)
Utilisation factor												0.5329 (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	-26.4558	-39.7630	-66.9659	-92.5674	-111.4822	-117.3302	-114.5129	-102.2607	-79.8148	-54.2966	-32.1577	-859.5260 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9188 (63)
Output from w/h	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823 (64)
Total per year (kWh/year) = Sum (64)m =												778.3562 (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	12.9236	0.4600	0.0000	0.7700	9.9332 (75)			
Southwest				3.5300	40.4699	0.4600	0.0000	0.7700	50.6006 (79)			
Northeast				4.5100	12.9236	0.4600	0.0000	0.7700	20.6446 (75)			
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811 (83)
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
MIT	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.0753	19.6789	19.0558	18.4799 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9419	0.9253	0.8839	0.7934	0.6349	0.4011	0.2354	0.2586	0.5472	0.8063	0.9113	0.9478	(94)
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066	(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	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464	(98)
Space heating												1993.5322	(98)
Space heating per m2											(98) / (4) =	24.9379	(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													2202.7980 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464	(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)	456.0163	362.4048	290.3853	149.8458	51.9625	0.0000	0.0000	0.0000	0.0000	134.9436	295.7520	461.4877	(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	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823	(64)
Efficiency of water heater	89.6726	89.7016	89.7069	89.7514	89.6412	87.3000	87.3000	87.3000	87.3000	89.1751	89.5063	89.6810	(216)
(217)m	154.8148	117.2577	93.1110	44.5061	18.5617	0.0000	0.0000	18.8257	45.4749	93.3431	129.9141	154.5281	(219)
Fuel for water heating, kWh/month												870.3372	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												2202.7980	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses												1751.9788	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2202.7980	3.9200	86.3497	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	870.3372	3.9200	34.1172	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	378.0032	16.9600	64.1093	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			-15.6012	(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	2202.7980	0.2160	475.8044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	870.3372	0.2160	187.9928	(264)
Space and water heating			663.7972	(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 Designed)

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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-21.8830 (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	2202.7980	1.2200	2687.4136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	870.3372	1.2200	1061.8114 (264)
Space and water heating			3749.2250 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-306.7254 (272)
Primary energy kWh/m2/year			-3.8369 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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)

Summer gain/loss ratio	2.92	2.77	2.60	(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	19.88	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 Designed)



Property Reference	4907-P637-6633-652				Issued on Date	19/10/2022
Assessment Reference	Plot 652		Prop Type Ref	Coiner-CB-As-SEMI		
Property	Plot 652, 2 Bed, K, WC, B, ES					
SAP Rating	84 B	DER	16.84	TER	18.80	
Environmental	87 B	% DER<TER	10.42			
CO ₂ Emissions (t/year)	1.11	DFEE	42.59	TFEE	52.77	
General Requirements Compliance	Pass	% DFEE<TFEE	19.28			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

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) 16.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.6 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: 5.01 (design value)
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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	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			
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)												
tau	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
util living area	0.9892	0.9825	0.9674	0.9271	0.8408	0.6940	0.5479	0.6032	0.8199	0.9489	0.9827	0.9909 (86)
MIT	19.1767	19.3716	19.7125	20.1819	20.5901	20.8615	20.9559	20.9376	20.7284	20.2066	19.6228	19.1556 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9869	0.9788	0.9601	0.9100	0.8017	0.6195	0.4421	0.4980	0.7618	0.9336	0.9784	0.9890 (89)
MIT 2	17.5443	17.8298	18.3256	19.0059	19.5652	19.9106	20.0038	19.9929	19.7617	19.0532	18.2081	17.5225 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	17.9792	18.2406	18.6951	19.3192	19.8383	20.1640	20.2575	20.2446	20.0193	19.3605	18.5850	17.9576 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8292	18.0906	18.5451	19.1692	19.6883	20.0140	20.1075	20.0946	19.8693	19.2105	18.4350	17.8076 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	439.4935	490.5898	534.4392	563.0535	535.3285	415.7129	288.0261	297.6301	400.6089	433.8725	420.7279	418.5325 (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	1208.3801	1173.3670	1067.1997	892.7516	691.9679	461.1242	298.7397	313.6905	494.6079	745.8693	989.0208	1196.2795 (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	572.0516	458.8263	396.3738	237.3827	116.5398	0.0000	0.0000	0.0000	0.0000	232.1256	409.1709	578.6437 (98)
Space heating												3001.1144 (98)
Space heating per m2										(98) / (4) =		37.5421 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3316.1485 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	572.0516	458.8263	396.3738	237.3827	116.5398	0.0000	0.0000	0.0000	0.0000	232.1256	409.1709	578.6437	(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)	632.1012	506.9904	437.9821	262.3013	128.7732	0.0000	0.0000	0.0000	0.0000	256.4924	452.1226	639.3853	(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	89.7624	89.7106	89.5962	89.3270	88.7956	87.3000	87.3000	87.3000	87.3000	89.2824	89.6254	89.7854	(216)
Fuel for water heating, kWh/month	184.1330	161.5696	167.9679	148.3452	144.2878	128.2841	120.5010	135.9628	136.9009	154.0453	165.6215	178.7609	(219)
Water heating fuel used												1826.3799	(219)
Annual totals kWh/year													
Space heating fuel - main system												3316.1485	(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												5595.5315	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3316.1485	0.2160	716.2881 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.3799	0.2160	394.4981 (264)
Space and water heating			1110.7861 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO ₂ , kg/year			1345.8948 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8400 (273)

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

DER		16.8400	ZC1
Total Floor Area		79.9400	
Assumed number of occupants		2.4617	
CO ₂ emission factor in Table 12 for electricity displaced from grid		0.5190	
CO ₂ emissions from appliances, equation (L14)		16.2574	ZC2
CO ₂ emissions from cooking, equation (L16)		2.2277	ZC3
Total CO ₂ emissions		35.3251	ZC4
Residual CO ₂ emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO ₂ emissions		35.3251	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

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Calculation Type: New Build (As Designed)

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		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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4006 (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) =	0.3706 (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	0.4725	0.4632	0.4539	0.4076	0.3984	0.3520	0.3520	0.3428	0.3706	0.3984	0.4169	0.4354 (22b)
Effective ac	0.6116	0.6073	0.6030	0.5831	0.5793	0.5620	0.5620	0.5587	0.5687	0.5793	0.5869	0.5948 (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	40.3363	40.0505	39.7703	38.4543	38.2081	37.0619	37.0619	36.8496	37.5034	38.2081	38.7062	39.2269 (38)
Average = Sum(39)m / 12 =	87.3625	87.0767	86.7965	85.4805	85.2343	84.0881	84.0881	83.8759	84.5296	85.2343	85.7324	86.2531 (39)
	85.4794 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0893	1.0858	1.0693	1.0662	1.0519	1.0519	1.0492	1.0574	1.0662	1.0725	1.0790 (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 Designed)

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)
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)
(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	37.9104	38.0348	38.1576	38.7450	38.8570	39.3866	39.3866	39.4863	39.1809	38.8570	38.6312	38.3980	
alpha	3.5274	3.5357	3.5438	3.5830	3.5905	3.6258	3.6258	3.6324	3.6121	3.5905	3.5754	3.5599	
util living area	0.9914	0.9855	0.9716	0.9338	0.8502	0.7058	0.5589	0.6181	0.8337	0.9560	0.9861	0.9929	(86)
MIT	19.1677	19.3627	19.7041	20.1709	20.5831	20.8572	20.9545	20.9344	20.7176	20.1877	19.6030	19.1409	(87)
Th 2	20.0067	20.0096	20.0125	20.0260	20.0285	20.0403	20.0403	20.0425	20.0358	20.0285	20.0234	20.0180	(88)
util rest of house	0.9896	0.9824	0.9653	0.9180	0.8128	0.6324	0.4530	0.5130	0.7783	0.9425	0.9826	0.9914	(89)
MIT 2	18.3251	18.5209	18.8610	19.3269	19.7145	19.9561	20.0222	20.0141	19.8477	19.3517	18.7713	18.3068	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5496	18.7452	19.0856	19.5518	19.9460	20.1962	20.2706	20.2593	20.0794	19.5744	18.9929	18.5291	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5496	18.7452	19.0856	19.5518	19.9460	20.1962	20.2706	20.2593	20.0794	19.5744	18.9929	18.5291	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	410.6513	464.1856	512.6455	548.8870	529.5459	418.3314	295.5490	303.8671	396.8675	416.4591	395.1402	389.9109	(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	1244.8793	1205.5970	1092.3884	910.5193	702.8379	470.5764	308.6559	323.7040	505.4403	764.9281	1019.6097	1235.9282	(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	620.6657	498.2284	431.3287	260.3753	128.9292	0.0000	0.0000	0.0000	0.0000	259.2610	449.6180	629.4369	(98)
Space heating												3277.8431	(98)
Space heating per m2										(98) / (4) =		41.0038	(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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	790.4284	622.2521	637.4566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8115	0.8738	0.8439	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	641.4193	543.7487	537.9199	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	150.4039	198.6734	159.4333	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												508.5106	(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	37.6010	49.6684	39.8583	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												127.1277	(107)
Space cooling per m2												1.5903	(108)
Energy for space heating												41.0038	(99)
Energy for space cooling												1.5903	(108)
Total												42.5941	(109)
Dwelling Fabric Energy Efficiency (DFEE)												42.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	(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	(98)	
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)	

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Calculation Type: New Build (As Designed)



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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =		0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
												84.7627 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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 Designed)

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				12.9236		0.4600		0.0000		0.7700		9.9332 (75)	
Southwest	3.5300				40.4699		0.4600		0.0000		0.7700		50.6006 (79)	
Northeast	4.5100				12.9236		0.4600		0.0000		0.7700		20.6446 (75)	
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811	(83)	
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030	(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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.0753	19.6789	19.0558	18.4799 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066 (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	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (98)
Space heating												1993.5322 (98)
RHI space heating demand												1994 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
	0.9704	0.9584	0.9335	0.8754	0.7694	0.6093	0.4657	0.5098	0.7251	0.8949	0.9555	0.9740 (86)
MIT	19.4688	19.6495	19.9576	20.3694	20.7039	20.9096	20.9737	20.9637	20.8245	20.4078	19.8843	19.4458 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9647	0.9504	0.9203	0.8503	0.7229	0.5352	0.3707	0.4135	0.6576	0.8683	0.9456	0.9690 (89)
MIT 2	17.9655	18.2277	18.6703	19.2572	19.7013	19.9552	20.0147	20.0104	19.8641	19.3235	18.5807	17.9418 (90)
Living area fraction	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	fLA = Living area / (4) =	19.6124	18.9280	18.3425 (92)
MIT	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	20.1200	19.6124	18.9280	18.3425 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2161	18.4566	18.8633	19.4036	19.8184	20.0595	20.1203	20.1144	19.9700	19.4624	18.7780	18.1925 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9510	0.9344	0.9017	0.8320	0.7126	0.5376	0.3800	0.4221	0.6535	0.8501	0.9294	0.9564 (94)
Ext temp.	599.4261	640.6038	663.7160	658.0874	590.0131	435.7943	293.6322	306.3039	443.2832	535.4609	560.4345	577.3859 (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	1242.9292	1205.9167	1095.3920	913.1234	703.2434	464.9994	299.8300	315.3703	503.2409	767.6873	1018.9493	1230.1160 (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	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312 (98)
Space heating per m2												2436.2311 (98)
										(98) / (4) =		30.4757 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2691.9681 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(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)	529.0235	419.7683	354.8807	202.9016	93.0866	0.0000	0.0000	0.0000	0.0000	190.9132	364.7853	536.6090	(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	89.6566	89.5930	89.4538	89.1306	88.5420	87.3000	87.3000	87.3000	87.3000	89.0532	89.4826	89.6834	(216)
Fuel for water heating, kWh/month	184.3503	161.7816	168.2354	148.6721	144.7011	128.2841	120.5010	135.9628	136.9009	154.4417	165.8858	178.9641	(217)
Water heating fuel used												1828.6808	(219)
Annual totals kWh/year													
Space heating fuel - main system												2691.9681	(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												4973.6521	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2691.9681	3.4800	93.6805 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.6808	3.4800	63.6381 (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)
Total energy cost			337.0697 (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] = 1.1331 (257)
SAP value	84.1933
SAP rating (Section 12)	84 (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	2691.9681	0.2160	581.4651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.6808	0.2160	394.9951 (264)
Space and water heating			976.4602 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1211.5688 (272)
CO2 emissions per m2			15.1600 (273)
EI value			87.0057
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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 Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
												84.7627 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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 Designed)

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	
Northeast	2.1700				12.9236		0.4600		0.0000		0.7700		9.9332 (75)	
Southwest	3.5300				40.4699		0.4600		0.0000		0.7700		50.6006 (79)	
Northeast	4.5100				12.9236		0.4600		0.0000		0.7700		20.6446 (75)	
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811 (83)		
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
util living area	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	fLA = Living area / (4) =	19.8289	19.2058	0.2664 (91)
MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.2253	19.6789	19.0558	18.6299 (92)
Temperature adjustment												-0.1500
adjusted MIT												18.4799 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066 (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	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (98)
Space heating												1993.5322 (98)
Space heating per m2												(98) / (4) = 24.9379 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	2202.7980 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464 (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)	456.0163	362.4048	290.3853	149.8458	51.9625	0.0000	0.0000	0.0000	0.0000	134.9436	295.7520	461.4877 (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	89.5612	89.4946	89.3080	88.8897	88.1367	87.3000	87.3000	87.3000	87.3000	88.7764	89.3319	87.3000 (216)
Fuel for water heating, kWh/month	184.5467	161.9595	168.5100	149.0750	145.3663	128.2841	120.5010	135.9628	136.9009	154.9234	166.1658	179.1540 (219)
Water heating fuel used												1831.3495 (219)
Annual totals kWh/year												
Space heating fuel - main system												2202.7980 (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												4487.1507 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2202.7980	3.9200	86.3497 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.3495	3.9200	71.7889 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	378.0032	16.9600	64.1093 (250)
Additional standing charges			88.0000 (251)
Total energy cost			322.9679 (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	2202.7980	0.2160	475.8044 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3495	0.2160	395.5715 (264)
Space and water heating			871.3759 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1106.4845 (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	2202.7980	1.2200	2687.4136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3495	1.2200	2234.2464 (264)
Space and water heating			4921.6600 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Primary energy kWh/year			6312.3797 (272)
Primary energy kWh/m2/year			78.9640 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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	-£ 29	-182 kg (16.4%)
U Solar photovoltaic panels	+ 10.7	-£ 309	-947 kg (102.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.27 kg/m²	B 85 B 89
Solar photovoltaic panels	£309	11.84 kg/m²	A 96 A 99
Total Savings	£339	14.12 kg/m²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
 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	£77	£85	-£8
Mains gas	£246	£208	£38
Space heating	£187	£187	£0
Water heating	£72	£43	£29
Lighting	£64	£64	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£323	-£16	£339
Total cost of uses	£323	-£15	£338
Delivered energy	56 kWh/m²	22 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	14 kg/m²
Primary energy	79 kWh/m²	-4 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733	
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116	
util living area	0.9704	0.9584	0.9335	0.8754	0.7694	0.6093	0.4657	0.5098	0.7251	0.8949	0.9555	0.9740	(86)
MIT	19.4688	19.6495	19.9576	20.3694	20.7039	20.9096	20.9737	20.9637	20.8245	20.4078	19.8843	19.4458	(87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011	(88)
util rest of house	0.9647	0.9504	0.9203	0.8503	0.7229	0.5352	0.3707	0.4135	0.6576	0.8683	0.9456	0.9690	(89)
MIT 2	17.9655	18.2277	18.6703	19.2572	19.7013	19.9552	20.0147	20.0104	19.8641	19.3235	18.5807	17.9418	(90)
Living area fraction	18.3661	18.6066	19.0133	19.5536	19.9684	20.2095	20.2703	20.2644	20.1200	19.6124	18.9280	18.3425	(91)
Temperature adjustment												-0.1500	(92)
adjusted MIT	18.2161	18.4566	18.8633	19.4036	19.8184	20.0595	20.1203	20.1144	19.9700	19.4624	18.7780	18.1925	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9344	0.9017	0.8320	0.7126	0.5376	0.3800	0.4221	0.6535	0.8501	0.9294	0.9564	(94)
Useful gains	599.4261	640.6038	663.7160	658.0874	590.0131	435.7943	293.6322	306.3039	443.2832	535.4609	560.4345	577.3859	(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	1242.9292	1205.9167	1095.3920	913.1234	703.2434	464.9994	299.8300	315.3703	503.2409	767.6873	1018.9493	1230.1160	(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	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(98)
Space heating												2436.2311	(98)
Space heating per m2											(98) / (4) =	30.4757	(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													2691.9681	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	478.7663	379.8903	321.1670	183.6259	84.2434	0.0000	0.0000	0.0000	0.0000	172.7764	330.1307	485.6312	(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)	529.0235	419.7683	354.8807	202.9016	93.0866	0.0000	0.0000	0.0000	0.0000	190.9132	364.7853	536.6090	(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	89.7523	89.7920	89.8370	89.9186	90.0587	87.3000	87.3000	87.3000	87.3000	89.4163	89.6273	87.3000	(216)	
Fuel for water heating, kWh/month	156.8952	115.9564	90.1215	43.7371	14.4346	0.0000	0.0000	24.1855	49.3568	95.4473	133.2404	155.9963	(219)	
Water heating fuel used												879.3711	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2691.9681	(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 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses												2347.1029	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2691.9681	3.4800	93.6805	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.3711	3.4800	30.6021	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			82.8058	(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] =	0.2784	(257)
SAP value		96.1169	
SAP rating (Section 12)		96	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2691.9681	0.2160	581.4651 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.3711	0.2160	189.9441 (264)
Space and water heating			771.4093 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			136.0307 (272)
CO2 emissions per m2			1.7000 (273)
EI value			98.5411
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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															5.0100		
Infiltration rate															0.4507 (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) =					0.4169 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)					
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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 39.2925	Feb 38.7052	Mar 38.7052	Apr 37.8779	May 37.8779	Jun 36.8752	Jul 37.1151	Aug 36.6424	Sep 36.8752	Oct 37.3622	Nov 37.3622	Dec 38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	Jan 1.0798	Feb 1.0724	Mar 1.0724	Apr 1.0621	May 1.0621	Jun 1.0496	Jul 1.0526	Aug 1.0466	Sep 1.0496	Oct 1.0556	Nov 1.0556	Dec 1.0655 (40)
HLP (average)												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)
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 Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3137 (H8)
Utilisation factor												0.5329 (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	-26.4558	-39.7630	-66.9659	-92.5674	-111.4822	-117.3302	-114.5129	-102.2607	-79.8148	-54.2966	-32.1577	-859.5260 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9188 (63)
Output from w/h	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823 (64)
Total per year (kWh/year) = Sum (64)m =												778.3562 (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	12.9236	0.4600	0.0000	0.7700	9.9332 (75)			
Southwest				3.5300	40.4699	0.4600	0.0000	0.7700	50.6006 (79)			
Northeast				4.5100	12.9236	0.4600	0.0000	0.7700	20.6446 (75)			
Solar gains	81.1784	133.8407	205.5356	304.6783	369.5622	409.8810	383.8155	331.2145	256.2343	165.1297	101.5645	67.5811 (83)
Total gains	638.7916	686.7211	736.5238	801.9971	832.5569	842.3136	798.5897	754.6033	699.2025	641.9790	615.8834	610.1030 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9637	0.9512	0.9188	0.8409	0.6971	0.4773	0.3228	0.3495	0.6262	0.8577	0.9416	0.9678 (86)
MIT	19.6695	19.8250	20.1382	20.5266	20.8253	20.9691	20.9946	20.9929	20.9135	20.5707	20.0849	19.6521 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9566	0.9418	0.9026	0.8092	0.6389	0.3937	0.2247	0.2477	0.5442	0.8220	0.9284	0.9615 (89)
MIT 2	18.2754	18.5017	18.9464	19.4853	19.8634	20.0226	20.0381	20.0423	19.9753	19.5595	18.8865	18.2587 (90)
Living area fraction	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
MIT	18.6468	18.8543	19.2640	19.7628	20.1197	20.2748	20.2930	20.2956	20.2253	19.8289	19.2058	18.6299 (92)
Temperature adjustment									fLA = Living area / (4) =			0.2664 (91)
adjusted MIT	18.4968	18.7043	19.1140	19.6128	19.9697	20.1248	20.1430	20.1456	20.0753	19.6789	19.0558	18.4799 (93)
												-0.1500

FULL SAP CALCULATION PRINTOUT

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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	0.9419	0.9253	0.8839	0.7934	0.6349	0.4011	0.2354	0.2586	0.5472	0.8063	0.9113	0.9478	(94)
Useful gains	601.7014	635.3923	651.0297	636.3057	528.5533	337.8813	187.9528	195.1703	382.6142	517.6245	561.2375	578.2539	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1156.3986	1123.4522	1004.2538	824.6535	591.7604	346.0774	188.7269	196.2528	409.0447	681.7696	932.9813	1139.6066	(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	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464	(98)
Space heating												1993.5322	(98)
Space heating per m2											(98) / (4) =	24.9379	(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													2202.7980 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	412.6948	327.9763	262.7987	135.6105	47.0261	0.0000	0.0000	0.0000	0.0000	122.1240	267.6555	417.6464	(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)	456.0163	362.4048	290.3853	149.8458	51.9625	0.0000	0.0000	0.0000	0.0000	134.9436	295.7520	461.4877	(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	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823	(64)
Efficiency of water heater	89.6726	89.7016	89.7069	89.7514	89.6412	87.3000	87.3000	87.3000	87.3000	89.1751	89.5063	89.6810	(216)
(217)m	154.8148	117.2577	93.1110	44.5061	18.5617	0.0000	0.0000	18.8257	45.4749	93.3431	129.9141	154.5281	(219)
Fuel for water heating, kWh/month												870.3372	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												2202.7980	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses												1751.9788	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2202.7980	3.9200	86.3497	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	870.3372	3.9200	34.1172	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	378.0032	16.9600	64.1093	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			-15.6012	(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	2202.7980	0.2160	475.8044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	870.3372	0.2160	187.9928	(264)
Space and water heating			663.7972	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	378.0032	0.5190	196.1836	(268)

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Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-21.8830 (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	2202.7980	1.2200	2687.4136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	870.3372	1.2200	1061.8114 (264)
Space and water heating			3749.2250 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-306.7254 (272)
Primary energy kWh/m2/year			-3.8369 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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)

Summer gain/loss ratio	2.92	2.77	2.60	(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	19.88	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 Designed)



Property Reference	4907-P637-6633-653				Issued on Date	19/10/2022
Assessment Reference	Plot 653	Prop Type Ref	Coiner-CB-Opp-SEMI			
Property	Plot 653, 2 Bed, K, WC, B, ES					
SAP Rating	84 B	DER	16.45	TER	18.39	
Environmental	87 B	% DER<TER	10.57			
CO ₂ Emissions (t/year)	1.08	DFEE	40.93	TFEE	50.72	
General Requirements Compliance	Pass	% DFEE<TFEE	19.32			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

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) 16.45 kgCO₂/m²OK

1b TFEE and DFEE

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

Dwelling Fabric Energy Efficiency (DFEE) 40.9 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: 5.01 (design value)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
util living area	0.9869	0.9776	0.9588	0.9142	0.8259	0.6788	0.5305	0.5766	0.7886	0.9347	0.9785	0.9892 (86)
MIT	19.2238	19.4428	19.7869	20.2361	20.6171	20.8713	20.9602	20.9461	20.7647	20.2703	19.6767	19.1973 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9842	0.9730	0.9499	0.8948	0.7849	0.6041	0.4267	0.4734	0.7263	0.9160	0.9732	0.9869 (89)
MIT 2	17.6126	17.9323	18.4310	19.0795	19.5981	19.9200	20.0065	19.9988	19.8015	19.1401	18.2855	17.5830 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.0419	18.3348	18.7923	19.3877	19.8696	20.1734	20.2606	20.2512	20.0581	19.4413	18.6562	18.0131 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8919	18.1848	18.6423	19.2377	19.7196	20.0234	20.1106	20.1012	19.9081	19.2913	18.5062	17.8631 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9759	0.9613	0.9340	0.8760	0.7708	0.6036	0.4359	0.4812	0.7178	0.8982	0.9619	0.9798 (94)
Useful gains	465.6206	529.3991	573.9983	590.7024	548.3536	419.8414	289.3995	300.4867	416.8832	466.3798	449.9055	441.6278 (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	1213.9798	1181.7388	1075.8049	898.7038	694.6847	461.9289	299.0073	314.2457	497.9391	752.8649	995.2298	1201.1592 (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	556.7793	438.3723	373.3441	221.7610	108.8703	0.0000	0.0000	0.0000	0.0000	213.1449	392.6335	565.0913 (98)
Space heating												2869.9968 (98)
Space heating per m2										(98) / (4) =		35.9019 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3171.2671 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.7793	438.3723	373.3441	221.7610	108.8703	0.0000	0.0000	0.0000	0.0000	213.1449	392.6335	565.0913	(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)	615.2257	484.3893	412.5350	245.0398	120.2987	0.0000	0.0000	0.0000	0.0000	235.5192	433.8492	624.4103	(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	89.7470	89.6831	89.5569	89.2760	88.7415	87.3000	87.3000	87.3000	87.3000	89.2174	89.5990	89.7721	(216)
Fuel for water heating, kWh/month	184.1647	161.6190	168.0417	148.4299	144.3757	128.2841	120.5010	135.9628	136.9009	154.1575	165.6704	178.7873	(219)
Water heating fuel used												1826.8950	(219)
Annual totals kWh/year													
Space heating fuel - main system												3171.2671	(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												5451.1653	(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	3171.2671	0.2160	684.9937 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.8950	0.2160	394.6093 (264)
Space and water heating			1079.6030 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/year			1314.7117 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4500 (273)

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

DER		16.4500	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		34.9351	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		34.9351	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed)

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	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								(63)
Output from w/h								Solar input	(sum of months) = Sum (63)m =					0.0000	(63)
	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	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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4006 (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) =	0.3706 (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	0.4725	0.4632	0.4539	0.4076	0.3984	0.3520	0.3520	0.3428	0.3706	0.3984	0.4169	0.4354 (22b)
Effective ac	0.6116	0.6073	0.6030	0.5831	0.5793	0.5620	0.5620	0.5587	0.5687	0.5793	0.5869	0.5948 (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	40.3363	40.0505	39.7703	38.4543	38.2081	37.0619	37.0619	36.8496	37.5034	38.2081	38.7062	39.2269 (38)
Average = Sum(39)m / 12 =	87.3625	87.0767	86.7965	85.4805	85.2343	84.0881	84.0881	83.8759	84.5296	85.2343	85.7324	86.2531 (39)
	85.4794 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0893	1.0858	1.0693	1.0662	1.0519	1.0519	1.0492	1.0574	1.0662	1.0725	1.0790 (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 Designed)

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)
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)
(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	37.9104	38.0348	38.1576	38.7450	38.8570	39.3866	39.3866	39.4863	39.1809	38.8570	38.6312	38.3980	
alpha	3.5274	3.5357	3.5438	3.5830	3.5905	3.6258	3.6258	3.6324	3.6121	3.5905	3.5754	3.5599	
util living area	0.9894	0.9810	0.9635	0.9212	0.8352	0.6902	0.5408	0.5902	0.8019	0.9425	0.9822	0.9914	(86)
MIT	19.2156	19.4352	19.7801	20.2268	20.6113	20.8676	20.9591	20.9436	20.7561	20.2535	19.6579	19.1832	(87)
Th 2	20.0067	20.0096	20.0125	20.0260	20.0285	20.0403	20.0403	20.0425	20.0358	20.0285	20.0234	20.0180	(88)
util rest of house	0.9872	0.9770	0.9555	0.9031	0.7957	0.6163	0.4368	0.4868	0.7418	0.9257	0.9779	0.9896	(89)
MIT 2	18.3725	18.5924	18.9349	19.3790	19.7381	19.9630	20.0242	20.0185	19.8770	19.4135	18.8254	18.3488	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5972	18.8169	19.1601	19.6049	19.9708	20.2040	20.2733	20.2650	20.1112	19.6373	19.0472	18.5711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5972	18.8169	19.1601	19.6049	19.9708	20.2040	20.2733	20.2650	20.1112	19.6373	19.0472	18.5711	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.3967	504.1784	553.8046	578.0539	543.4985	422.9204	297.1660	307.2651	414.9278	450.9697	425.3029	413.4971	(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	1249.0375	1211.8404	1098.8510	915.0606	704.9545	471.2302	308.8827	324.1807	508.1276	770.2910	1024.2641	1239.5550	(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	603.8608	475.5489	405.5145	242.6449	120.1233	0.0000	0.0000	0.0000	0.0000	237.5750	431.2521	614.5871	(98)
Space heating												3131.1066	(98)
Space heating per m2												39.1682	(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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	790.4284	622.2521	637.4566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8227	0.8838	0.8608	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	650.3141	549.9384	548.7058	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	163.4976	216.1978	182.2272	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												561.9226	(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	40.8744	54.0494	45.5568	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												140.4806	(107)
Space cooling per m2												1.7573	(108)
Energy for space heating												39.1682	(99)
Energy for space cooling												1.7573	(108)
Total												40.9255	(109)
Dwelling Fabric Energy Efficiency (DFEE)												40.9	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	Specific data or Table 6b	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	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	(96)
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	(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	(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 Designed)



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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =		0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
												84.7627 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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 Designed)

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	40.4699	0.4600	0.0000	0.7700	31.1057 (77)
Northwest												3.5300	12.9236	0.4600	0.0000	0.7700	16.1587 (81)
Southeast												4.5100	40.4699	0.4600	0.0000	0.7700	64.6483 (77)
Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433	94.2181 (83)					
Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622	636.7401 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8854	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9351	0.9144	0.8687	0.7761	0.6209	0.3920	0.2287	0.2475	0.5192	0.7818	0.8993	0.9421 (94)
Ext temp.	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625 (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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (98)
RHI space heating demand												1892.9433 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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)
								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	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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
	0.9664	0.9507	0.9217	0.8603	0.7546	0.5965	0.4525	0.4894	0.6957	0.8765	0.9485	0.9708 (86)
MIT	19.5123	19.7137	20.0221	20.4128	20.7233	20.9157	20.9761	20.9681	20.8473	20.4583	19.9323	19.4846 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9601	0.9415	0.9067	0.8332	0.7071	0.5228	0.3596	0.3956	0.6269	0.8469	0.9373	0.9652 (89)
MIT 2	18.0278	18.3186	18.7595	19.3140	19.7237	19.9605	20.0161	20.0133	19.8870	19.3890	18.6481	17.9974 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.4233	18.6903	19.0959	19.6068	19.9900	20.2150	20.2719	20.2677	20.1429	19.6739	18.9903	18.3937 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2733	18.5403	18.9459	19.4568	19.8400	20.0650	20.1219	20.1177	19.9929	19.5239	18.8403	18.2437 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9455	0.9244	0.8875	0.8156	0.6978	0.5257	0.3688	0.4043	0.6246	0.8293	0.9202	0.9519 (94)
Ext temp.	622.8823	674.6827	697.1993	679.9222	599.2756	438.2670	294.3385	307.7449	453.2527	560.4932	585.5871	598.2810 (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	1248.0459	1213.3676	1102.7045	917.7530	705.1155	465.4695	299.9671	315.6478	505.2060	773.0159	1024.3778	1234.6115 (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	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299 (98)
Space heating per m2												2326.2731 (98)
										(98) / (4) =		29.1002 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2570.4675 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299	(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)	513.9466	399.9959	333.3656	189.2135	87.0109	0.0000	0.0000	0.0000	0.0000	174.7148	349.0932	523.1269	(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	89.6385	89.5614	89.4093	89.0756	88.4911	87.3000	87.3000	87.3000	87.3000	88.9827	89.4519	89.6678	(216)
Fuel for water heating, kWh/month	184.3875	161.8388	168.3191	148.7639	144.7843	128.2841	120.5010	135.9628	136.9009	154.5642	165.9429	178.9952	(217)
Water heating fuel used												1829.2445	(219)
Annual totals kWh/year													
Space heating fuel - main system												2570.4675	(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												4852.7151	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2570.4675	3.4800	89.4523 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.2445	3.4800	63.6577 (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)
Total energy cost			332.8611 (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] =	1.1190 (257)
SAP value	84.3906	
SAP rating (Section 12)	84	(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	2570.4675	0.2160	555.2210 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.2445	0.2160	395.1168 (264)
Space and water heating			950.3378 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1185.4464 (272)
CO2 emissions per m2			14.8300 (273)
EI value			87.2859
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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

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Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
	84.7627 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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			Solar flux			g			FF			Access			Gains
			m2			Table 6a			Specific data			Specific data			factor			W
						W/m2			or Table 6b			or Table 6c			Table 6d			
Southeast			2.1700			40.4699			0.4600			0.0000			0.7700			31.1057 (77)
Northwest			3.5300			12.9236			0.4600			0.0000			0.7700			16.1587 (81)
Southeast			4.5100			40.4699			0.4600			0.0000			0.7700			64.6483 (77)
Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433	94.2181	(83)					
Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622	636.7401	(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	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8954	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	fLA = Living area / (4) =	19.8800	19.2699	0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9351	0.9144	0.8687	0.7761	0.6209	0.3920	0.2287	0.2475	0.5192	0.7818	0.8993	0.9421 (94)
Ext temp.	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625 (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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (98)
Space heating per m2												1892.9433 (98)
										(98) / (4) =		23.6796 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	2091.6501 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (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)	440.2649	343.9913	271.6192	138.9761	48.4206	0.0000	0.0000	0.0000	0.0000	121.2605	279.6330	447.4844 (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	89.5377	89.4583	89.2576	88.8295	88.0939	87.3000	87.3000	87.3000	87.3000	88.6918	89.2900	87.3000 (216)
Fuel for water heating, kWh/month	184.5951	162.0253	168.6052	149.1760	145.4371	128.2841	120.5010	135.9628	136.9009	155.0711	166.2438	179.1945 (219)
Water heating fuel used												1831.9967 (219)
Annual totals kWh/year												
Space heating fuel - main system												2091.6501 (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												4376.6499 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2091.6501	3.9200	81.9927 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.9967	3.9200	71.8143 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	378.0032	16.9600	64.1093 (250)
Additional standing charges			88.0000 (251)
Total energy cost			318.6363 (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	2091.6501	0.2160	451.7964 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.9967	0.2160	395.7113 (264)
Space and water heating			847.5077 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1082.6163 (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	2091.6501	1.2200	2551.8131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.9967	1.2200	2235.0359 (264)
Space and water heating			4786.8490 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Primary energy kWh/year			6177.5687 (272)
Primary energy kWh/m2/year			77.2776 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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	-£ 29	-182 kg (16.8%)
U Solar photovoltaic panels	+ 10.7	-£ 309	-947 kg (105.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.27 kg/m²	B 86 B 89
Solar photovoltaic panels	£309	11.84 kg/m²	A 96 A 99
Total Savings	£339	14.12 kg/m²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
 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	£77	£85	-£8
Mains gas	£242	£204	£38
Space heating	£183	£183	£0
Water heating	£72	£43	£29
Lighting	£64	£64	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£319	-£20	£339
Total cost of uses	£319	-£19	£338
Delivered energy	55 kWh/m²	21 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-1 kg/m²	14 kg/m²
Primary energy	77 kWh/m²	-6 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
	86.9332 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733	
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116	
	0.9664	0.9507	0.9217	0.8603	0.7546	0.5965	0.4525	0.4894	0.6957	0.8765	0.9485	0.9708 (86)	
MIT	19.5123	19.7137	20.0221	20.4128	20.7233	20.9157	20.9761	20.9681	20.8473	20.4583	19.9323	19.4846 (87)	
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)	
util rest of house	0.9601	0.9415	0.9067	0.8332	0.7071	0.5228	0.3596	0.3956	0.6269	0.8469	0.9373	0.9652 (89)	
MIT 2	18.0278	18.3186	18.7595	19.3140	19.7237	19.9605	20.0161	20.0133	19.8870	19.3890	18.6481	17.9974 (90)	
Living area fraction	18.4233	18.6903	19.0959	19.6068	19.9900	20.2150	20.2719	20.2677	20.1429	19.6739	18.9903	18.3937 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.2733	18.5403	18.9459	19.4568	19.8400	20.0650	20.1219	20.1177	19.9929	19.5239	18.8403	18.2437 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9455	0.9244	0.8875	0.8156	0.6978	0.5257	0.3688	0.4043	0.6246	0.8293	0.9202	0.9519	(94)
Useful gains	622.8823	674.6827	697.1993	679.9222	599.2756	438.2670	294.3385	307.7449	453.2527	560.4932	585.5871	598.2810	(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	1248.0459	1213.3676	1102.7045	917.7530	705.1155	465.4695	299.9671	315.6478	505.2060	773.0159	1024.3778	1234.6115	(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	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299	(98)
Space heating												2326.2731	(98)
Space heating per m2											(98) / (4) =	29.1002	(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													2570.4675	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299	(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)	513.9466	399.9959	333.3656	189.2135	87.0109	0.0000	0.0000	0.0000	0.0000	174.7148	349.0932	523.1269	(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	89.7356	89.7650	89.8035	89.8846	90.0324	87.3000	87.3000	87.3000	87.3000	89.3519	89.5991	89.7491	(216)	
(217)m	89.7356	89.7650	89.8035	89.8846	90.0324	87.3000	87.3000	87.3000	87.3000	89.3519	89.5991	89.7491	(217)	
Fuel for water heating, kWh/month	156.9244	115.9912	90.1551	43.7536	14.4388	0.0000	0.0000	24.1855	49.3568	95.5161	133.2823	156.0215	(219)	
Water heating fuel used												879.6254	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2570.4675	(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 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses												2225.8566	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2570.4675	3.4800	89.4523	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.6254	3.4800	30.6110	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			78.5865	(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] =	0.2642	(257)
SAP value		96.3147	
SAP rating (Section 12)		96	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2570.4675	0.2160	555.2210 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.6254	0.2160	189.9991 (264)
Space and water heating			745.2201 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			109.8415 (272)
CO2 emissions per m2			1.3700 (273)
EI value			98.8219
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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										5.0100							
Infiltration rate										0.4507 (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) =					0.4169 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960	(22b)				
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784	(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 39.2925	Feb 38.7052	Mar 38.7052	Apr 37.8779	May 37.8779	Jun 36.8752	Jul 37.1151	Aug 36.6424	Sep 36.8752	Oct 37.3622	Nov 37.3622	Dec 38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	Jan 1.0798	Feb 1.0724	Mar 1.0724	Apr 1.0621	May 1.0621	Jun 1.0496	Jul 1.0526	Aug 1.0466	Sep 1.0496	Oct 1.0556	Nov 1.0556	Dec 1.0655 (40)
HLP (average)												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)
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 Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3137 (H8)
Utilisation factor												0.5329 (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	-26.4558	-39.7630	-66.9659	-92.5674	-111.4822	-117.3302	-114.5129	-102.2607	-79.8148	-54.2966	-32.1577	-859.5260 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9188 (63)
Output from w/h	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823 (64)
Total per year (kWh/year) = Sum (64)m =												778.3562 (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	40.4699		0.4600	0.0000	0.7700	31.1057 (77)	
Northwest					3.5300	12.9236		0.4600	0.0000	0.7700	16.1587 (81)	
Southeast					4.5100	40.4699		0.4600	0.0000	0.7700	64.6483 (77)	
Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433	94.2181 (83)
Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622	636.7401 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8854	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9351	0.9144	0.8687	0.7761	0.6209	0.3920	0.2287	0.2475	0.5192	0.7818	0.8993	0.9421	(94)
Useful gains	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625	(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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734	(98)
Space heating												1892.9433	(98)
Space heating per m2											(98) / (4) =	23.6796	(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													2091.6501	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734	(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)	440.2649	343.9913	271.6192	138.9761	48.4206	0.0000	0.0000	0.0000	0.0000	121.2605	279.6330	447.4844	(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	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823	(64)	
Efficiency of water heater	89.6509	89.6699	89.6664	89.7074	89.5962	87.3000	87.3000	87.3000	87.3000	89.0914	89.4675	89.6621	(216)	
Fuel for water heating, kWh/month	154.8524	117.2991	93.1530	44.5280	18.5710	0.0000	0.0000	18.8257	45.4749	93.4308	129.9704	154.5607	(219)	
Water heating fuel used												870.6660	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2091.6501	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)	
Total delivered energy for all uses												1641.1596	(238)	

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2091.6501	3.9200	81.9927	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	870.6660	3.9200	34.1301	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	378.0032	16.9600	64.1093	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			-19.9453	(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	2091.6501	0.2160	451.7964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	870.6660	0.2160	188.0639	(264)
Space and water heating			639.8603	(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 Designed)

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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-45.8199 (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	2091.6501	1.2200	2551.8131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	870.6660	1.2200	1062.2126 (264)
Space and water heating			3614.0256 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-441.9248 (272)
Primary energy kWh/m2/year			-5.5282 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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 Designed)



Property Reference	4907-P637-6633-654				Issued on Date	19/10/2022
Assessment Reference	Plot 654	Prop Type Ref	Coiner-CB-As-SEMI			
Property	Plot 654, 2 Bed, K, WC, B, ES					
SAP Rating	84 B	DER	16.45	TER	18.39	
Environmental	87 B	% DER<TER	10.57			
CO ₂ Emissions (t/year)	1.08	DFEE	40.93	TFEE	50.72	
General Requirements Compliance	Pass	% DFEE<TFEE	19.32			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

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) 16.45 kgCO₂/m²OK

1b TFEE and DFEE

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

Dwelling Fabric Energy Efficiency (DFEE)40.9 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: 5.01 (design value)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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
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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
util living area	0.9869	0.9776	0.9588	0.9142	0.8259	0.6788	0.5305	0.5766	0.7886	0.9347	0.9785	0.9892 (86)
MIT	19.2238	19.4428	19.7869	20.2361	20.6171	20.8713	20.9602	20.9461	20.7647	20.2703	19.6767	19.1973 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9842	0.9730	0.9499	0.8948	0.7849	0.6041	0.4267	0.4734	0.7263	0.9160	0.9732	0.9869 (89)
MIT 2	17.6126	17.9323	18.4310	19.0795	19.5981	19.9200	20.0065	19.9988	19.8015	19.1401	18.2855	17.5830 (90)
Living area fraction	18.0419	18.3348	18.7923	19.3877	19.8696	20.1734	20.2606	20.2512	20.0581	19.4413	18.6562	18.0131 (92)
MIT	18.0419	18.3348	18.7923	19.3877	19.8696	20.1734	20.2606	20.2512	20.0581	19.4413	18.6562	18.0131 (92)
Temperature adjustment	17.8919	18.1848	18.6423	19.2377	19.7196	20.0234	20.1106	20.1012	19.9081	19.2913	18.5062	-0.1500
adjusted MIT	17.8919	18.1848	18.6423	19.2377	19.7196	20.0234	20.1106	20.1012	19.9081	19.2913	18.5062	17.8631 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9759	0.9613	0.9340	0.8760	0.7708	0.6036	0.4359	0.4812	0.7178	0.8982	0.9619	0.9798 (94)
Useful gains	465.6206	529.3991	573.9983	590.7024	548.3536	419.8414	289.3995	300.4867	416.8832	466.3798	449.9055	441.6278 (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	1213.9798	1181.7388	1075.8049	898.7038	694.6847	461.9289	299.0073	314.2457	497.9391	752.8649	995.2298	1201.1592 (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	556.7793	438.3723	373.3441	221.7610	108.8703	0.0000	0.0000	0.0000	0.0000	213.1449	392.6335	565.0913 (98)
Space heating												2869.9968 (98)
Space heating per m2	(98) / (4) =											35.9019 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3171.2671 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.7793	438.3723	373.3441	221.7610	108.8703	0.0000	0.0000	0.0000	0.0000	213.1449	392.6335	565.0913	(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)	615.2257	484.3893	412.5350	245.0398	120.2987	0.0000	0.0000	0.0000	0.0000	235.5192	433.8492	624.4103	(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	89.7470	89.6831	89.5569	89.2760	88.7415	87.3000	87.3000	87.3000	87.3000	89.2174	89.5990	89.7721	(216)
Fuel for water heating, kWh/month	184.1647	161.6190	168.0417	148.4299	144.3757	128.2841	120.5010	135.9628	136.9009	154.1575	165.6704	178.7873	(219)
Water heating fuel used												1826.8950	(219)
Annual totals kWh/year													
Space heating fuel - main system												3171.2671	(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												5451.1653	(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	3171.2671	0.2160	684.9937 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.8950	0.2160	394.6093 (264)
Space and water heating			1079.6030 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total CO2, kg/year			1314.7117 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4500 (273)

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

DER		16.4500	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		34.9351	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		34.9351	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed)

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 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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4006 (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) =	0.3706 (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	0.4725	0.4632	0.4539	0.4076	0.3984	0.3520	0.3520	0.3428	0.3706	0.3984	0.4169	0.4354 (22b)
Effective ac	0.6116	0.6073	0.6030	0.5831	0.5793	0.5620	0.5620	0.5587	0.5687	0.5793	0.5869	0.5948 (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	40.3363	40.0505	39.7703	38.4543	38.2081	37.0619	37.0619	36.8496	37.5034	38.2081	38.7062	39.2269 (38)
Average = Sum(39)m / 12 =	87.3625	87.0767	86.7965	85.4805	85.2343	84.0881	84.0881	83.8759	84.5296	85.2343	85.7324	86.2531 (39)
	85.4794 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0893	1.0858	1.0693	1.0662	1.0519	1.0519	1.0492	1.0574	1.0662	1.0725	1.0790 (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)
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	37.9104	38.0348	38.1576	38.7450	38.8570	39.3866	39.3866	39.4863	39.1809	38.8570	38.6312	38.3980	
alpha	3.5274	3.5357	3.5438	3.5830	3.5905	3.6258	3.6258	3.6324	3.6121	3.5905	3.5754	3.5599	
util living area	0.9894	0.9810	0.9635	0.9212	0.8352	0.6902	0.5408	0.5902	0.8019	0.9425	0.9822	0.9914	(86)
MIT	19.2156	19.4352	19.7801	20.2268	20.6113	20.8676	20.9591	20.9436	20.7561	20.2535	19.6579	19.1832	(87)
Th 2	20.0067	20.0096	20.0125	20.0260	20.0285	20.0403	20.0403	20.0425	20.0358	20.0285	20.0234	20.0180	(88)
util rest of house	0.9872	0.9770	0.9555	0.9031	0.7957	0.6163	0.4368	0.4868	0.7418	0.9257	0.9779	0.9896	(89)
MIT 2	18.3725	18.5924	18.9349	19.3790	19.7381	19.9630	20.0242	20.0185	19.8770	19.4135	18.8254	18.3488	(90)
Living area fraction									fLA = Living area / (4) =			0.2664	(91)
MIT	18.5972	18.8169	19.1601	19.6049	19.9708	20.2040	20.2733	20.2650	20.1112	19.6373	19.0472	18.5711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5972	18.8169	19.1601	19.6049	19.9708	20.2040	20.2733	20.2650	20.1112	19.6373	19.0472	18.5711	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.3967	504.1784	553.8046	578.0539	543.4985	422.9204	297.1660	307.2651	414.9278	450.9697	425.3029	413.4971	(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	1249.0375	1211.8404	1098.8510	915.0606	704.9545	471.2302	308.8827	324.1807	508.1276	770.2910	1024.2641	1239.5550	(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	603.8608	475.5489	405.5145	242.6449	120.1233	0.0000	0.0000	0.0000	0.0000	237.5750	431.2521	614.5871	(98)
Space heating												3131.1066	(98)
Space heating per m2												39.1682	(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	790.4284	622.2521	637.4566	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8227	0.8838	0.8608	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	650.3141	549.9384	548.7058	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	163.4976	216.1978	182.2272	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												561.9226	(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	40.8744	54.0494	45.5568	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												140.4806	(107)
Space cooling per m2												1.7573	(108)
Energy for space heating												39.1682	(99)
Energy for space cooling												1.7573	(108)
Total												40.9255	(109)
Dwelling Fabric Energy Efficiency (DFEE)												40.9	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	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 Designed)



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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =		0.4169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)
	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Average = Sum(39)m / 12 =	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
												84.7627 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (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 Designed)

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	40.4699	0.4600	0.0000	0.7700	31.1057 (77)												
												Northwest	3.5300	12.9236	0.4600	0.0000	0.7700	16.1587 (81)												
												Southeast	4.5100	40.4699	0.4600	0.0000	0.7700	64.6483 (77)												
																		Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433	94.2181 (83)
												Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622	636.7401 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8854	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9351	0.9144	0.8687	0.7761	0.6209	0.3920	0.2287	0.2475	0.5192	0.7818	0.8993	0.9421 (94)
Ext temp.	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625 (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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (98)
RHI space heating demand												1892.9433 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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			
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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
util living area	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
	0.9664	0.9507	0.9217	0.8603	0.7546	0.5965	0.4525	0.4894	0.6957	0.8765	0.9485	0.9708 (86)
MIT	19.5123	19.7137	20.0221	20.4128	20.7233	20.9157	20.9761	20.9681	20.8473	20.4583	19.9323	19.4846 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9601	0.9415	0.9067	0.8332	0.7071	0.5228	0.3596	0.3956	0.6269	0.8469	0.9373	0.9652 (89)
MIT 2	18.0278	18.3186	18.7595	19.3140	19.7237	19.9605	20.0161	20.0133	19.8870	19.3890	18.6481	17.9974 (90)
Living area fraction	18.4233	18.6903	19.0959	19.6068	19.9900	20.2150	20.2719	20.2677	fLA = Living area / (4) =	20.1429	19.6739	18.9903
MIT	18.4233	18.6903	19.0959	19.6068	19.9900	20.2150	20.2719	20.2677	20.1429	19.6739	18.9903	18.3937 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2733	18.5403	18.9459	19.4568	19.8400	20.0650	20.1219	20.1177	19.9929	19.5239	18.8403	18.2437 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9455	0.9244	0.8875	0.8156	0.6978	0.5257	0.3688	0.4043	0.6246	0.8293	0.9202	0.9519 (94)
Ext temp.	622.8823	674.6827	697.1993	679.9222	599.2756	438.2670	294.3385	307.7449	453.2527	560.4932	585.5871	598.2810 (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	1248.0459	1213.3676	1102.7045	917.7530	705.1155	465.4695	299.9671	315.6478	505.2060	773.0159	1024.3778	1234.6115 (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	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299 (98)
Space heating per m2												2326.2731 (98)
										(98) / (4) =		29.1002 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	2570.4675 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299 (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)	513.9466	399.9959	333.3656	189.2135	87.0109	0.0000	0.0000	0.0000	0.0000	174.7148	349.0932	523.1269 (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	89.6385	89.5614	89.4093	89.0756	88.4911	87.3000	87.3000	87.3000	87.3000	88.9827	89.4519	89.6678 (217)
Fuel for water heating, kWh/month	184.3875	161.8388	168.3191	148.7639	144.7843	128.2841	120.5010	135.9628	136.9009	154.5642	165.9429	178.9952 (219)
Water heating fuel used												1829.2445 (219)
Annual totals kWh/year												
Space heating fuel - main system												2570.4675 (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												4852.7151 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2570.4675	3.4800	89.4523 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.2445	3.4800	63.6577 (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)
Total energy cost			332.8611 (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] = 1.1190 (257)
SAP value	84.3906
SAP rating (Section 12)	84 (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	2570.4675	0.2160	555.2210 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.2445	0.2160	395.1168 (264)
Space and water heating			950.3378 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1185.4464 (272)
CO2 emissions per m2			14.8300 (273)
EI value			87.2859
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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															5.0100		
Infiltration rate															0.4507 (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) =					0.4169 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960	(22b)				
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784	(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	39.2925	38.7052	38.7052	37.8779	37.8779	36.8752	37.1151	36.6424	36.8752	37.3622	37.3622	38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	1.0798	1.0724	1.0724	1.0621	1.0621	1.0496	1.0526	1.0466	1.0496	1.0556	1.0556	1.0655 (40)
HLP (average)												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)

	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 Designed)

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	40.4699		0.4600	0.0000		0.7700	31.1057 (77)	
Northwest				3.5300	12.9236		0.4600	0.0000		0.7700	16.1587 (81)	
Southeast				4.5100	40.4699		0.4600	0.0000		0.7700	64.6483 (77)	
Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433	94.2181 (83)
Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622	636.7401 (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	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8954	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	fLA = Living area / (4) =	19.8800	19.2699	0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625 (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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (98)
Space heating												1892.9433 (98)
Space heating per m2										(98) / (4) =		23.6796 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	2091.6501 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734 (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)	440.2649	343.9913	271.6192	138.9761	48.4206	0.0000	0.0000	0.0000	0.0000	121.2605	279.6330	447.4844 (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	89.5377	89.4583	89.2576	88.8295	88.0939	87.3000	87.3000	87.3000	87.3000	88.6918	89.2900	87.3000 (216)
Fuel for water heating, kWh/month	184.5951	162.0253	168.6052	149.1760	145.4371	128.2841	120.5010	135.9628	136.9009	155.0711	166.2438	179.1945 (219)
Water heating fuel used												1831.9967 (219)
Annual totals kWh/year												
Space heating fuel - main system												2091.6501 (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												4376.6499 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2091.6501	3.9200	81.9927 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.9967	3.9200	71.8143 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	378.0032	16.9600	64.1093 (250)
Additional standing charges			88.0000 (251)
Total energy cost			318.6363 (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	2091.6501	0.2160	451.7964 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.9967	0.2160	395.7113 (264)
Space and water heating			847.5077 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	378.0032	0.5190	196.1836 (268)
Total kg/year			1082.6163 (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	2091.6501	1.2200	2551.8131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.9967	1.2200	2235.0359 (264)
Space and water heating			4786.8490 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	378.0032	3.0700	1160.4697 (268)
Primary energy kWh/year			6177.5687 (272)
Primary energy kWh/m2/year			77.2776 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

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

Current environmental impact rating:

B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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	-£ 29	-182 kg (16.8%)
U Solar photovoltaic panels	+ 10.7	-£ 309	-947 kg (105.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.27 kg/m²	B 86 B 89
Solar photovoltaic panels	£309	11.84 kg/m²	A 96 A 99
Total Savings	£339	14.12 kg/m²	

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
 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	£77	£85	-£8
Mains gas	£242	£204	£38
Space heating	£183	£183	£0
Water heating	£72	£43	£29
Lighting	£64	£64	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£319	-£20	£339
Total cost of uses	£319	-£19	£338
Delivered energy	55 kWh/m²	21 kWh/m²	34 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-1 kg/m²	14 kg/m²
Primary energy	77 kWh/m²	-6 kWh/m²	83 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4507 (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) =	0.4169 (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	0.5315	0.5211	0.5106	0.4585	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6412	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (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	42.2900	41.9283	41.5738	39.9085	39.5969	38.1465	38.1465	37.8779	38.7052	39.5969	40.2272	40.8862 (38)
Average = Sum(39)m / 12 =	89.3162	88.9545	88.6000	86.9347	86.6231	85.1727	85.1727	84.9042	85.7314	86.6231	87.2534	87.9124 (39)
												86.9332 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1173	1.1128	1.1083	1.0875	1.0836	1.0655	1.0655	1.0621	1.0724	1.0836	1.0915	1.0997 (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 Designed)

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	37.0811	37.2319	37.3809	38.0970	38.2340	38.8851	38.8851	39.0081	38.6317	38.2340	37.9578	37.6733
alpha	3.4721	3.4821	3.4921	3.5398	3.5489	3.5923	3.5923	3.6005	3.5754	3.5489	3.5305	3.5116
util living area	0.9664	0.9507	0.9217	0.8603	0.7546	0.5965	0.4525	0.4894	0.6957	0.8765	0.9485	0.9708 (86)
MIT	19.5123	19.7137	20.0221	20.4128	20.7233	20.9157	20.9761	20.9681	20.8473	20.4583	19.9323	19.4846 (87)
Th 2	19.9867	19.9904	19.9940	20.0111	20.0142	20.0291	20.0291	20.0319	20.0234	20.0142	20.0078	20.0011 (88)
util rest of house	0.9601	0.9415	0.9067	0.8332	0.7071	0.5228	0.3596	0.3956	0.6269	0.8469	0.9373	0.9652 (89)
MIT 2	18.0278	18.3186	18.7595	19.3140	19.7237	19.9605	20.0161	20.0133	19.8870	19.3890	18.6481	17.9974 (90)
Living area fraction												
MIT	18.4233	18.6903	19.0959	19.6068	19.9900	20.2150	20.2719	20.2677	20.1429	19.6739	18.9903	18.3937 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2733	18.5403	18.9459	19.4568	19.8400	20.0650	20.1219	20.1177	19.9929	19.5239	18.8403	18.2437 (93)

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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	0.9455	0.9244	0.8875	0.8156	0.6978	0.5257	0.3688	0.4043	0.6246	0.8293	0.9202	0.9519	(94)
Useful gains	622.8823	674.6827	697.1993	679.9222	599.2756	438.2670	294.3385	307.7449	453.2527	560.4932	585.5871	598.2810	(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	1248.0459	1213.3676	1102.7045	917.7530	705.1155	465.4695	299.9671	315.6478	505.2060	773.0159	1024.3778	1234.6115	(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	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299	(98)
Space heating												2326.2731	(98)
Space heating per m2											(98) / (4) =	29.1002	(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													2570.4675	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	465.1217	361.9963	301.6959	171.2382	78.7449	0.0000	0.0000	0.0000	0.0000	158.1169	315.9294	473.4299	(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)	513.9466	399.9959	333.3656	189.2135	87.0109	0.0000	0.0000	0.0000	0.0000	174.7148	349.0932	523.1269	(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	89.7356	89.7650	89.8035	89.8846	90.0324	87.3000	87.3000	87.3000	87.3000	89.3519	89.5991	89.7491	(216)	
(217)m	89.7356	89.7650	89.8035	89.8846	90.0324	87.3000	87.3000	87.3000	87.3000	89.3519	89.5991	89.7491	(217)	
Fuel for water heating, kWh/month	156.9244	115.9912	90.1551	43.7536	14.4388	0.0000	0.0000	24.1855	49.3568	95.5161	133.2823	156.0215	(219)	
Water heating fuel used												879.6254	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2570.4675	(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 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)	
Total delivered energy for all uses												2225.8566	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2570.4675	3.4800	89.4523	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	879.6254	3.4800	30.6110	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			78.5865	(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] =	0.2642	(257)
SAP value		96.3147	
SAP rating (Section 12)		96	(258)
SAP band		A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	2570.4675	0.2160	555.2210 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	879.6254	0.2160	189.9991 (264)
Space and water heating			745.2201 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			109.8415 (272)
CO2 emissions per m2			1.3700 (273)
EI value			98.8219
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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										5.0100							
Infiltration rate										0.4507 (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) =					0.4169 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.4377	0.4169	0.4169	0.3856	0.3856	0.3439	0.3543	0.3335	0.3439	0.3647	0.3647	0.3960 (22b)					
Effective ac	0.5958	0.5869	0.5869	0.5743	0.5743	0.5591	0.5628	0.5556	0.5591	0.5665	0.5665	0.5784 (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 39.2925	Feb 38.7052	Mar 38.7052	Apr 37.8779	May 37.8779	Jun 36.8752	Jul 37.1151	Aug 36.6424	Sep 36.8752	Oct 37.3622	Nov 37.3622	Dec 38.1465 (38)
Heat transfer coeff	86.3187	85.7314	85.7314	84.9042	84.9042	83.9014	84.1414	83.6686	83.9014	84.3885	84.3885	85.1727 (39)
Average = Sum(39)m / 12 =												84.7627 (39)
HLP	Jan 1.0798	Feb 1.0724	Mar 1.0724	Apr 1.0621	May 1.0621	Jun 1.0496	Jul 1.0526	Aug 1.0466	Sep 1.0496	Oct 1.0556	Nov 1.0556	Dec 1.0655 (40)
HLP (average)												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)
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 Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3137 (H8)
Utilisation factor												0.5329 (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	-26.4558	-39.7630	-66.9659	-92.5674	-111.4822	-117.3302	-114.5129	-102.2607	-79.8148	-54.2966	-32.1577	-859.5260 (H17)
Solar input (sum of months) = Sum (63)m =												-21.9188 (63)
Output from w/h	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823 (64)
Total per year (kWh/year) = Sum (64)m =												778.3562 (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		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				2.1700	40.4699		0.4600		0.0000		0.7700		31.1057 (77)
Northwest				3.5300	12.9236		0.4600		0.0000		0.7700		16.1587 (81)
Southeast				4.5100	40.4699		0.4600		0.0000		0.7700		64.6483 (77)
Solar gains	111.9127	176.4805	251.7773	344.7095	396.8354	431.2817	407.3318	365.8071	303.7028	212.0896	138.3433		94.2181 (83)
Total gains	669.5259	729.3610	782.7655	842.0283	859.8301	863.7142	822.1060	789.1959	746.6710	688.9388	652.6622		636.7401 (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	38.3688	38.6317	38.6317	39.0081	39.0081	39.4743	39.3617	39.5841	39.4743	39.2464	39.2464	38.8851
alpha	3.5579	3.5754	3.5754	3.6005	3.6005	3.6316	3.6241	3.6389	3.6316	3.6164	3.6164	3.5923
util living area	0.9586	0.9426	0.9057	0.8244	0.6827	0.4669	0.3139	0.3348	0.5961	0.8349	0.9319	0.9636 (86)
MIT	19.7155	19.8854	20.1950	20.5615	20.8371	20.9712	20.9951	20.9938	20.9264	20.6142	20.1349	19.6929 (87)
Th 2	20.0174	20.0234	20.0234	20.0319	20.0319	20.0422	20.0398	20.0446	20.0422	20.0372	20.0372	20.0291 (88)
util rest of house	0.9506	0.9318	0.8876	0.7909	0.6242	0.3846	0.2183	0.2370	0.5152	0.7961	0.9170	0.9566 (89)
MIT 2	18.3408	18.5866	19.0238	19.5293	19.8758	20.0241	20.0383	20.0426	19.9862	19.6133	18.9557	18.3168 (90)
Living area fraction									fLA = Living area / (4) =			0.2664 (91)
MIT	18.7071	18.9326	19.3359	19.8043	20.1319	20.2764	20.2932	20.2961	20.2367	19.8800	19.2699	18.6834 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5571	18.7826	19.1859	19.6543	19.9819	20.1264	20.1432	20.1461	20.0867	19.7300	19.1199	18.5334 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9351	0.9144	0.8687	0.7761	0.6209	0.3920	0.2287	0.2475	0.5192	0.7818	0.8993	0.9421	(94)
Useful gains	626.0619	666.9045	680.0207	653.4987	533.8967	338.6037	188.0437	195.3592	387.6489	538.5780	586.9100	599.8435	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1161.5992	1130.1665	1010.4177	828.1839	592.7954	346.2135	188.7470	196.2934	410.0001	686.0791	938.3932	1144.1625	(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	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734	(98)
Space heating												1892.9433	(98)
Space heating per m2											(98) / (4) =	23.6796	(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													2091.6501	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	398.4398	311.3121	245.8154	125.7733	43.8207	0.0000	0.0000	0.0000	0.0000	109.7408	253.0679	404.9734	(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)	440.2649	343.9913	271.6192	138.9761	48.4206	0.0000	0.0000	0.0000	0.0000	121.2605	279.6330	447.4844	(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	138.8265	105.1820	83.5270	39.9449	16.6389	0.0000	0.0000	16.4348	39.6996	83.2388	116.2813	138.5823	(64)	
Efficiency of water heater	89.6509	89.6699	89.6664	89.7074	89.5962	87.3000	87.3000	87.3000	87.3000	89.0914	89.4675	89.6621	(216)	
Fuel for water heating, kWh/month	154.8524	117.2991	93.1530	44.5280	18.5710	0.0000	0.0000	18.8257	45.4749	93.4308	129.9704	154.5607	(219)	
Water heating fuel used												870.6660	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2091.6501	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)	
Total delivered energy for all uses												1641.1596	(238)	

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2091.6501	3.9200	81.9927	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	870.6660	3.9200	34.1301	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	378.0032	16.9600	64.1093	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			-19.9453	(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	2091.6501	0.2160	451.7964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	870.6660	0.2160	188.0639	(264)
Space and water heating			639.8603	(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 Designed)

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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-45.8199 (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	2091.6501	1.2200	2551.8131 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	870.6660	1.2200	1062.2126 (264)
Space and water heating			3614.0256 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-441.9248 (272)
Primary energy kWh/m2/year			-5.5282 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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	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	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 Designed)



Property Reference	4907-P637-6633-655				Issued on Date	19/10/2022
Assessment Reference	Plot 655	Prop Type Ref	Goldsmith-CB-AS-DET			
Property	Plot 655, 4 Bed, K, WC, U, B, 2ES, Country Brick					
SAP Rating	85 B	DER	15.45	TER	16.05	
Environmental	86 B	% DER<TER	3.73			
CO ₂ Emissions (t/year)	1.79	DFEE	45.31	TFEE	55.15	
General Requirements Compliance	Pass	% DFEE<TFEE	17.83			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 138 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) 16.05 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.45 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H24

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.76 kWh/day
Permitted by DBSCG 2.56 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): Slight OK

Based on:

Overshading: Average
Windows facing South East: 11.56 m², No overhang
Windows facing South West: 0.72 m², No overhang
Windows facing North West: 9.58 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 0.029 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (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	0.5405	0.5299	0.5193	0.4663	0.4557	0.4027	0.4027	0.3921	0.4239	0.4557	0.4769	0.4981 (22b)
Effective ac	0.6461	0.6404	0.6348	0.6087	0.6038	0.5811	0.5811	0.5769	0.5899	0.6038	0.6137	0.6240 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	73.7674	73.1198	72.4850	69.5035	68.9456	66.3488	66.3488	65.8679	67.3491	68.9456	70.0741	71.2539 (38)
Heat transfer coeff	163.5453	162.8977	162.2629	159.2814	158.7236	156.1267	156.1267	155.6458	157.1270	158.7236	159.8520	161.0318 (39)
Average = Sum(39)m / 12 =												159.2787 (39)
HLP	1.1817	1.1770	1.1724	1.1509	1.1468	1.1281	1.1281	1.1246	1.1353	1.1468	1.1550	1.1635 (40)
HLP (average)												1.1509 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (64)
Heat gains from water heating, kWh/month	98.2674	87.1525	92.7998	84.9509	84.5252	77.3600	76.0403	81.0352	80.1386	88.0029	90.8386	96.4977 (65)
Total per year (kWh/year) = Sum(64)m =												2247.7859 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6818	25.4749	20.7176	15.6845	11.7244	9.8982	10.6954	13.9022	18.6595	23.6926	27.6527	29.4789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	307.5854	310.7772	302.7340	285.6111	263.9964	243.6817	230.1102	226.9184	234.9616	252.0846	273.6992	294.0139 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699 (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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591 (71)
Water heating gains (Table 5)	132.0799	129.6912	124.7308	117.9873	113.6092	107.4445	102.2047	108.9183	111.3037	118.2834	126.1647	129.7012 (72)
Total internal gains	538.0567	535.6529	517.8921	488.9926	459.0396	430.7341	412.7199	419.4486	434.6345	463.7702	497.2263	522.9037 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	7.0500	36.7938		0.4600	0.0000	0.7700	91.8782 (77)
Southwest	0.7200	36.7938		0.4600	0.0000	0.7700	9.3833 (79)
Northwest	9.5800	11.2829		0.4600	0.0000	0.7700	38.2857 (81)
Southeast	4.5100	36.7938		0.4600	0.0000	0.7700	58.7760 (77)

Solar gains	198.3233	350.5348	513.3956	692.7399	827.6047	844.3514	804.5850	700.4946	574.9560	396.5232	239.8614	168.2248 (83)
Total gains	736.3800	886.1877	1031.2877	1181.7325	1286.6443	1275.0855	1217.3050	1119.9433	1009.5905	860.2934	737.0878	691.1285 (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	31.4024	31.5272	31.6506	32.2430	32.3563	32.8945	32.8945	32.9961	32.6851	32.3563	32.1279	31.8925
alpha	3.0935	3.1018	3.1100	3.1495	3.1571	3.1930	3.1930	3.1997	3.1790	3.1571	3.1419	3.1262
util living area	0.9873	0.9769	0.9553	0.9046	0.8088	0.6621	0.5208	0.5743	0.7871	0.9344	0.9789	0.9895 (86)
MIT	18.8672	19.1278	19.5407	20.0785	20.5319	20.8325	20.9427	20.9212	20.6877	20.0898	19.3910	18.8376 (87)
Th 2	19.9347	19.9384	19.9421	19.9595	19.9628	19.9780	19.9780	19.9808	19.9721	19.9628	19.9562	19.9493 (88)
util rest of house	0.9848	0.9723	0.9462	0.8843	0.7667	0.5868	0.4157	0.4693	0.7254	0.9164	0.9740	0.9874 (89)
MIT 2	17.0795	17.4599	18.0584	18.8327	19.4510	19.8333	19.9442	19.9305	19.6715	18.8643	17.8560	17.0450 (90)
Living area fraction	17.2979	17.6637	18.2395	18.9849	19.5831	19.9554	20.0662	20.0516	19.7957	19.0141	18.0436	17.2260 (91)
MIT	17.2979	17.6637	18.2395	18.9849	19.5831	19.9554	20.0662	20.0516	19.7957	19.0141	18.0436	17.2260 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1479	17.5137	18.0895	18.8349	19.4331	19.8054	19.9162	19.9016	19.6457	18.8641	17.8936	17.1140 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9743	0.9567	0.9238	0.8563	0.7413	0.5727	0.4089	0.4604	0.7021	0.8901	0.9592	0.9784 (94)
Useful gains	717.4561	847.8563	952.7410	1011.8629	953.7383	730.2742	497.7843	515.6589	708.7980	765.7522	707.0242	676.2299 (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	2101.2205	2054.7394	1880.5531	1582.4514	1227.4181	812.7002	517.7499	545.0076	871.3777	1311.7029	1725.3782	2079.5658 (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	1029.5208	811.0255	690.2922	410.8237	203.6178	0.0000	0.0000	0.0000	0.0000	406.1873	733.2148	1044.0819 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 5328.7640 (98)
38.5026 (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 %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5868.6828 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1029.5208	811.0255	690.2922	410.8237	203.6178	0.0000	0.0000	0.0000	0.0000	406.1873	733.2148	1044.0819	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	1133.8334	893.1999	760.2337	452.4490	224.2486	0.0000	0.0000	0.0000	0.0000	447.3428	807.5053	1149.8699	(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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867	(64)
Efficiency of water heater	88.7027	88.5069	88.1055	87.2001	85.4432	80.1000	80.1000	80.1000	80.1000	87.0855	88.2588	88.7667	(216)
(217)m	88.7027	88.5069	88.1055	87.2001	85.4432	80.1000	80.1000	80.1000	80.1000	87.0855	88.2588	88.7667	(217)
Fuel for water heating, kWh/month	249.6081	220.4969	232.6362	210.7232	210.7591	200.9005	192.9598	211.7142	211.3333	218.7947	228.2585	243.4322	(219)
Water heating fuel used	249.6081	220.4969	232.6362	210.7232	210.7591	200.9005	192.9598	211.7142	211.3333	218.7947	228.2585	2631.6166	(219)
Annual totals kWh/year													
Space heating fuel - main system												5868.6828	(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)												506.5287	(232)
Total delivered energy for all uses												9081.8281	(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	5868.6828	0.2160	1267.6355	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2631.6166	0.2160	568.4292	(264)
Space and water heating			1836.0647	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	506.5287	0.5190	262.8884	(268)
Total CO2, kg/year			2137.8781	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4500	(273)

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

DER		15.4500	ZC1
Total Floor Area	TFA	138.4000	
Assumed number of occupants	N	2.9140	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1697	ZC2
CO2 emissions from cooking, equation (L16)		1.3651	ZC3
Total CO2 emissions		29.9848	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		29.9848	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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) =	0.1156 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3656 (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) =					0.3656	(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	0.4661	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)				
Effective ac	0.6086	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(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)			21.8600	1.3258	28.9811			(27)					
GF B&B J150 P/A=0.50			69.2000	0.1300	8.9960			(28a)					
EW Brick AAC011	166.4500	25.9200	140.5300	0.1800	25.2954			(29a)					
PR 400mm MW044	69.2000		69.2000	0.1300	8.9960			(30)					
Total net area of external elements Aum(A, m2)			304.8500					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.7345			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.6453 (36)					
Total fabric heat loss						(33) + (36) =		89.3798 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 69.4954	Feb 69.0136	Mar 68.5415	Apr 66.3237	May 65.9087	Jun 63.9771	Jul 63.9771	Aug 63.6194	Sep 64.7211	Oct 65.9087	Nov 66.7481	Dec 67.6257	(38)
Heat transfer coeff	158.8751	158.3934	157.9212	155.7034	155.2885	153.3569	153.3569	152.9991	154.1009	155.2885	156.1279	157.0055	(39)
Average = Sum(39)m / 12 =												155.7014	(39)
HLP	Jan 1.1479	Feb 1.1445	Mar 1.1410	Apr 1.1250	May 1.1220	Jun 1.1081	Jul 1.1081	Aug 1.1055	Sep 1.1134	Oct 1.1220	Nov 1.1281	Dec 1.1344	(40)
HLP (average)												1.1250	(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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
Daily hot water use	Jan 113.7476	Feb 109.6114	Mar 105.4751	Apr 101.3388	May 97.2025	Jun 93.0663	Jul 93.0663	Aug 97.2025	Sep 101.3388	Oct 105.4751	Nov 109.6114	Dec 113.7476 (44)
Energy conte	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Energy content (annual)												Total = Sum(45)m = 1626.9939 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (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	223.5913	197.1257	207.1471	185.8624	182.2613	163.0329	156.7428	171.7651	171.3895	192.7204	203.5699	218.2687 (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	223.5913	197.1257	207.1471	185.8624	182.2613	163.0329	156.7428	171.7651	171.3895	192.7204	203.5699	218.2687 (64)
Heat gains from water heating, kWh/month	100.0130	88.7291	94.5453	86.6401	86.2708	79.0493	77.7859	82.7808	81.8279	89.7484	92.5279	98.2433 (65)

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	28.6818	25.4749	20.7176	15.6845	11.7244	9.8982	10.6954	13.9022	18.6595	23.6926	27.6527	29.4789 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	307.5854	310.7772	302.7340	285.6111	263.9964	243.6817	230.1102	226.9184	234.9616	252.0846	273.6992	294.0139 (68)
Pumps, fans	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591 (71)
Total internal gains	134.4261	132.0374	127.0771	120.3335	115.9554	109.7907	104.5509	111.2645	113.6499	120.6296	128.5109	132.0474 (72)
	540.4029	537.9991	520.2383	491.3388	461.3858	433.0803	415.0662	421.7949	436.9807	466.1164	499.5726	525.2499 (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				11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (77)			
Southwest				0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)			
Northwest				9.5800	11.2829	0.6300	0.7000	0.7700	33.0339 (81)			
Solar gains	171.1185	302.4506	442.9711	597.7141	714.0789	728.5284	694.2170	604.4050	496.0870	342.1306	206.9587	145.1488 (83)
Total gains	711.5214	840.4497	963.2094	1089.0529	1175.4648	1161.6087	1109.2831	1026.1999	933.0677	808.2470	706.5313	670.3987 (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	60.4948	60.6787	60.8602	61.7270	61.8920	62.6715	62.6715	62.8181	62.3690	61.8920	61.5592	61.2151
util living area	5.0330	5.0452	5.0573	5.1151	5.1261	5.1781	5.1781	5.1879	5.1579	5.1261	5.1039	5.0810
	0.9990	0.9975	0.9927	0.9735	0.9096	0.7603	0.5892	0.6521	0.8870	0.9854	0.9978	0.9993 (86)
MIT	19.6814	19.8372	20.0935	20.4384	20.7443	20.9328	20.9856	20.9763	20.8390	20.4417	20.0018	19.6609 (87)
Th 2	19.9619	19.9647	19.9675	19.9804	19.9829	19.9942	19.9942	19.9964	19.9899	19.9829	19.9780	19.9728 (88)
util rest of house	0.9987	0.9966	0.9900	0.9627	0.8720	0.6719	0.4643	0.5262	0.8258	0.9777	0.9969	0.9990 (89)
MIT 2	18.1944	18.4241	18.7995	19.3047	19.7219	19.9474	19.9887	19.9861	19.8527	19.3167	18.6745	18.1721 (90)
Living area fraction	18.3761	18.5967	18.9576	19.4432	19.8468	20.0678	20.1105	20.1071	19.9732	19.4542	18.8366	18.3540 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3761	18.5967	18.9576	19.4432	19.8468	20.0678	20.1105	20.1071	19.9732	19.4542	18.8366	18.3540 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9979	0.9949	0.9860	0.9551	0.8659	0.6790	0.4793	0.5410	0.8246	0.9719	0.9952	0.9984 (94)
Ext temp.	709.9968	836.1321	949.7553	1040.1472	1017.8307	788.7381	531.7230	555.1643	769.3922	785.5022	703.1707	669.3364 (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	2236.3384	2169.4745	1967.3144	1641.6145	1265.1090	838.5197	538.3582	567.1755	905.0675	1374.9519	1832.4158	2222.2558 (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	1135.5981	896.0061	757.0640	433.0564	183.9751	0.0000	0.0000	0.0000	0.0000	438.5506	813.0564	1155.3720 (98)
												5812.6788 (98)
												41.9991 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													6216.7687 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1135.5981	896.0061	757.0640	433.0564	183.9751	0.0000	0.0000	0.0000	0.0000	438.5506	813.0564	1155.3720	(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)	1214.5435	958.2953	809.6942	463.1619	196.7648	0.0000	0.0000	0.0000	0.0000	469.0380	869.5791	1235.6920	(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	223.5913	197.1257	207.1471	185.8624	182.2613	163.0329	156.7428	171.7651	171.3895	192.7204	203.5699	218.2687	(64)
Efficiency of water heater (217)m	88.5469	88.3634	87.9660	86.9970	84.8388	79.8000	79.8000	79.8000	79.8000	86.9411	88.1337	88.6120	(216)
Fuel for water heating, kWh/month	252.5117	223.0853	235.4854	213.6424	214.8325	204.3019	196.4195	215.2445	214.7739	221.6678	230.9786	246.3194	(219)
Water heating fuel used												2669.2628	(219)
Annual totals kWh/year													
Space heating fuel - main system												6216.7687	(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)												506.5287	(232)
Total delivered energy for all uses												9467.5602	(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	6216.7687	0.2160	1342.8220 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2669.2628	0.2160	576.5608 (264)
Space and water heating			1919.3828 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	506.5287	0.5190	262.8884 (268)
Total CO2, kg/m2/year			2221.1962 (272)
Emissions per m2 for space and water heating			13.8684 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8995 (272b)
Emissions per m2 for pumps and fans			0.2813 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8684 * 1.00) + 1.8995 + 0.2813, rounded to 2 d.p.			16.0500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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) = 0.1156 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3661 (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) =	0.3661 (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	0.4668	0.4576	0.4485	0.4027	0.3936	0.3478	0.3478	0.3386	0.3661	0.3936	0.4119	0.4302 (22b)
Effective ac	0.6089	0.6047	0.6006	0.5811	0.5774	0.5605	0.5605	0.5573	0.5670	0.5774	0.5848	0.5925 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	80.7977	(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	69.5293	69.0463	68.5728	66.3489	65.9329	63.9959	63.9959	63.6373	64.7420	65.9329	66.7746	67.6546 (38)
Heat transfer coeff	159.3072	158.8242	158.3507	156.1268	155.7108	153.7739	153.7739	153.4152	154.5199	155.7108	156.5525	157.4325 (39)
Average = Sum(39)m / 12 =												156.1249 (39)
HLP	1.1511	1.1476	1.1442	1.1281	1.1251	1.1111	1.1111	1.1085	1.1165	1.1251	1.1312	1.1375 (40)
HLP (average)												1.1281 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

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Energy conte	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Energy content (annual)	Total = Sum (45)m =											1626.9939 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.8454	31.3507	32.3511	28.2044	27.0628	23.3532	21.6401	24.8324	25.1290	29.2854	31.9673	34.7144 (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	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6818	25.4749	20.7176	15.6845	11.7244	9.8982	10.6954	13.9022	18.6595	23.6926	27.6527	29.4789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	307.5854	310.7772	302.7340	285.6111	263.9964	243.6817	230.1102	226.9184	234.9616	252.0846	273.6992	294.0139 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699 (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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591 (71)
Water heating gains (Table 5)	48.1794	46.6528	43.4826	39.1728	36.3748	32.4350	29.0862	33.3769	34.9013	39.3621	44.3990	46.6591 (72)
Total internal gains	451.1562	449.6145	433.6439	407.1781	378.8052	352.7245	336.6014	340.9072	355.2322	381.8489	412.4606	436.8616 (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					7.0500	36.7938	0.4600		0.0000		0.7700		91.8782 (77)
Southwest					0.7200	36.7938	0.4600		0.0000		0.7700		9.3833 (79)
Northwest					9.5800	11.2829	0.4600		0.0000		0.7700		38.2857 (81)
Southeast					4.5100	36.7938	0.4600		0.0000		0.7700		58.7760 (77)
Solar gains	198.3233	350.5348	513.3956	692.7399	827.6047	844.3514	804.5850	700.4946	574.9560	396.5232	239.8614	168.2248	(83)
Total gains	649.4795	800.1493	947.0394	1099.9180	1206.4099	1197.0759	1141.1865	1041.4018	930.1881	778.3721	652.3220	605.0865	(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	32.2378	32.3358	32.4325	32.8945	32.9824	33.3978	33.3978	33.4759	33.2366	32.9824	32.8050	32.6217
alpha	3.1492	3.1557	3.1622	3.1930	3.1988	3.2265	3.2265	3.2317	3.2158	3.1988	3.1870	3.1748
util living area	0.9911	0.9823	0.9634	0.9171	0.8262	0.6841	0.5427	0.6007	0.8120	0.9477	0.9848	0.9928 (86)
MIT	18.8349	19.0967	19.5115	20.0486	20.5118	20.8205	20.9378	20.9129	20.6629	20.0463	19.3440	18.7969 (87)
Th 2	19.9593	19.9622	19.9649	19.9780	19.9804	19.9918	19.9918	19.9939	19.9874	19.9804	19.9755	19.9703 (88)
util rest of house	0.9893	0.9788	0.9558	0.8991	0.7865	0.6100	0.4364	0.4952	0.7542	0.9328	0.9813	0.9914 (89)
MIT 2	17.9710	18.2330	18.6450	19.1775	19.6121	19.8844	19.9663	19.9552	19.7617	19.1859	18.4902	17.9410 (90)
Living area fraction	fLA = Living area / (4) =											0.1222 (91)
MIT	18.0765	18.3385	18.7509	19.2839	19.7220	19.9988	20.0850	20.0722	19.8718	19.2910	18.5945	18.0456 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0765	18.3385	18.7509	19.2839	19.7220	19.9988	20.0850	20.0722	19.8718	19.2910	18.5945	18.0456 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9847	0.9712	0.9442	0.8840	0.7749	0.6106	0.4469	0.5041	0.7465	0.9197	0.9745	0.9876 (94)
Useful gains	639.5334	777.1396	894.1637	972.3565	934.8670	730.9425	510.0347	525.0115	694.3906	715.8761	635.6988	597.5768 (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	2194.6974	2134.3604	1939.9377	1621.2111	1249.1172	830.1944	535.8973	563.3684	891.8600	1353.2844	1799.4907	2179.7435 (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	1157.0420	912.0524	778.0559	467.1753	233.8022	0.0000	0.0000	0.0000	0.0000	474.2318	837.9302	1177.1320 (98)
Space heating												6037.4218 (98)
Space heating per m2												(98) / (4) = 43.6230 (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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Calculation Type: New Build (As Designed)



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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1445.4742	1137.9265	1165.9553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7826	0.8471	0.8136	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1131.1859	963.9059	948.6539	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1521.4661	1453.3742	1339.2540	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	281.0018	364.1644	290.6065	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												935.7728	(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	70.2505	91.0411	72.6516	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												233.9432	(107)
Space cooling per m2												1.6903	(108)
Energy for space heating												43.6230	(99)
Energy for space cooling												1.6903	(108)
Total												45.3133	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.3	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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) = 0.1156 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3656 (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) =	0.3656 (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	0.4661	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296 (22b)
Effective ac	0.6086	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923 (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)			21.8600	1.3258	28.9811		(27)
GF B&B J150 P/A=0.50			69.2000	0.1300	8.9960		(28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.1800	25.2954		(29a)
PR 400mm MW044	69.2000		69.2000	0.1300	8.9960		(30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.7345		(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)							12.6453 (36)
Total fabric heat loss						(33) + (36) =	89.3798 (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	69.4954	69.0136	68.5415	66.3237	65.9087	63.9771	63.9771	63.6194	64.7211	65.9087	66.7481	67.6257 (38)
Heat transfer coeff	158.8751	158.3934	157.9212	155.7034	155.2885	153.3569	153.3569	152.9991	154.1009	155.2885	156.1279	157.0055 (39)
Average = Sum(39)m / 12 =												155.7014 (39)
HLP	1.1479	1.1445	1.1410	1.1250	1.1220	1.1081	1.1081	1.1055	1.1134	1.1220	1.1281	1.1344 (40)
HLP (average)												1.1250 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)
Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m												1626.9939 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	35.8454	31.3507	32.3511	28.2044	27.0628	23.3532	21.6401	24.8324	25.1290	29.2854	31.9673	(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	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	145.6988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6818	25.4749	20.7176	15.6845	11.7244	9.8982	10.6954	13.9022	18.6595	23.6926	27.6527	29.4789	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	307.5854	310.7772	302.7340	285.6111	263.9964	243.6817	230.1102	226.9184	234.9616	252.0846	273.6992	294.0139	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	37.5699	(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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	(71)
Water heating gains (Table 5)	48.1794	46.6528	43.4826	39.1728	36.3748	32.4350	29.0862	33.3769	34.9013	39.3621	44.3990	46.6591	(72)
Total internal gains	451.1562	449.6145	433.6439	407.1781	378.8052	352.7245	336.6014	340.9072	355.2322	381.8489	412.4606	436.8616	(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	11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (77)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)
Northwest	9.5800	11.2829	0.6300	0.7000	0.7700	33.0339 (81)

Solar gains	171.1185	302.4506	442.9711	597.7141	714.0789	728.5284	694.2170	604.4050	496.0870	342.1306	206.9587	145.1488	(83)
Total gains	622.2747	752.0651	876.6149	1004.8922	1092.8842	1081.2530	1030.8184	945.3122	851.3192	723.9794	619.4193	582.0104	(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	60.4948	60.6787	60.8602	61.7270	61.8920	62.6715	62.6715	62.8181	62.3690	61.8920	61.5592	61.2151	
alpha	5.0330	5.0452	5.0573	5.1151	5.1261	5.1781	5.1781	5.1879	5.1579	5.1261	5.1039	5.0810	
util living area	0.9995	0.9985	0.9952	0.9809	0.9288	0.7950	0.6274	0.6954	0.9151	0.9909	0.9988	0.9996	(86)
MIT	19.6211	19.7779	20.0366	20.3876	20.7073	20.9167	20.9808	20.9683	20.8058	20.3878	19.9430	19.6009	(87)
Th 2	19.9619	19.9647	19.9675	19.9804	19.9829	19.9942	19.9942	19.9964	19.9899	19.9829	19.9780	19.9728	(88)
util rest of house	0.9993	0.9980	0.9933	0.9727	0.8967	0.7095	0.4976	0.5669	0.8632	0.9859	0.9983	0.9995	(89)
MIT 2	18.6949	18.8537	19.1137	19.4707	19.7740	19.9532	19.9890	19.9865	19.8718	19.4759	19.0294	18.6834	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.8080	18.9666	19.2265	19.5827	19.8880	20.0709	20.1102	20.1065	19.9860	19.5873	19.1410	18.7955	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8080	18.9666	19.2265	19.5827	19.8880	20.0709	20.1102	20.1065	19.9860	19.5873	19.1410	18.7955	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	621.6505	749.9838	869.1255	973.2289	975.9774	775.1329	529.2558	550.3643	734.6439	711.7109	617.9806	581.5997	(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	2304.9649	2228.0555	2009.7823	1663.3345	1271.5088	839.0005	538.3176	567.0863	907.0306	1395.6266	1879.9421	2291.5814	(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	1252.3859	993.2642	848.6487	496.8761	219.8754	0.0000	0.0000	0.0000	0.0000	508.8332	908.6122	1272.2264	(98)
Space heating												6500.7221	(98)
Space heating per m2												46.9705	(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	1441.5544	1134.8407	1162.7935	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8213	0.8954	0.8600	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1183.8876	1016.1279	1000.0426	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1386.0886	1324.3725	1226.9415	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	145.5847	229.3340	168.8128	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												543.7316 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	36.3962	57.3335	42.2032	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												135.9329 (107)
Space cooling per m2												0.9822 (108)
Energy for space heating												46.9705 (99)
Energy for space cooling												0.9822 (108)
Total												47.9527 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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					6 * 10 = 60.0000 (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)					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4451	0.4239	0.4239	0.3921	0.3921	0.3497	0.3603	0.3391	0.3497	0.3709	0.3709	0.4027 (22b)
	0.5991	0.5899	0.5899	0.5769	0.5769	0.5612	0.5649	0.5575	0.5612	0.5688	0.5688	0.5811 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	68.4006	67.3491	67.3491	65.8679	65.8679	64.0726	64.5022	63.6558	64.0726	64.9446	64.9446	66.3488 (38)
Heat transfer coeff	158.1785	157.1270	157.1270	155.6458	155.6458	153.8505	154.2801	153.4337	153.8505	154.7225	154.7225	156.1267 (39)
Average = Sum(39)m / 12 =												155.3926 (39)
HLP	1.1429	1.1353	1.1353	1.1246	1.1246	1.1116	1.1147	1.1086	1.1116	1.1179	1.1179	1.1281 (40)
HLP (average)												1.1228 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (64)
Total per year (kWh/year) = Sum(64)m =												2247.7859 (64)
RHI water heating demand												2248 (64)
Heat gains from water heating, kWh/month	98.2674	87.1525	92.7998	84.9509	84.5252	77.3600	76.0403	81.0352	80.1386	88.0029	90.8386	96.4977 (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	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7044	63.6872	51.7939	39.2113	29.3109	24.7455	26.7384	34.7556	46.6489	59.2315	69.1319	73.6973 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.0827	463.8466	451.8418	426.2852	394.0245	363.7040	343.4481	338.6842	350.6890	376.2456	408.5063	438.8268 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	(71)
Water heating gains (Table 5)	132.0799	129.6912	124.7308	117.9873	113.6092	107.4445	102.2047	108.9183	111.3037	118.2834	126.1647	129.7012 (72)
Total internal gains	779.5444	773.9023	745.0440	700.1612	653.6220	612.5714	589.0686	599.0355	625.3189	670.4379	720.4803	758.9026 (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				7.0500	40.4699	0.4600		0.0000		0.7700	101.0578 (77)	
Southwest				0.7200	40.4699	0.4600		0.0000		0.7700	10.3208 (79)	
Northwest				9.5800	12.9236	0.4600		0.0000		0.7700	43.8527 (81)	
Southeast				4.5100	40.4699	0.4600		0.0000		0.7700	64.6483 (77)	

Solar gains	219.8797	350.4790	509.3800	712.3383	832.1318	909.6525	857.0167	761.0003	619.7670	423.9462	272.5881	184.6250 (83)
Total gains	999.4240	1124.3813	1254.4240	1412.4995	1485.7538	1522.2240	1446.0853	1360.0358	1245.0859	1094.3840	993.0684	943.5276 (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	32.4678	32.6851	32.6851	32.9961	32.9961	33.3812	33.2892	33.4719	33.3812	33.1930	33.1930	32.8945
alpha	3.1645	3.1790	3.1790	3.1997	3.1997	3.2254	3.2192	3.2315	3.2254	3.2129	3.2129	3.1930
util living area	0.9668	0.9512	0.9149	0.8322	0.6909	0.4760	0.3244	0.3523	0.6249	0.8578	0.9447	0.9713 (86)
MIT	19.3333	19.5438	19.9331	20.4027	20.7634	20.9516	20.9900	20.9872	20.8759	20.4411	19.8367	19.3076 (87)
Th 2	19.9659	19.9721	19.9721	19.9808	19.9808	19.9913	19.9888	19.9938	19.9913	19.9862	19.9862	19.9780 (88)
util rest of house	0.9605	0.9422	0.8986	0.8003	0.6326	0.3902	0.2215	0.2454	0.5421	0.8230	0.9327	0.9658 (89)
MIT 2	17.7728	18.0784	18.6324	19.2858	19.7484	19.9595	19.9856	19.9894	19.8923	19.3562	18.5125	17.7435 (90)
Living area fraction									fLA = Living area / (4) =			0.1222 (91)
MIT	17.9635	18.2574	18.7913	19.4222	19.8724	20.0807	20.1084	20.1113	20.0125	19.4888	18.6743	17.9346 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8135	18.1074	18.6413	19.2722	19.7224	19.9307	19.9584	19.9613	19.8625	19.3388	18.5243	17.7846 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9418	0.9197	0.8716	0.7740	0.6162	0.3848	0.2183	0.2419	0.5304	0.7957	0.9090	0.9486 (94)
Useful gains	941.2576	1034.1012	1093.4147	1093.2961	915.5559	585.7960	315.6782	328.9833	660.4460	870.8207	902.7188	895.0623 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2010.9983	1965.2508	1766.3148	1458.7485	1046.3140	604.7397	317.5639	331.6120	717.3291	1197.3663	1628.3456	1980.4105 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	795.8871	625.7325	500.6377	263.1258	97.2840	0.0000	0.0000	0.0000	0.0000	242.9500	522.4513	807.4991 (98)
Space heating												3855.5673 (98)
RHI space heating demand												3856 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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					6 * 10 = 60.0000 (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)					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (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	0.5405	0.5299	0.5193	0.4663	0.4557	0.4027	0.4027	0.3921	0.4239	0.4557	0.4769	0.4981 (22b)
Effective ac	0.6461	0.6404	0.6348	0.6087	0.6038	0.5811	0.5811	0.5769	0.5899	0.6038	0.6137	0.6240 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	73.7674	73.1198	72.4850	69.5035	68.9456	66.3488	66.3488	65.8679	67.3491	68.9456	70.0741	71.2539 (38)
Heat transfer coeff	163.5453	162.8977	162.2629	159.2814	158.7236	156.1267	156.1267	155.6458	157.1270	158.7236	159.8520	161.0318 (39)
Average = Sum(39)m / 12 =												159.2787 (39)
HLP	1.1817	1.1770	1.1724	1.1509	1.1468	1.1281	1.1281	1.1246	1.1353	1.1468	1.1550	1.1635 (40)
HLP (average)												1.1509 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

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Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (64)
Heat gains from water heating, kWh/month	98.2674	87.1525	92.7998	84.9509	84.5252	77.3600	76.0403	81.0352	80.1386	88.0029	90.8386	96.4977 (65)
Total per year (kWh/year) = Sum(64)m =												2247.7859 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7044	63.6872	51.7939	39.2113	29.3109	24.7455	26.7384	34.7556	46.6489	59.2315	69.1319	73.6973 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.0827	463.8466	451.8418	426.2852	394.0245	363.7040	343.4481	338.6842	350.6890	376.2456	408.5063	438.8268 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978 (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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591 (71)
Water heating gains (Table 5)	132.0799	129.6912	124.7308	117.9873	113.6092	107.4445	102.2047	108.9183	111.3037	118.2834	126.1647	129.7012 (72)
Total internal gains	779.5444	773.9023	745.0440	700.1612	653.6220	612.5714	589.0686	599.0355	625.3189	670.4379	720.4803	758.9026 (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	7.0500	36.7938	0.4600	0.0000	0.7700	91.8782 (77)
Southwest	0.7200	36.7938	0.4600	0.0000	0.7700	9.3833 (79)
Northwest	9.5800	11.2829	0.4600	0.0000	0.7700	38.2857 (81)
Southeast	4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)

Solar gains	198.3233	350.5348	513.3956	692.7399	827.6047	844.3514	804.5850	700.4946	574.9560	396.5232	239.8614	168.2248 (83)
Total gains	977.8676	1124.4371	1258.4395	1392.9011	1481.2267	1456.9229	1393.6536	1299.5301	1200.2749	1066.9611	960.3417	927.1274 (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	31.4024	31.5272	31.6506	32.2430	32.3563	32.8945	32.8945	32.9961	32.6851	32.3563	32.1279	31.8925
alpha	3.0935	3.1018	3.1100	3.1495	3.1571	3.1930	3.1930	3.1997	3.1790	3.1571	3.1419	3.1262
util living area	0.9728	0.9574	0.9281	0.8653	0.7581	0.6045	0.4654	0.5109	0.7207	0.8935	0.9580	0.9766 (86)
MIT	19.1059	19.3524	19.7357	20.2248	20.6204	20.8719	20.9585	20.9438	20.7637	20.2504	19.6039	19.0746 (87)
Th 2	19.9347	19.9384	19.9421	19.9595	19.9628	19.9780	19.9780	19.9808	19.9721	19.9628	19.9562	19.9493 (88)
util rest of house	0.9678	0.9496	0.9146	0.8395	0.7114	0.5297	0.3677	0.4121	0.6532	0.8675	0.9490	0.9723 (89)
MIT 2	17.4243	17.7816	18.3322	19.0283	19.5570	19.8704	19.9542	19.9462	19.7531	19.0803	18.1598	17.3880 (90)
Living area fraction	17.6298	17.9735	18.5037	19.1745	19.6869	19.9927	20.0770	20.0681	19.8765	19.2233	18.3363	17.5941 (92)
MIT	17.6298	17.9735	18.5037	19.1745	19.6869	19.9927	20.0770	20.0681	19.8765	19.2233	18.3363	17.5941 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4798	17.8235	18.3537	19.0245	19.5369	19.8427	19.9270	19.9181	19.7265	19.0733	18.1863	17.4441 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	929.6417	1043.3612	1117.4915	1130.2016	1021.3948	756.0567	505.2564	527.0863	761.9318	895.1780	890.6518	887.0808 (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	2155.4897	2105.2083	1923.4125	1612.6450	1243.9033	818.5328	519.4265	547.5756	884.0802	1344.9109	1772.1644	2132.7233 (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	912.0309	713.5613	599.6052	347.3592	165.5464	0.0000	0.0000	0.0000	0.0000	334.6013	634.6891	926.7580 (98)

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Space heating 4634.1515 (98)
 Space heating per m2 (98) / (4) = 33.4838 (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 %) 90.8000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 5103.6911 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	912.0309	713.5613	599.6052	347.3592	165.5464	0.0000	0.0000	0.0000	0.0000	334.6013	634.6891	926.7580 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	1004.4394	785.8605	660.3582	382.5542	182.3198	0.0000	0.0000	0.0000	0.0000	368.5037	698.9968	1020.6586 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (64)
Efficiency of water heater (217)m	88.4909	88.2678	87.8117	86.7889	84.8915	80.1000	80.1000	80.1000	80.1000	86.6025	87.9687	80.1000 (216)
Fuel for water heating, kWh/month	250.2058	221.0942	233.4143	211.7215	212.1287	200.9005	192.9598	211.7142	211.3333	220.0148	229.0113	243.9918 (219)
Water heating fuel used												2638.4900 (219)
Annual totals kWh/year												
Space heating fuel - main system												5103.6911 (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)												506.5287 (232)
Total delivered energy for all uses												8323.7098 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5103.6911	3.4800	177.6084 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2638.4900	3.4800	91.8195 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	506.5287	13.1900	66.8111 (250)
Additional standing charges			120.0000 (251)
Total energy cost			466.1315 (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] = 1.0675 (257)
 SAP value 85.1087
 SAP rating (Section 12) 85 (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	5103.6911	0.2160	1102.3973 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2638.4900	0.2160	569.9138 (264)
Space and water heating			1672.3111 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	506.5287	0.5190	262.8884 (268)
Total kg/year			1974.1245 (272)
CO2 emissions per m2			14.2600 (273)
EI value			85.5762
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9080 = 3.833$, stars = 4
 Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9080 = 0.2379$, stars = 4

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Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8498 = 4.095$, stars = 4
 $0.216 / 0.8498 = 0.2542$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 346.0000 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4451	0.4239	0.4239	0.3921	0.3921	0.3497	0.3603	0.3391	0.3497	0.3709	0.3709	0.4027 (22b)
Effective ac	0.5991	0.5899	0.5899	0.5769	0.5769	0.5612	0.5649	0.5575	0.5612	0.5688	0.5688	0.5811 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	68.4006	67.3491	67.3491	65.8679	65.8679	64.0726	64.5022	63.6558	64.0726	64.9446	64.9446	66.3488 (38)
Heat transfer coeff	158.1785	157.1270	157.1270	155.6458	155.6458	153.8505	154.2801	153.4337	153.8505	154.7225	154.7225	156.1267 (39)
Average = Sum(39)m / 12 =												155.3926 (39)
HLP	1.1429	1.1353	1.1353	1.1246	1.1246	1.1116	1.1147	1.1086	1.1116	1.1179	1.1179	1.1281 (40)
HLP (average)												1.1228 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	1626.9939 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867 (64)
Heat gains from water heating, kWh/month	98.2674	87.1525	92.7998	84.9509	84.5252	77.3600	76.0403	81.0352	80.1386	88.0029	90.8386	96.4977 (65)
Total per year (kWh/year) = Sum(64)m =												2247.7859 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7044	63.6872	51.7939	39.2113	29.3109	24.7455	26.7384	34.7556	46.6489	59.2315	69.1319	73.6973 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.0827	463.8466	451.8418	426.2852	394.0245	363.7040	343.4481	338.6842	350.6890	376.2456	408.5063	438.8268 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978 (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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591 (71)
Water heating gains (Table 5)	132.0799	129.6912	124.7308	117.9873	113.6092	107.4445	102.2047	108.9183	111.3037	118.2834	126.1647	129.7012 (72)
Total internal gains	779.5444	773.9023	745.0440	700.1612	653.6220	612.5714	589.0686	599.0355	625.3189	670.4379	720.4803	758.9026 (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					7.0500	40.4699		0.4600	0.0000	0.7700	101.0578 (77)	
Southwest					0.7200	40.4699		0.4600	0.0000	0.7700	10.3208 (79)	
Northwest					9.5800	12.9236		0.4600	0.0000	0.7700	43.8527 (81)	
Southeast					4.5100	40.4699		0.4600	0.0000	0.7700	64.6483 (77)	

Solar gains	219.8797	350.4790	509.3800	712.3383	832.1318	909.6525	857.0167	761.0003	619.7670	423.9462	272.5881	184.6250 (83)
Total gains	999.4240	1124.3813	1254.4240	1412.4995	1485.7538	1522.2240	1446.0853	1360.0358	1245.0859	1094.3840	993.0684	943.5276 (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	32.4678	32.6851	32.6851	32.9961	32.9961	33.3812	33.2882	33.4719	33.3812	33.1930	33.1930	32.8945
alpha	3.1645	3.1790	3.1790	3.1997	3.1997	3.2254	3.2192	3.2315	3.2254	3.2129	3.2129	3.1930
util living area	0.9668	0.9512	0.9149	0.8322	0.6909	0.4760	0.3244	0.3523	0.6249	0.8578	0.9447	0.9713 (86)
MIT	19.3333	19.5438	19.9331	20.4027	20.7634	20.9516	20.9900	20.9872	20.8759	20.4411	19.8367	19.3076 (87)
Th 2	19.9659	19.9721	19.9721	19.9808	19.9808	19.9913	19.9888	19.9938	19.9913	19.9862	19.9862	19.9780 (88)
util rest of house	0.9605	0.9422	0.8986	0.8003	0.6326	0.3902	0.2215	0.2454	0.5421	0.8230	0.9327	0.9658 (89)
MIT 2	17.7728	18.0784	18.6324	19.2858	19.7484	19.9595	19.9856	19.9894	19.8923	19.3562	18.5125	17.7435 (90)
Living area fraction	17.9635	18.2574	18.7913	19.4222	19.8724	20.0807	20.1084	20.1113	20.0125	19.4888	18.6743	17.9346 (92)
MIT	17.9635	18.2574	18.7913	19.4222	19.8724	20.0807	20.1084	20.1113	20.0125	19.4888	18.6743	17.9346 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8135	18.1074	18.6413	19.2722	19.7224	19.9307	19.9584	19.9613	19.8625	19.3388	18.5243	17.7846 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	941.2576	1034.1012	1093.4147	1093.2961	915.5559	585.7960	315.6782	328.9833	660.4460	870.8207	902.7188	895.0623 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2010.9983	1965.2508	1766.3148	1458.7485	1046.3140	604.7397	317.5639	331.6120	717.3291	1197.3663	1628.3456	1980.4105 (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	795.8871	625.7325	500.6377	263.1258	97.2840	0.0000	0.0000	0.0000	0.0000	242.9500	522.4513	807.4991 (98)

FULL SAP CALCULATION PRINTOUT

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

Space heating 3855.5673 (98)
 Space heating per m2 (98) / (4) = 27.8581 (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 %)												90.8000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4246.2195	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.8871	625.7325	500.6377	263.1258	97.2840	0.0000	0.0000	0.0000	0.0000	242.9500	522.4513	807.4991	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	876.5276	689.1327	551.3631	289.7861	107.1410	0.0000	0.0000	0.0000	0.0000	267.5660	575.3869	889.3161	(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	221.4093	195.1549	204.9651	183.7508	180.0793	160.9213	154.5608	169.5831	169.2779	190.5384	201.4583	216.0867	(64)
Efficiency of water heater	88.2347	88.0052	87.4083	86.0722	83.5535	80.1000	80.1000	80.1000	80.1000	85.7643	87.5455	88.3096	(216)
(217)m	88.2347	88.0052	87.4083	86.0722	83.5535	80.1000	80.1000	80.1000	80.1000	85.7643	87.5455	88.3096	(217)
Fuel for water heating, kWh/month	250.9322	221.7539	234.4917	213.4844	215.5259	200.9005	192.9598	211.7142	211.3333	222.1652	230.1184	244.6921	(219)
Water heating fuel used	250.9322	221.7539	234.4917	213.4844	215.5259	200.9005	192.9598	211.7142	211.3333	222.1652	230.1184	2650.0716	(219)
Annual totals kWh/year													
Space heating fuel - main system												4246.2195	(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)												506.5287	(232)
Total delivered energy for all uses												7477.8198	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4246.2195	3.9200	166.4518	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2650.0716	3.9200	103.8828	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	506.5287	16.9600	85.9073	(250)
Additional standing charges			88.0000	(251)
Total energy cost			456.9619	(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	4246.2195	0.2160	917.1834	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2650.0716	0.2160	572.4155	(264)
Space and water heating			1489.5989	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	506.5287	0.5190	262.8884	(268)
Total kg/year			1791.4123	(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	4246.2195	1.2200	5180.3878	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2650.0716	1.2200	3233.0874	(264)
Space and water heating			8413.4752	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	506.5287	3.0700	1555.0431	(268)
Primary energy kWh/year			10198.7683	(272)
Primary energy kWh/m2/year			73.6905	(273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

(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	Recommended
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	-£ 44	-264 kg (14.7%)
U Solar photovoltaic panels	+ 7.3	-£ 309	-947 kg (62.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£44	1.91 kg/m²	B 86 B 87
Solar photovoltaic panels	£309	6.84 kg/m²	A 94 A 94
Total Savings	£354	8.75 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£99	£107	-£8
Mains gas	£358	£306	£53
Space heating	£267	£268	-£1
Water heating	£104	£58	£45
Lighting	£86	£86	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£457	£104	£354
Total cost of uses	£457	£103	£353
Delivered energy	54 kWh/m²	32 kWh/m²	23 kWh/m²
Carbon dioxide emissions	1.8 tonnes	0.6 tonnes	1.2 tonnes
CO2 emissions per m²	13 kg/m²	4 kg/m²	9 kg/m²
Primary energy	74 kWh/m²	23 kWh/m²	51 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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					6 * 10 = 60.0000 (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)					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (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	0.5405	0.5299	0.5193	0.4663	0.4557	0.4027	0.4027	0.3921	0.4239	0.4557	0.4769	0.4981 (22b)
Effective ac	0.6461	0.6404	0.6348	0.6087	0.6038	0.5811	0.5811	0.5769	0.5899	0.6038	0.6137	0.6240 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	73.7674	73.1198	72.4850	69.5035	68.9456	66.3488	66.3488	65.8679	67.3491	68.9456	70.0741	71.2539 (38)
Heat transfer coeff	163.5453	162.8977	162.2629	159.2814	158.7236	156.1267	156.1267	155.6458	157.1270	158.7236	159.8520	161.0318 (39)
Average = Sum(39)m / 12 =												159.2787 (39)
HLP	1.1817	1.1770	1.1724	1.1509	1.1468	1.1281	1.1281	1.1246	1.1353	1.1468	1.1550	1.1635 (40)
HLP (average)												1.1509 (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											2.9140 (42)	
Average daily hot water use (litres/day)											103.4069 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	20.6237	19.9584	20.6237	19.9584	20.6237 (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	212.5705	187.1715	194.7307	168.4436	158.4463	139.7610	132.6951	148.6479	155.3215	180.3039	192.9047	207.2480 (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												1.1147 (H8)
Utilisation factor												0.5923 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												103.4069 (H14)
Volume ratio Veff/V												1.2330 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-944.4575 (H17)
Solar input	-27.3874	-45.7017	-77.8352	-104.3145	-128.8718	-126.7015	-125.0271	-109.2368	-85.5543	-58.4235	-32.4854	-22.9186 (63)
Solar input (sum of months) = Sum(63)m =												-944.4575 (63)
Output from w/h	185.1832	141.4699	116.8955	64.1291	29.5745	13.0595	7.6681	39.4112	69.7672	121.8804	160.4193	184.3294 (64)
Total per year (kWh/year) = Sum(64)m =												1133.7872 (64)
Heat gains from water heating, kWh/month	91.1964	80.7658	84.6122	72.7051	67.2188	60.4318	58.5478	64.2871	68.9735	79.8153	83.9957	89.4267 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7044	63.6872	51.7939	39.2113	29.3109	24.7455	26.7384	34.7556	46.6489	59.2315	69.1319	73.6973	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.0827	463.8466	451.8418	426.2852	394.0245	363.7040	343.4481	338.6842	350.6890	376.2456	408.5063	438.8268	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	(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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	(71)
Water heating gains (Table 5)	122.5759	120.1872	113.7260	100.9793	90.3478	83.9330	78.6932	86.4074	95.7965	107.2786	116.6607	120.1972	(72)
Total internal gains	770.0404	764.3983	734.0392	683.1532	630.3606	589.0600	565.5571	576.5246	609.8117	659.4331	710.9763	749.3986	(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
Southeast	7.0500	36.7938	0.4600	0.0000	0.7700	91.8782 (77)
Southwest	0.7200	36.7938	0.4600	0.0000	0.7700	9.3833 (79)
Northwest	9.5800	11.2829	0.4600	0.0000	0.7700	38.2857 (81)
Southeast	4.5100	36.7938	0.4600	0.0000	0.7700	58.7760 (77)

Solar gains	198.3233	350.5348	513.3956	692.7399	827.6047	844.3514	804.5850	700.4946	574.9560	396.5232	239.8614	168.2248 (83)
Total gains	968.3636	1114.9331	1247.4347	1375.8931	1457.9653	1433.4114	1370.1422	1277.0192	1184.7677	1055.9563	950.8377	917.6234 (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	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.4024	31.5272	31.6506	32.2430	32.3563	32.8945	32.8945	32.9961	32.6851	32.3563	32.1279	31.8925
alpha	3.0935	3.1018	3.1100	3.1495	3.1571	3.1930	3.1930	3.1997	3.1790	3.1571	3.1419	3.1262
util living area	0.9735	0.9583	0.9295	0.8686	0.7641	0.6115	0.4722	0.5183	0.7259	0.8958	0.9590	0.9772 (86)
MIT	19.0967	19.3438	19.7267	20.2138	20.6108	20.8675	20.9568	20.9414	20.7583	20.2424	19.5952	19.0653 (87)
Th 2	19.9347	19.9384	19.9421	19.9595	19.9628	19.9780	19.9780	19.9808	19.9721	19.9628	19.9562	19.9493 (88)
util rest of house												
	0.9686	0.9506	0.9163	0.8432	0.7178	0.5366	0.3735	0.4186	0.6587	0.8702	0.9502	0.9730 (89)
MIT 2	17.4112	17.7693	18.3197	19.0139	19.5457	19.8663	19.9532	19.9446	19.7475	19.0699	18.1475	17.3746 (90)
Living area fraction												fLA = Living area / (4) = 0.1222 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	5140.1715	0.2160	1110.2770 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1294.6429	0.2160	279.6429 (264)
Space and water heating			1389.9199 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	506.5287	0.5190	262.8884 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			821.2461 (272)
EI value			5.9300 (273)
EI rating			93.9996
EI band			94 (274) A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	69.2000 (1b)	x 2.3900 (2b)	= 165.3880 (1b) - (3b)
First floor	69.2000 (1c)	x 2.6100 (2c)	= 180.6120 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	138.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 346.0000 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1734 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4239 (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) =	0.4239 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4451	0.4239	0.4239	0.3921	0.3921	0.3497	0.3603	0.3391	0.3497	0.3709	0.3709	0.4027 (22b)
	0.5991	0.5899	0.5899	0.5769	0.5769	0.5612	0.5649	0.5575	0.5612	0.5688	0.5688	0.5811 (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	1.4000	2.8420		(26a)
Window (Uw = 1.30)			17.3500	1.2357	21.4401		(27)
French Door (Uw = 1.30)			4.5100	1.2357	5.5732		(27)
GF B&B J150 P/A=0.50			69.2000	0.1200	8.3040	75.0000	5190.0000 (28a)
EW Brick AAC011	166.4500	25.9200	140.5300	0.2400	33.7272	42.1000	5916.3130 (29a)
PR 400mm MW044	69.2000		69.2000	0.1100	7.6120	9.0000	622.8000 (30)
Total net area of external elements Aum(A, m ²)			304.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7977		(33)
GF Masonry			76.5300			39.0000	2984.6700 (32c)
GF Timber			41.7800			9.0000	376.0200 (32c)
1F Timber			170.0400			9.0000	1530.3600 (32c)
Internal Floor			69.2000			18.0000	1245.6000 (32d)
Internal Ceiling			69.2000			9.0000	622.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18488.5630 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							133.5879 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9802 (36)
Total fabric heat loss						(33) + (36) =	89.7779 (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	68.4006	67.3491	67.3491	65.8679	65.8679	64.0726	64.5022	63.6558	64.0726	64.9446	64.9446	66.3488 (38)
Heat transfer coeff	158.1785	157.1270	157.1270	155.6458	155.6458	153.8505	154.2801	153.4337	153.8505	154.7225	154.7225	156.1267 (39)
Average = Sum(39)m / 12 =												155.3926 (39)
HLP	1.1429	1.1353	1.1353	1.1246	1.1246	1.1116	1.1147	1.1086	1.1116	1.1179	1.1179	1.1281 (40)
HLP (average)												1.1228 (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												2.9140 (42)
Average daily hot water use (litres/day)												103.4069 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.7476	109.6114	105.4751	101.3388	97.2025	93.0663	93.0663	97.2025	101.3388	105.4751	109.6114	113.7476 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	168.6845	147.5325	152.2403	132.7268	127.3545	109.8973	101.8360	116.8583	118.2539	137.8136	150.4343	163.3619 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3027	22.1299	22.8361	19.9090	19.1032	16.4846	15.2754	17.5287	17.7381	20.6720	22.5651	24.5043 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624 (56)
If cylinder contains dedicated solar storage	20.6237	18.6278	20.6237	19.9584	20.6237	19.9584	20.6237	20.6237	19.9584	20.6237	19.9584	20.6237 (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	212.5705	187.1715	194.7307	168.4436	158.4463	139.7610	132.6951	148.6479	155.3215	180.3039	192.9047	207.2480 (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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1772 (H8)
Utilisation factor												0.5723 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												103.4069 (H14)
Volume ratio Veff/V												1.2330 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-963.9290 (H17)
Solar input	-29.6693	-44.5928	-75.1000	-103.8111	-125.0235	-131.5818	-128.4223	-114.6819	-89.5096	-60.8917	-36.0638	-24.5812 (63)
Solar input (sum of months) = Sum(63)m =												-963.9290 (63)
Output from w/h	182.9013	142.5787	119.6307	64.6325	33.4228	8.1791	4.2728	33.9660	65.8118	119.4122	156.8409	182.6668 (64)
Total per year (kWh/year) = Sum(64)m =												1114.3157 (64)
Heat gains from water heating, kWh/month	91.1964	80.7658	84.6122	72.7051	67.2188	60.4318	58.5478	64.2871	68.9735	79.8153	83.9957	89.4267 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	174.8386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.7044	63.6872	51.7939	39.2113	29.3109	24.7455	26.7384	34.7556	46.6489	59.2315	69.1319	73.6973	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	459.0827	463.8466	451.8418	426.2852	394.0245	363.7040	343.4481	338.6842	350.6890	376.2456	408.5063	438.8268	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	55.3978	(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)	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	-116.5591	(71)
Water heating gains (Table 5)	122.5759	120.1872	113.7260	100.9793	90.3478	83.9330	78.6932	86.4074	95.7965	107.2786	116.6607	120.1972	(72)
Total internal gains	770.0404	764.3983	734.0392	683.1532	630.3606	589.0600	565.5571	576.5246	609.8117	659.4331	710.9763	749.3986	(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					7.0500	40.4699	0.4600	0.0000	0.7700			101.0578 (77)
Southwest					0.7200	40.4699	0.4600	0.0000	0.7700			10.3208 (79)
Northwest					9.5800	12.9236	0.4600	0.0000	0.7700			43.8527 (81)
Southeast					4.5100	40.4699	0.4600	0.0000	0.7700			64.6483 (77)

Solar gains	219.8797	350.4790	509.3800	712.3383	832.1318	909.6525	857.0167	761.0003	619.7670	423.9462	272.5881	184.6250 (83)
Total gains	989.9200	1114.8773	1243.4192	1395.4915	1462.4924	1498.7125	1422.5738	1337.5249	1229.5787	1083.3792	983.5644	934.0236 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.4678	32.6851	32.6851	32.9961	32.9961	33.3812	33.2882	33.4719	33.3812	33.1930	33.1930	32.8945	
alpha	3.1645	3.1790	3.1790	3.1997	3.1997	3.2254	3.2192	3.2315	3.2254	3.2129	3.2129	3.1930	
util living area	0.9676	0.9522	0.9166	0.8360	0.6975	0.4824	0.3295	0.3578	0.6303	0.8607	0.9460	0.9720 (86)	
MIT	19.3243	19.5353	19.9245	20.3931	20.7564	20.9497	20.9896	20.9866	20.8726	20.4342	19.8284	19.2984 (87)	
Th 2	19.9659	19.9721	19.9721	19.9808	19.9808	19.9913	19.9888	19.9938	19.9913	19.9862	19.9862	19.9780 (88)	
util rest of house	0.9615	0.9433	0.9006	0.8045	0.6394	0.3958	0.2251	0.2495	0.5474	0.8263	0.9342	0.9667 (89)	
MIT 2	17.7599	18.0663	18.6206	19.2735	19.7409	19.9581	19.9855	19.9891	19.8895	19.3475	18.5008	17.7303 (90)	
Living area fraction													fLA = Living area / (4) = 0.1222 (91)

MIT	17.9510	18.2458	18.7799	19.4103	19.8650	20.0793	20.1082	20.1110	20.0096	19.4803	18.6630	17.9219 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8010	18.0958	18.6299	19.2603	19.7150	19.9293	19.9582	19.9610	19.8596	19.3303	18.5130	17.7719 (93)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4279.2312	0.2160	924.3139 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1275.0427	0.2160	275.4092 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			1199.7232 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	506.5287	0.5190	262.8884 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			580.7477 (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	4279.2312	1.2200	5220.6621 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1275.0427	1.2200	1555.5521 (264)
Space and water heating			6776.2142 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	506.5287	3.0700	1555.0431 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			3114.8372 (272)
Primary energy kWh/m2/year			22.5060 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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 West
Overshading	Average or unknown
Thermal mass parameter	133.6 (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	456.72 (P1)
Transmission heat loss coefficient	89.78 (37)
Summer heat loss coefficient	546.50 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	7.0500	119.9223	0.4600	0.0000	0.9000	350.0174
South West	0.7200	119.9223	0.4600	0.0000	0.9000	35.7465
North West	9.5800	98.8453	0.4600	0.0000	0.9000	392.0322
South East	4.5100	119.9223	0.4600	0.0000	0.9000	223.9118

total: 1001.7078

	Jun	Jul	Aug	
Solar gains	1063	1002	889	(P4)
Internal gains	610	586	596	
Total summer gains	1673	1588	1486	(P5)
Summer gain/loss ratio	3.06	2.91	2.72	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 133.6)	1.06	1.06	1.06	
Threshold temperature	20.13	21.87	21.58	(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 Designed)



Property Reference	4907-P637-6633-656			Issued on Date	19/10/2022
Assessment Reference	Plot 656	Prop Type Ref	Bowyer Bay-CB-As-DET		
Property	Plot 656, 4 Bed, K, WC, U, B, ES, Country Brick				
SAP Rating	84 B	DER	16.57	TER	17.49
Environmental	85 B	% DER<TER	5.27		
CO ₂ Emissions (t/year)	1.77	DFEE	51.54	TFEE	61.74
General Requirements Compliance	Pass	% DFEE<TFEE	16.53		
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk			Assessor ID	P637-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 126 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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)	0.14 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:	Average
Windows facing North East:	13.42 m ² , No overhang
Windows facing South East:	7.78 m ² , No overhang
Windows facing South West:	3.86 m ² , No overhang
Windows facing North West:	8.98 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
Floor U-value	0.12 W/m ² K
Door U-value	0.80 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =		0.3778 (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	0.4817	0.4723	0.4628	0.4156	0.4062	0.3589	0.3589	0.3495	0.3778	0.4062	0.4251	0.4439 (22b)
Effective ac	0.6160	0.6115	0.6071	0.5864	0.5825	0.5644	0.5644	0.5611	0.5714	0.5825	0.5903	0.5985 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	63.8637	63.3966	62.9387	60.7882	60.3859	58.5128	58.5128	58.1660	59.2343	60.3859	61.1998	62.0508 (38)
Average = Sum(39)m / 12 =	168.5635	168.0964	167.6385	165.4880	165.0856	163.2126	163.2126	162.8658	163.9341	165.0856	165.8996	166.7506 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3397	1.3360	1.3324	1.3153	1.3121	1.2972	1.2972	1.2944	1.3029	1.3121	1.3185	1.3253 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (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												
	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Heat gains from water heating, kWh/month												
	93.0507	82.4519	87.6216	79.9740	79.4054	72.4367	70.9803	75.9400	75.1957	82.8585	85.8202	91.2934 (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	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	26.0863	23.1696	18.8428	14.2652	10.6634	9.0025	9.7275	12.6442	16.9710	21.5486	25.1504	26.8113 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	292.6086	295.6450	287.9934	271.7042	251.1420	231.8165	218.9058	215.8694	223.5210	239.8102	260.3724	279.6979 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	125.0681	122.6963	117.7709	111.0750	106.7277	100.6065	95.4037	102.0699	104.4385	111.3690	119.1947	122.7062 (72)
Total internal gains												
	513.0120	510.7598	493.8561	466.2934	437.7821	410.6745	393.2860	399.8325	414.1794	441.9767	473.9664	498.4644 (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		13.4200	11.2829	0.4600	0.0000	0.7700	53.6319 (75)
Southeast		7.7800	36.7938	0.4600	0.0000	0.7700	101.3919 (77)
Southwest		3.8600	36.7938	0.4600	0.0000	0.7700	50.3050 (79)
Northwest		5.6500	11.2829	0.4600	0.0000	0.7700	22.5798 (81)
Northwest		3.3300	11.2829	0.4600	0.0000	0.7700	13.3081 (81)

Solar gains	241.2166	440.6159	681.8511	977.2309	1215.4143	1259.7760	1192.4395	1006.6182	782.8601	508.2698	294.3369	202.9272 (83)
Total gains	754.2286	951.3758	1175.7072	1443.5242	1653.1964	1670.4505	1585.7255	1406.4507	1197.0395	950.2465	768.3033	701.3916 (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	28.0182	28.0960	28.1728	28.5389	28.6084	28.9367	28.9367	28.9984	28.8094	28.6084	28.4681	28.3228
alpha	2.8679	2.8731	2.8782	2.9026	2.9072	2.9291	2.9291	2.9332	2.9206	2.9072	2.8979	2.8882
util living area												
	0.9831	0.9673	0.9321	0.8503	0.7159	0.5550	0.4274	0.4898	0.7235	0.9112	0.9720	0.9862 (86)
MIT												
Th 2	18.6945	19.0120	19.5128	20.1326	20.6060	20.8678	20.9546	20.9322	20.7023	20.0466	19.2563	18.6451 (87)
util rest of house												
	0.9797	0.9607	0.9184	0.8207	0.6623	0.4743	0.3247	0.3823	0.6497	0.8868	0.9653	0.9834 (89)
MIT 2	16.7556	17.2163	17.9351	18.8061	19.4255	19.7386	19.8194	19.8066	19.5703	18.7135	17.5830	16.6901 (90)
Living area fraction												
MIT	17.0983	17.5337	18.2140	19.0406	19.6341	19.9382	20.0200	20.0056	19.7704	18.9491	17.8788	17.0356 (92)
Temperature adjustment												
adjusted MIT	16.9483	17.3837	18.0640	18.8906	19.4841	19.7882	19.8700	19.8556	19.6204	18.7991	17.7288	16.8856 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9666	0.9409	0.8910	0.7918	0.6444	0.4702	0.3272	0.3833	0.6337	0.8578	0.9471	0.9721 (94)
Ext temp.	729.0219	895.1700	1047.5949	1143.0473	1065.3761	785.4562	518.9205	539.1550	758.5049	815.0836	727.6710	681.7878 (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	2132.0475	2098.4639	1938.5738	1653.3219	1285.0468	846.7750	533.7085	562.7939	904.9833	1353.5548	1763.3109	2115.3377 (97)
	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 Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	1043.8510	808.6135	662.8883	367.3977	163.4350	0.0000	0.0000	0.0000	0.0000	400.6225	745.6607	1066.5611 (98)
Space heating												5259.0300 (98)
Space heating per m2												(98) / (4) = 41.7980 (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												5817.5111 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1043.8510	808.6135	662.8883	367.3977	163.4350	0.0000	0.0000	0.0000	0.0000	400.6225	745.6607	1066.5611 (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)	1154.7025	894.4840	733.2835	406.4134	180.7910	0.0000	0.0000	0.0000	0.0000	443.1665	824.8460	1179.8243 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Efficiency of water heater	88.3798	88.1608	87.6937	86.6193	84.5599	79.7000	79.7000	79.7000	79.7000	86.7411	87.9564	79.7000 (216)
(217)m	88.3798	88.1608	87.6937	86.6193	84.5599	79.7000	79.7000	79.7000	79.7000	86.7411	87.9564	88.4549 (217)
Fuel for water heating, kWh/month	242.3551	214.0078	225.6319	204.3223	204.7717	193.6187	185.4656	204.1812	204.0299	211.5950	221.2063	236.1745 (219)
Water heating fuel used												2547.3601 (219)
Annual totals kWh/year												
Space heating fuel - main system												5817.5111 (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)												460.6917 (232)
Total delivered energy for all uses												8900.5628 (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	5817.5111	0.2160	1256.5824 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2547.3601	0.2160	550.2298 (264)
Space and water heating			1806.8122 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	460.6917	0.5190	239.0990 (268)
Total CO2, kg/year			2084.8362 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5700 (273)

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

DER			16.5700 ZC1
Total Floor Area		TFA	125.8200
Assumed number of occupants		N	2.8833
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.7811 ZC2
CO2 emissions from cooking, equation (L16)			1.4958 ZC3
Total CO2 emissions			31.8469 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			31.8469 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) =	0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3773 (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) =		0.3773 (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	0.4811	0.4717	0.4622	0.4151	0.4056	0.3585	0.3585	0.3490	0.3773	0.4056	0.4245	0.4434 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5823	0.5642	0.5642	0.5609	0.5712	0.5823	0.5901	0.5983 (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)			27.3900	1.3258	36.3125		(27)
GF B&B J150 P/A=0.50			64.7300	0.1300	8.4149		(28a)
EW Brick AAC011	166.2400	31.4500	134.7900	0.1800	24.2622		(29a)
PR 400mm MW044	61.0900		61.0900	0.1300	7.9417		(30)
Bays	3.6300		3.6300	0.1300	0.4719		(30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.8692		(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)							15.8662 (36)
Total fabric heat loss						(33) + (36) =	97.7354 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	63.8318	63.3660	62.9093	60.7645	60.3632	58.4952	58.4952	58.1492	59.2147	60.3632	61.1750	62.0237 (38)
Heat transfer coeff	161.5672	161.1014	160.6447	158.4999	158.0986	156.2306	156.2306	155.8846	156.9501	158.0986	158.9104	159.7591 (39)
Average = Sum(39)m / 12 =												158.4980 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2841	1.2804	1.2768	1.2597	1.2565	1.2417	1.2417	1.2389	1.2474	1.2565	1.2630	1.2697 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy conte	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Energy content (annual)												Total = Sum(45)m = 1615.5178 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												180.0000 (47)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
216.7373	190.9691	200.4092	179.4448	175.6989	156.7763	150.3603	165.2767	165.0740	186.0842	197.0274	211.4523	(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												
216.7373	190.9691	200.4092	179.4448	175.6989	156.7763	150.3603	165.2767	165.0740	186.0842	197.0274	211.4523	(64)
Heat gains from water heating, kWh/month												
95.0861	84.2903	89.6570	81.9437	81.4408	74.4065	73.0158	77.9754	77.1655	84.8939	87.7899	93.3288	(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	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
26.1053	23.1865	18.8565	14.2756	10.6712	9.0091	9.7346	12.6534	16.9834	21.5643	25.1687	26.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
292.6086	295.6450	287.9934	271.7042	251.1420	231.8165	218.9058	215.8694	223.5210	239.8102	260.3724	279.6979	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	(71)
Water heating gains (Table 5)												
127.8039	125.4321	120.5067	113.8107	109.4635	103.3423	98.1395	104.8057	107.1742	114.1047	121.9305	125.4420	(72)
Total internal gains												
515.7668	513.5125	496.6056	469.0395	440.5257	413.4168	396.0288	402.5775	416.9275	444.7282	476.7205	501.2197	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast					10.8000	11.2829	0.6300	0.7000	0.7700	37.2407 (75)			
Southeast					6.2600	36.7938	0.6300	0.7000	0.7700	70.3917 (77)			
Southwest					3.1100	36.7938	0.6300	0.7000	0.7700	34.9709 (79)			
Northwest					7.2200	11.2829	0.6300	0.7000	0.7700	24.8961 (81)			
Solar gains	167.4994	305.9527	473.4397	678.5044	843.8541	874.6446	827.8976	698.8991	543.5645	352.9243	204.3843	140.9125	(83)
Total gains	683.2662	819.4652	970.0454	1147.5440	1284.3798	1288.0614	1223.9265	1101.4766	960.4920	797.6525	681.1048	642.1322	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0796	54.2360	54.3902	55.1262	55.2661	55.9270	55.9270	56.0511	55.6706	55.2661	54.9838	54.6917
alpha	4.6053	4.6157	4.6260	4.6751	4.6844	4.7285	4.7285	4.7367	4.7114	4.6844	4.6656	4.6461
util living area	0.9987	0.9966	0.9898	0.9615	0.8748	0.7078	0.5449	0.6185	0.8705	0.9823	0.9971	0.9990 (86)
MIT	19.5312	19.7044	20.0010	20.4040	20.7461	20.9352	20.9850	20.9737	20.8190	20.3698	19.8812	19.5080 (87)
Th 2	19.8533	19.8562	19.8591	19.8725	19.8750	19.8868	19.8868	19.8890	19.8823	19.8750	19.8699	19.8646 (88)
util rest of house	0.9982	0.9954	0.9859	0.9462	0.8267	0.6107	0.4155	0.4848	0.8007	0.9728	0.9959	0.9987 (89)
MIT 2	17.8994	18.1543	18.5878	19.1723	19.6276	19.8445	19.8815	19.8783	19.7335	19.1346	18.4228	17.8732 (90)
Living area fraction									fLA = Living area / (4) =			0.1768 (91)
MIT	18.1878	18.4283	18.8376	19.3900	19.8253	20.0373	20.0765	20.0719	19.9254	19.3530	18.6806	18.1621 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1878	18.4283	18.8376	19.3900	19.8253	20.0373	20.0765	20.0719	19.9254	19.3530	18.6806	18.1621 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9971	0.9931	0.9809	0.9377	0.8242	0.6249	0.4384	0.5082	0.8040	0.9665	0.9939	0.9978	(94)
Useful gains	681.2743	813.8458	951.5426	1076.0129	1058.5227	804.9676	536.5955	559.7219	772.2180	770.9036	676.9356	640.7262 (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												
2243.8210	2179.4224	1981.9717	1662.6611	1284.6000	849.4711	543.1406	572.3977	914.2978	1383.8297	1840.2734	2230.5798	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh												
1162.5348	917.6674	766.6392	422.3867	168.2015	0.0000	0.0000	0.0000	0.0000	456.0170	837.6032	1182.8510	(98)
Space heating												5913.9008 (98)
Space heating per m2												(98) / (4) = 47.0029 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6325.0276	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1162.5348	917.6674	766.6392	422.3867	168.2015	0.0000	0.0000	0.0000	0.0000	456.0170	837.6032	1182.8510	(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)	1243.3527	981.4625	819.9350	451.7505	179.8947	0.0000	0.0000	0.0000	0.0000	487.7187	895.8323	1265.0813	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	216.7373	190.9691	200.4092	179.4448	175.6989	156.7763	150.3603	165.2767	165.0740	186.0842	197.0274	211.4523	(64)	
Efficiency of water heater (217)m	88.6325	88.4569	88.0532	87.0209	84.6978	79.8000	79.8000	79.8000	79.8000	87.1148	88.2467	88.6964	(216)	
Fuel for water heating, kWh/month	244.5348	215.8894	227.6000	206.2087	207.4420	196.4615	188.4215	207.1136	206.8597	213.6079	223.2689	238.4001	(219)	
Water heating fuel used												2575.8082	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6325.0276	(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)													461.0275	(232)
Total delivered energy for all uses													9436.8633	(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	6325.0276	0.2160	1366.2060 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2575.8082	0.2160	556.3746 (264)
Space and water heating			1922.5805 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	461.0275	0.5190	239.2733 (268)
Total CO2, kg/m2/year			2200.7788 (272)
Emissions per m2 for space and water heating			15.2804 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9017 (272b)
Emissions per m2 for pumps and fans			0.3094 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2804 * 1.00) + 1.9017 + 0.3094, rounded to 2 d.p.			17.4900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =	0.3778 (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	0.4817	0.4723	0.4628	0.4156	0.4062	0.3589	0.3589	0.3495	0.3778	0.4062	0.4251	0.4439 (22b)
Effective ac	0.6160	0.6115	0.6071	0.5864	0.5825	0.5644	0.5644	0.5611	0.5714	0.5825	0.5903	0.5985 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			9.0000	549.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16452.4240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.7616 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	63.8637	63.3966	62.9387	60.7882	60.3859	58.5128	58.5128	58.1660	59.2343	60.3859	61.1998	62.0508 (38)
Average = Sum(39)m / 12 =	168.5635	168.0964	167.6385	165.4880	165.0856	163.2126	163.2126	162.8658	163.9341	165.0856	165.8996	166.7506 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3397	1.3360	1.3324	1.3153	1.3121	1.2972	1.2972	1.2944	1.3029	1.3121	1.3185	1.3253 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1615.5178 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5926	31.1295	32.1229	28.0055	26.8719	23.1884	21.4875	24.6572	24.9517	29.0788	31.7418	34.4695 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.0863	23.1696	18.8428	14.2652	10.6634	9.0025	9.7275	12.6442	16.9710	21.5486	25.1504	26.8113	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6086	295.6450	287.9934	271.7042	251.1420	231.8165	218.9058	215.8694	223.5210	239.8102	260.3724	279.6979	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	(71)
Water heating gains (Table 5)	47.8395	46.3237	43.1759	38.8965	36.1182	32.2062	28.8811	33.1414	34.6552	39.0844	44.0858	46.3300	(72)
Total internal gains	432.7834	431.3872	416.2611	391.1149	364.1726	339.2741	323.7633	327.9040	341.3961	366.6922	395.8576	419.0882	(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					13.4200	11.2829	0.4600	0.0000			0.7700			53.6319 (75)
Southeast					7.7800	36.7938	0.4600	0.0000			0.7700			101.3919 (77)
Southwest					3.8600	36.7938	0.4600	0.0000			0.7700			50.3050 (79)
Northwest					5.6500	11.2829	0.4600	0.0000			0.7700			22.5798 (81)
Northwest					3.3300	11.2829	0.4600	0.0000			0.7700			13.3081 (81)
Solar gains	241.2166	440.6159	681.8511	977.2309	1215.4143	1259.7760	1192.4395	1006.6182	782.8601	508.2698	294.3369	202.9272	(83)	
Total gains	674.0000	872.0032	1098.1122	1368.3458	1579.5869	1599.0502	1516.2029	1334.5222	1124.2562	874.9620	690.1945	622.0155	(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	27.1121	27.1875	27.2617	27.6160	27.6833	28.0010	28.0010	28.0606	27.8778	27.6833	27.5475	27.4069	
alpha	2.8075	2.8125	2.8174	2.8411	2.8456	2.8667	2.8667	2.8707	2.8585	2.8456	2.8365	2.8271	
util living area	0.9862	0.9716	0.9386	0.8603	0.7293	0.5705	0.4427	0.5088	0.7431	0.9221	0.9769	0.9889	(86)
MIT	18.5589	18.8873	19.4073	20.0568	20.5616	20.8479	20.9460	20.9193	20.6608	19.9589	19.1366	18.5081	(87)
Th 2	19.8099	19.8127	19.8156	19.8289	19.8314	19.8430	19.8430	19.8452	19.8385	19.8314	19.8263	19.8211	(88)
util rest of house	0.9834	0.9659	0.9262	0.8324	0.6771	0.4897	0.3378	0.3995	0.6717	0.9004	0.9714	0.9867	(89)
MIT 2	17.5943	17.9212	18.4333	19.0635	19.5193	19.7595	19.8233	19.8130	19.6257	18.9892	18.1810	17.5516	(90)
Living area fraction									fLA =	Living area / (4) =		0.1768	(91)
MIT	17.7648	18.0920	18.6055	19.2391	19.7036	19.9519	20.0218	20.0085	19.8087	19.1606	18.3499	17.7207	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7648	18.0920	18.6055	19.2391	19.7036	19.9519	20.0218	20.0085	19.8087	19.1606	18.3499	17.7207	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9765	0.9548	0.9100	0.8158	0.6708	0.4978	0.3548	0.4160	0.6696	0.8844	0.9617	0.9809	(94)
Useful gains	658.1680	832.5533	999.3260	1116.2725	1059.5921	795.9860	537.9051	555.1134	752.8222	773.7897	663.7291	610.1127	(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	2269.6750	2217.5194	2029.3458	1710.9988	1321.2745	873.4916	558.4766	587.7091	935.8477	1413.2358	1866.3504	2254.5804	(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	1198.9612	930.6972	766.3347	428.2029	194.6916	0.0000	0.0000	0.0000	0.0000	475.7480	865.8873	1223.4840	(98)
Space heating												6084.0069	(98)
Space heating per m2												(98) / (4) =	48.3548 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	1534.1987	1207.7734	1237.7798	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8281	0.8781	0.8415	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1270.4567	1060.5132	1041.5409	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1986.0208	1886.5336	1676.3599	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	515.2061	614.5591	472.3053	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1602.0706 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 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	128.8015	153.6398	118.0763	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													400.5176 (107)
Energy for space heating													3.1833 (108)
Energy for space cooling													48.3548 (99)
Total													3.1833 (108)
Dwelling Fabric Energy Efficiency (DFEE)													51.5381 (109)
													51.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3773 (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) =	0.3773 (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	0.4811	0.4717	0.4622	0.4151	0.4056	0.3585	0.3585	0.3490	0.3773	0.4056	0.4245	0.4434 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5823	0.5642	0.5642	0.5609	0.5712	0.5823	0.5901	0.5983 (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)			27.3900	1.3258	36.3125		(27)
GF B&B J150 P/A=0.50			64.7300	0.1300	8.4149		(28a)
EW Brick AAC011	166.2400	31.4500	134.7900	0.1800	24.2622		(29a)
PR 400mm MW044	61.0900		61.0900	0.1300	7.9417		(30)
Bays	3.6300		3.6300	0.1300	0.4719		(30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.8692		(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)							15.8662 (36)
Total fabric heat loss						(33) + (36) =	97.7354 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	63.8318	63.3660	62.9093	60.7645	60.3632	58.4952	58.4952	58.1492	59.2147	60.3632	61.1750	62.0237 (38)
Heat transfer coeff	161.5672	161.1014	160.6447	158.4999	158.0986	156.2306	156.2306	155.8846	156.9501	158.0986	158.9104	159.7591 (39)
Average = Sum(39)m / 12 =												158.4980 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2841	1.2804	1.2768	1.2597	1.2565	1.2417	1.2417	1.2389	1.2474	1.2565	1.2630	1.2697 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy conte	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Energy content (annual)												Total = Sum(45)m = 1615.5178 (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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Calculation Type: New Build (As Designed)

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)
	35.5926	31.1295	32.1229	28.0055	26.8719	23.1884	21.4875	24.6572	24.9517	29.0788	31.7418	34.4695 (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	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	144.1633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.1053	23.1865	18.8565	14.2756	10.6712	9.0091	9.7346	12.6534	16.9834	21.5643	25.1687	26.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6086	295.6450	287.9934	271.7042	251.1420	231.8165	218.9058	215.8694	223.5210	239.8102	260.3724	279.6979	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	37.4163	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	(71)
Water heating gains (Table 5)	47.8395	46.3237	43.1759	38.8965	36.1182	32.2062	28.8811	33.1414	34.6552	39.0844	44.0858	46.3300	(72)
Total internal gains	432.8024	431.4041	416.2748	391.1253	364.1804	339.2807	323.7704	327.9132	341.4085	366.7079	395.8759	419.1078	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.8000	11.2829	0.6300	0.7000	0.7700	37.2407	(75)
Southeast	6.2600	36.7938	0.6300	0.7000	0.7700	70.3917	(77)
Southwest	3.1100	36.7938	0.6300	0.7000	0.7700	34.9709	(79)
Northwest	7.2200	11.2829	0.6300	0.7000	0.7700	24.8961	(81)

Solar gains	167.4994	305.9527	473.4397	678.5044	843.8541	874.6446	827.8976	698.8991	543.5645	352.9243	204.3843	140.9125	(83)
Total gains	600.3018	737.3569	889.7146	1069.6298	1208.0345	1213.9253	1151.6681	1026.8123	884.9729	719.6322	600.2602	560.0202	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	54.0796	54.2360	54.3902	55.1262	55.2661	55.9270	55.9270	56.0511	55.6706	55.2661	54.9838	54.6917	
alpha	4.6053	4.6157	4.6260	4.6751	4.6844	4.7285	4.7285	4.7367	4.7114	4.6844	4.6656	4.6461	
util living area	0.9992	0.9978	0.9928	0.9701	0.8944	0.7372	0.5748	0.6543	0.8968	0.9882	0.9983	0.9995	(86)
MIT	19.4711	19.6453	19.9450	20.3558	20.7145	20.9229	20.9813	20.9668	20.7878	20.3168	19.8228	19.4482	(87)
Th 2	19.8533	19.8562	19.8591	19.8725	19.8750	19.8868	19.8868	19.8890	19.8823	19.8750	19.8699	19.8646	(88)
util rest of house	0.9990	0.9971	0.9900	0.9576	0.8507	0.6408	0.4404	0.5171	0.8351	0.9815	0.9976	0.9993	(89)
MIT 2	18.4593	18.6355	18.9359	19.3494	19.6812	19.8515	19.8822	19.8795	19.7587	19.3185	18.8237	18.4453	(90)
Living area fraction									fLA = Living area / (4) =			0.1768	(91)
MIT	18.6381	18.8140	19.1143	19.5273	19.8638	20.0409	20.0764	20.0716	19.9406	19.4950	19.0003	18.6226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6381	18.8140	19.1143	19.5273	19.8638	20.0409	20.0764	20.0716	19.9406	19.4950	19.0003	18.6226	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	599.4158	734.4296	878.5274	1019.0677	1027.0691	795.7257	534.8035	555.8788	742.5883	704.0535	598.3195	559.4269	(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	2316.5689	2241.5609	2026.4203	1684.4258	1290.6882	850.0351	543.1263	572.3537	916.6840	1406.2824	1891.0850	2304.1366	(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	1277.5619	1012.7922	854.0323	479.0579	196.1326	0.0000	0.0000	0.0000	0.0000	522.4583	930.7912	1298.0640	(98)
Space heating												6570.8903	(98)
Space heating per m2										(98) / (4) =		52.2245	(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	1468.5673	1156.1062	1184.7231	0.0000	0.0000	0.0000	0.0000	(100)
Useful gains	0.0000	0.0000	0.0000	0.0000	0.0000	0.8434	0.9065	0.8663	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1238.5919	1047.9540	1026.2763	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1535.8835	1460.4633	1316.7113	0.0000	0.0000	0.0000	0.0000	(103)
	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 kWh	0.0000	0.0000	0.0000	0.0000	0.0000	214.0500	306.9069	216.0837	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												737.0406 (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	53.5125	76.7267	54.0209	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												184.2602 (107)
Space cooling per m2												1.4645 (108)
Energy for space heating												52.2245 (99)
Energy for space cooling												1.4645 (108)
Total												53.6890 (109)
Target Fabric Energy Efficiency (TFEE)												61.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) =	0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =		0.3778 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3967	0.3778	0.3778	0.3495	0.3495	0.3117	0.3212	0.3023	0.3117	0.3306	0.3306	0.3589 (22b)
	0.5787	0.5714	0.5714	0.5611	0.5611	0.5486	0.5516	0.5457	0.5486	0.5546	0.5546	0.5644 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	59.9927	59.2343	59.2343	58.1660	58.1660	56.8710	57.1809	56.5704	56.8710	57.5000	57.5000	58.5128 (38)
Average = Sum(39)m / 12 =	164.6925	163.9341	163.9341	162.8658	162.8658	161.5708	161.8807	161.2702	161.5708	162.1998	162.1998	163.2126 (39)
												162.6831 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3090	1.3029	1.3029	1.2944	1.2944	1.2841	1.2866	1.2818	1.2841	1.2891	1.2891	1.2972 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
								Total per year (kWh/year) = Sum (64)m =				2165.3538 (64)
RHI water heating demand												2165 (64)
Heat gains from water heating, kWh/month												
	93.0507	82.4519	87.6216	79.9740	79.4054	72.4367	70.9803	75.9400	75.1957	82.8585	85.8202	91.2934 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.2157	57.9240	47.1070	35.6630	26.6585	22.5062	24.3188	31.6105	42.4275	53.8715	62.8759	67.0282 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	436.7293	441.2611	429.8409	405.5287	374.8388	345.9947	326.7251	322.1932	333.6134	357.9256	388.6155	417.4596 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	125.0681	122.6963	117.7709	111.0750	106.7277	100.6065	95.4037	102.0699	104.4385	111.3690	119.1947	122.7062 (72)
Total internal gains	742.8612	737.7296	710.5670	668.1148	624.0732	584.9556	562.2957	571.7217	596.3275	639.0142	686.5343	723.0422 (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				13.4200		12.9236		0.4600		0.0000		0.7700		61.4304 (75)
Southeast				7.7800		40.4699		0.4600		0.0000		0.7700		111.5220 (77)
Southwest				3.8600		40.4699		0.4600		0.0000		0.7700		55.3310 (79)
Northwest				5.6500		12.9236		0.4600		0.0000		0.7700		25.8630 (81)
Northwest				3.3300		12.9236		0.4600		0.0000		0.7700		15.2432 (81)
Solar gains	269.3895	444.4771	683.3595	1014.1543	1230.9986	1365.6615	1278.6727	1102.8483	852.3380	548.6176	337.1086			224.2238 (83)
Total gains	1012.2507	1182.2067	1393.9265	1682.2691	1855.0719	1950.6172	1840.9684	1674.5700	1448.6655	1187.6318	1023.6429			947.2660 (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	28.6767	28.8094	28.8094	28.9984	28.9984	29.2308	29.1748	29.2853	29.2308	29.1174	29.1174	28.9367
alpha	2.9118	2.9206	2.9206	2.9332	2.9332	2.9487	2.9450	2.9524	2.9487	2.9412	2.9412	2.9291
util living area	0.9605	0.9389	0.8870	0.7719	0.6036	0.3955	0.2683	0.3015	0.5699	0.8307	0.9348	0.9662 (86)
MIT	19.1541	19.4112	19.8847	20.4268	20.7937	20.9590	20.9910	20.9874	20.8740	20.3934	19.7016	19.1104 (87)
Th 2	19.8338	19.8385	19.8385	19.8452	19.8452	19.8533	19.8513	19.8552	19.8533	19.8493	19.8493	19.8430 (88)
util rest of house	0.9528	0.9273	0.8656	0.7315	0.5387	0.3116	0.1708	0.1966	0.4800	0.7889	0.9200	0.9594 (89)
MIT 2	17.4327	17.8022	18.4690	19.2035	19.6548	19.8288	19.8489	19.8515	19.7598	19.1870	18.2309	17.3760 (90)
Living area fraction									fLA = Living area / (4) =			0.1768 (91)
MIT	17.7370	18.0866	18.7193	19.4197	19.8561	20.0286	20.0508	20.0523	19.9568	19.4003	18.4909	17.6826 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5870	17.9366	18.5693	19.2697	19.7061	19.8786	19.9008	19.9023	19.8068	19.2503	18.3409	17.5326 (93)

8. Space heating requirement

Utilisation	0.9312	0.9014	0.8361	0.7084	0.5303	0.3135	0.1751	0.2010	0.4760	0.7624	0.8936	0.9397 (94)
Useful gains	942.6494	1065.6261	1165.4978	1191.6355	983.7256	611.5512	322.2902	336.6049	689.5820	905.4404	914.7375	890.1714 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2056.5092	2022.3905	1831.0237	1526.0039	1092.1964	626.6715	323.8912	339.0306	744.3196	1240.8731	1677.2898	2029.1569 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	828.7117	642.9457	495.1513	240.7453	80.7023	0.0000	0.0000	0.0000	0.0000	249.5619	549.0376	847.4052	(98)
Space heating												3934.2610	(98)
RHI space heating demand												3934	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =		0.3778 (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	0.4817	0.4723	0.4628	0.4156	0.4062	0.3589	0.3589	0.3495	0.3778	0.4062	0.4251	0.4439 (22b)
Effective ac	0.6160	0.6115	0.6071	0.5864	0.5825	0.5644	0.5644	0.5611	0.5714	0.5825	0.5903	0.5985 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	63.8637	63.3966	62.9387	60.7882	60.3859	58.5128	58.5128	58.1660	59.2343	60.3859	61.1998	62.0508 (38)
Average = Sum(39)m / 12 =	168.5635	168.0964	167.6385	165.4880	165.0856	163.2126	163.2126	162.8658	163.9341	165.0856	165.8996	166.7506 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3397	1.3360	1.3324	1.3153	1.3121	1.2972	1.2972	1.2944	1.3029	1.3121	1.3185	1.3253 (40)
HLP (average)												1.3153 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Heat gains from water heating, kWh/month												
	93.0507	82.4519	87.6216	79.9740	79.4054	72.4367	70.9803	75.9400	75.1957	82.8585	85.8202	91.2934 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.2157	57.9240	47.1070	35.6630	26.6585	22.5062	24.3188	31.6105	42.4275	53.8715	62.8759	67.0282 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	436.7293	441.2611	429.8409	405.5287	374.8388	345.9947	326.7251	322.1932	333.6134	357.9256	388.6155	417.4596 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	125.0681	122.6963	117.7709	111.0750	106.7277	100.6065	95.4037	102.0699	104.4385	111.3690	119.1947	122.7062 (72)
Total internal gains												
	742.8612	737.7296	710.5670	668.1148	624.0732	584.9556	562.2957	571.7217	596.3275	639.0142	686.5343	723.0422 (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		13.4200	11.2829	0.4600	0.0000	0.7700	53.6319 (75)
Southeast		7.7800	36.7938	0.4600	0.0000	0.7700	101.3919 (77)
Southwest		3.8600	36.7938	0.4600	0.0000	0.7700	50.3050 (79)
Northwest		5.6500	11.2829	0.4600	0.0000	0.7700	22.5798 (81)
Northwest		3.3300	11.2829	0.4600	0.0000	0.7700	13.3081 (81)

Solar gains	241.2166	440.6159	681.8511	977.2309	1215.4143	1259.7760	1192.4395	1006.6182	782.8601	508.2698	294.3369	202.9272 (83)
Total gains	984.0778	1178.3455	1392.4181	1645.3457	1839.4875	1844.7317	1754.7352	1578.3399	1379.1876	1147.2840	980.8712	925.9694 (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	28.0182	28.0960	28.1728	28.5389	28.6084	28.9367	28.9367	28.9984	28.8094	28.6084	28.4681	28.3228
alpha	2.8679	2.8731	2.8782	2.9026	2.9072	2.9291	2.9291	2.9332	2.9206	2.9072	2.8979	2.8882
util living area	0.9675	0.9461	0.9029	0.8116	0.6735	0.5142	0.3911	0.4451	0.6672	0.8704	0.9500	0.9723 (86)
MIT	18.9287	19.2286	19.6925	20.2535	20.6680	20.8921	20.9641	20.9474	20.7630	20.1953	19.4632	18.8779 (87)
Th 2	19.8099	19.8127	19.8156	19.8289	19.8314	19.8430	19.8430	19.8452	19.8385	19.8314	19.8263	19.8211 (88)
util rest of house	0.9613	0.9360	0.8848	0.7778	0.6183	0.4363	0.2953	0.3443	0.5908	0.8385	0.9389	0.9669 (89)
MIT 2	17.0928	17.5242	18.1835	18.9619	19.4950	19.7593	19.8247	19.8160	19.6314	18.9092	17.8766	17.0262 (90)
Living area fraction												
MIT	17.4173	17.8255	18.4502	19.1902	19.7023	19.9595	20.0261	20.0160	19.8314	19.1365	18.1570	17.3535 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2673	17.6755	18.3002	19.0402	19.5523	19.8095	19.8761	19.8660	19.6814	18.9865	18.0070	17.2035 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9416	0.9108	0.8551	0.7510	0.6038	0.4339	0.2981	0.3462	0.5792	0.8093	0.9145	0.9491 (94)
Useful gains	926.5924	1073.2607	1190.6451	1235.7217	1110.6111	800.4703	523.1452	546.4054	798.8414	928.4668	896.9982	878.8035 (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												
	2185.8152	2147.5121	1978.1747	1678.0855	1296.3029	850.2582	534.6966	564.4893	914.9846	1384.4963	1809.4697	2168.3412 (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 Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	936.8617	721.8970	585.9220	318.5020	138.1547	0.0000	0.0000	0.0000	0.0000	339.2860	656.9795	959.4161 (98)
Space heating												4657.0189 (98)
Space heating per m2												(98) / (4) = 37.0133 (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												5151.5696 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	936.8617	721.8970	585.9220	318.5020	138.1547	0.0000	0.0000	0.0000	0.0000	339.2860	656.9795	959.4161 (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)	1036.3515	798.5586	648.1439	352.3252	152.8260	0.0000	0.0000	0.0000	0.0000	375.3163	726.7472	1061.3009 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Efficiency of water heater (217)m	88.1966	87.9534	87.4366	86.2633	84.1186	79.7000	79.7000	79.7000	79.7000	86.3312	87.7095	79.7000 (216)
Fuel for water heating, kWh/month	242.8585	214.5127	226.2953	205.1656	205.8459	193.6187	185.4656	204.1812	204.0299	212.5997	221.8290	236.6405 (219)
Water heating fuel used												2553.0426 (219)
Annual totals kWh/year												
Space heating fuel - main system												5151.5696 (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)												460.6917 (232)
Total delivered energy for all uses												8240.3039 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5151.5696	3.4800	179.2746 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2553.0426	3.4800	88.8459 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	460.6917	13.1900	60.7652 (250)
Additional standing charges			120.0000 (251)
Total energy cost			458.7782 (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] =	1.1280 (257)
SAP value		84.2642
SAP rating (Section 12)		84 (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	5151.5696	0.2160	1112.7390 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2553.0426	0.2160	551.4572 (264)
Space and water heating			1664.1962 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	460.6917	0.5190	239.0990 (268)
Total kg/year			1942.2202 (272)
CO2 emissions per m2			15.4400 (273)
EI value			84.7642
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
 $3.48 / 0.8459 = 4.114$, stars = 4
 $0.216 / 0.8459 = 0.2553$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =	0.3778 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3967	0.3778	0.3778	0.3495	0.3495	0.3117	0.3212	0.3023	0.3117	0.3306	0.3306	0.3589 (22b)
	0.5787	0.5714	0.5714	0.5611	0.5611	0.5486	0.5516	0.5457	0.5486	0.5546	0.5546	0.5644 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	59.9927	59.2343	59.2343	58.1660	58.1660	56.8710	57.1809	56.5704	56.8710	57.5000	57.5000	58.5128 (38)
Average = Sum(39)m / 12 =	164.6925	163.9341	163.9341	162.8658	162.8658	161.5708	161.8807	161.2702	161.5708	162.1998	162.1998	163.2126 (39)
	162.6831 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3090	1.3029	1.3029	1.2944	1.2944	1.2841	1.2866	1.2818	1.2841	1.2891	1.2891	1.2972 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

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

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Heat gains from water heating, kWh/month												
	93.0507	82.4519	87.6216	79.9740	79.4054	72.4367	70.9803	75.9400	75.1957	82.8585	85.8202	91.2934 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.2157	57.9240	47.1070	35.6630	26.6585	22.5062	24.3188	31.6105	42.4275	53.8715	62.8759	67.0282 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	436.7293	441.2611	429.8409	405.5287	374.8388	345.9947	326.7251	322.1932	333.6134	357.9256	388.6155	417.4596 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	125.0681	122.6963	117.7709	111.0750	106.7277	100.6065	95.4037	102.0699	104.4385	111.3690	119.1947	122.7062 (72)
Total internal gains												
	742.8612	737.7296	710.5670	668.1148	624.0732	584.9556	562.2957	571.7217	596.3275	639.0142	686.5343	723.0422 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
Northeast					13.4200	12.9236	0.4600		0.0000	0.7700	61.4304 (75)	
Southeast					7.7800	40.4699	0.4600		0.0000	0.7700	111.5220 (77)	
Southwest					3.8600	40.4699	0.4600		0.0000	0.7700	55.3310 (79)	
Northwest					5.6500	12.9236	0.4600		0.0000	0.7700	25.8630 (81)	
Northwest					3.3300	12.9236	0.4600		0.0000	0.7700	15.2432 (81)	
Solar gains	269.3895	444.4771	683.3595	1014.1543	1230.9986	1365.6615	1278.6727	1102.8483	852.3380	548.6176	337.1086	224.2238 (83)
Total gains	1012.2507	1182.2067	1393.9265	1682.2691	1855.0719	1950.6172	1840.9684	1674.5700	1448.6655	1187.6318	1023.6429	947.2660 (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	28.6767	28.8094	28.8094	28.9984	28.9984	29.2308	29.1748	29.2853	29.2308	29.1174	29.1174	28.9367
alpha	2.9118	2.9206	2.9206	2.9332	2.9332	2.9487	2.9450	2.9524	2.9487	2.9412	2.9412	2.9291
util living area	0.9605	0.9389	0.8870	0.7719	0.6036	0.3955	0.2683	0.3015	0.5699	0.8307	0.9348	0.9662 (86)
MIT	19.1541	19.4112	19.8847	20.4268	20.7937	20.9590	20.9910	20.9874	20.8740	20.3934	19.7016	19.1104 (87)
Th 2	19.8338	19.8385	19.8385	19.8452	19.8452	19.8533	19.8513	19.8552	19.8533	19.8493	19.8493	19.8430 (88)
util rest of house	0.9528	0.9273	0.8656	0.7315	0.5387	0.3116	0.1708	0.1966	0.4800	0.7889	0.9200	0.9594 (89)
MIT 2	17.4327	17.8022	18.4690	19.2035	19.6548	19.8288	19.8489	19.8515	19.7598	19.1870	18.2309	17.3760 (90)
Living area fraction												
MIT	17.7370	18.0866	18.7193	19.4197	19.8561	20.0286	20.0508	20.0523	19.9568	19.4003	18.4909	17.6826 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5870	17.9366	18.5693	19.2697	19.7061	19.8786	19.9008	19.9023	19.8068	19.2503	18.3409	17.5326 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9312	0.9014	0.8361	0.7084	0.5303	0.3135	0.1751	0.2010	0.4760	0.7624	0.8936	0.9397 (94)
Useful gains	942.6494	1065.6261	1165.4978	1191.6355	983.7256	611.5512	322.2902	336.6049	689.5820	905.4404	914.7375	890.1714 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	2056.5092	2022.3905	1831.0237	1526.0039	1092.1964	626.6715	323.8912	339.0306	744.3196	1240.8731	1677.2898	2029.1569 (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 Designed)

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

Space heating kWh	828.7117	642.9457	495.1513	240.7453	80.7023	0.0000	0.0000	0.0000	0.0000	249.5619	549.0376	847.4052 (98)
Space heating												3934.2610 (98)
Space heating per m2												(98) / (4) = 31.2690 (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												4352.0586 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	828.7117	642.9457	495.1513	240.7453	80.7023	0.0000	0.0000	0.0000	0.0000	249.5619	549.0376	847.4052 (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)	916.7165	711.2231	547.7337	266.3111	89.2725	0.0000	0.0000	0.0000	0.0000	276.0641	607.3425	937.3951 (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	214.1930	188.6711	197.8649	176.9826	173.1546	154.3141	147.8161	162.7324	162.6118	183.5399	194.5652	208.9080 (64)
Efficiency of water heater (217)m	87.9743	87.7279	87.0628	85.5347	82.8162	79.7000	79.7000	79.7000	79.7000	85.5337	87.3322	79.7000 (216)
Fuel for water heating, kWh/month	243.4724	215.0638	227.2669	206.9131	209.0830	193.6187	185.4656	204.1812	204.0299	214.5821	222.7874	237.2288 (219)
Water heating fuel used												2563.6928 (219)
Annual totals kWh/year												
Space heating fuel - main system												4352.0586 (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)												460.6917 (232)
Total delivered energy for all uses												7451.4431 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4352.0586	3.9200	170.6007 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2563.6928	3.9200	100.4968 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	460.6917	16.9600	78.1333 (250)
Additional standing charges			88.0000 (251)
Total energy cost			449.9508 (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	4352.0586	0.2160	940.0447 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2563.6928	0.2160	553.7577 (264)
Space and water heating			1493.8023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	460.6917	0.5190	239.0990 (268)
Total kg/year			1771.8263 (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	4352.0586	1.2200	5309.5115 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2563.6928	1.2200	3127.7053 (264)
Space and water heating			8437.2168 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	460.6917	3.0700	1414.3235 (268)
Primary energy kWh/year			10081.7902 (272)
Primary energy kWh/m2/year			80.1287 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 84
Current environmental impact rating: B 85

(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	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 44	-264 kg (14.9%)
U Solar photovoltaic panels	+ 7.8	-£ 309	-947 kg (62.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£44	2.10 kg/m²	B 86 B 87
Solar photovoltaic panels	£309	7.52 kg/m²	A 93 A 94
Total Savings	£354	9.62 kg/m²	

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£91	£99	-£8
Mains gas	£359	£306	£53
Space heating	£271	£272	-£1
Water heating	£100	£55	£45
Lighting	£78	£78	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£450	£96	£354
Total cost of uses	£449	£96	£353
Delivered energy	59 kWh/m²	34 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.8 tonnes	0.6 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	4 kg/m²	10 kg/m²
Primary energy	80 kWh/m²	24 kWh/m²	56 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3778 (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) =		0.3778 (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	0.4817	0.4723	0.4628	0.4156	0.4062	0.3589	0.3589	0.3495	0.3778	0.4062	0.4251	0.4439 (22b)
Effective ac	0.6160	0.6115	0.6071	0.5864	0.5825	0.5644	0.5644	0.5611	0.5714	0.5825	0.5903	0.5985 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.2799		(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (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	63.8637	63.3966	62.9387	60.7882	60.3859	58.5128	58.5128	58.1660	59.2343	60.3859	61.1998	62.0508 (38)
Average = Sum(39)m / 12 =	168.5635	168.0964	167.6385	165.4880	165.0856	163.2126	163.2126	162.8658	163.9341	165.0856	165.8996	166.7506 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3397	1.3360	1.3324	1.3153	1.3121	1.2972	1.2972	1.2944	1.3029	1.3121	1.3185	1.3253 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage												
	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	205.4626	180.7855	187.7387	161.7802	151.6299	133.2586	126.0587	141.9055	148.7601	173.4137	186.1164	200.1776 (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												1.1226 (H8)
Utilisation factor												0.5897 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.6776 (H14)
Volume ratio Veff/V												1.0664 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-940.3299 (H17)
Solar input	-27.2677	-45.5019	-77.4950	-103.8586	-128.3085	-126.1477	-124.4806	-108.7594	-85.1804	-58.1682	-32.3434	-22.8184 (63)
Solar input (sum of months) = Sum (63)m =												-940.3299 (63)
Output from w/h												
	178.1949	135.2836	110.2437	57.9216	23.3213	7.1109	1.5781	33.1462	63.5798	115.2455	153.7730	177.3592 (64)
Heat gains from water heating, kWh/month												
	86.0663	76.1435	79.5206	67.8121	62.1856	55.5923	53.5744	59.2785	64.1143	74.7576	79.0611	84.3091 (65)

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
	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.2157	57.9240	47.1070	35.6630	26.6585	22.5062	24.3188	31.6105	42.4275	53.8715	62.8759	67.0282 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	436.7293	441.2611	429.8409	405.5287	374.8388	345.9947	326.7251	322.1932	333.6134	357.9256	388.6155	417.4596 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	115.6806	113.3087	106.8826	94.1834	83.5828	77.2115	72.0087	79.6754	89.0477	100.4806	109.8071	113.3186 (72)
Total internal gains												
	733.4737	728.3420	699.6786	651.2233	600.9283	561.5606	538.9007	549.3272	580.9367	628.1259	677.1467	713.6546 (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	13.4200	11.2829	0.4600	0.0000	0.7700	53.6319 (75)
Southeast	7.7800	36.7938	0.4600	0.0000	0.7700	101.3919 (77)
Southwest	3.8600	36.7938	0.4600	0.0000	0.7700	50.3050 (79)
Northwest	5.6500	11.2829	0.4600	0.0000	0.7700	22.5798 (81)
Northwest	3.3300	11.2829	0.4600	0.0000	0.7700	13.3081 (81)

Solar gains	241.2166	440.6159	681.8511	977.2309	1215.4143	1259.7760	1192.4395	1006.6182	782.8601	508.2698	294.3369	202.9272 (83)
Total gains	974.6903	1168.9579	1381.5297	1628.4541	1816.3426	1821.3367	1731.3402	1555.9454	1363.7968	1136.3957	971.4836	916.5819 (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	28.0182	28.0960	28.1728	28.5389	28.6084	28.9367	28.9367	28.9984	28.8094	28.6084	28.4681	28.3228
alpha	2.8679	2.8731	2.8782	2.9026	2.9072	2.9291	2.9291	2.9332	2.9206	2.9072	2.8979	2.8882
util living area												
	0.9683	0.9470	0.9044	0.8149	0.6786	0.5194	0.3957	0.4505	0.6717	0.8728	0.9511	0.9729 (86)
MIT	18.9194	19.2200	19.6839	20.2440	20.6610	20.8892	20.9629	20.9457	20.7585	20.1877	19.4544	18.8684 (87)
Th 2	19.8099	19.8127	19.8156	19.8289	19.8314	19.8430	19.8430	19.8452	19.8385	19.8314	19.8263	19.8211 (88)
util rest of house												
	0.9621	0.9371	0.8866	0.7814	0.6236	0.4411	0.2991	0.3488	0.5955	0.8412	0.9402	0.9677 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.0795	17.5120	18.1718	18.9499	19.4872	19.7568	19.8240	19.8150	19.6269	18.8993	17.8642	17.0126 (90)
Living area fraction									fLA = Living area / (4) =			0.1768 (91)
MIT	17.4047	17.8139	18.4391	19.1787	19.6946	19.9570	20.0253	20.0148	19.8270	19.1270	18.1453	17.3406 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2547	17.6639	18.2891	19.0287	19.5446	19.8070	19.8753	19.8648	19.6770	18.9770	17.9953	17.1906 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9427	0.9121	0.8569	0.7544	0.6086	0.4385	0.3019	0.3507	0.5836	0.8119	0.9160	0.9501 (94)	
Useful gains	918.8398	1066.2374	1183.8618	1228.5064	1105.4719	798.6771	522.6379	545.5960	795.8504	922.6934	889.8987	870.8687 (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													
	2183.6894	2145.5694	1976.2997	1676.1738	1295.0364	849.8446	534.5781	564.3006	914.2523	1382.9305	1807.5239	2166.1896 (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													
	941.0481	725.3111	589.5738	322.3205	141.0359	0.0000	0.0000	0.0000	0.0000	342.4164	660.6901	963.7187 (98)	
Space heating												4686.1148 (98)	
Space heating per m2												37.2446 (99)	
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5183.7553 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	941.0481	725.3111	589.5738	322.3205	141.0359	0.0000	0.0000	0.0000	0.0000	342.4164	660.6901	963.7187 (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)	1040.9825	802.3353	652.1834	356.5492	156.0132	0.0000	0.0000	0.0000	0.0000	378.7792	730.8519	1066.0606 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	178.1949	135.2836	110.2437	57.9216	23.3213	7.1109	1.5781	33.1462	63.5798	115.2455	153.7730	177.3592 (64)	
Efficiency of water heater (217)m	88.5082	88.5316	88.5277	88.5883	88.7101	79.7000	79.7000	79.7000	79.7000	87.4438	88.1652	88.5522 (217)	
Fuel for water heating, kWh/month	201.3316	152.8082	124.5302	65.3829	26.2894	8.9220	1.9800	41.5887	79.7738	131.7938	174.4145	200.2878 (219)	
Water heating fuel used												1209.1029 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5183.7553 (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)													460.6917 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)	
Total delivered energy for all uses												5251.3105 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5183.7553	3.4800	180.3947 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1209.1029	3.4800	42.0768 (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	460.6917	13.1900	60.7652 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			191.9013 (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		93.4179

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

93 (258)
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	5183.7553	0.2160	1119.6911 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1209.1029	0.2160	261.1662 (264)
Space and water heating			1380.8574 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	460.6917	0.5190	239.0990 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			788.3941 (272)
CO2 emissions per m2			6.2700 (273)
EI value			93.8154
EI rating			94 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	64.7300 (1b)	x 2.3900 (2b)	= 154.7047 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.1496 (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) =							
Pressure test										40.0000 / (5) =							0.1273 (8)
Measured/design AP50										Yes							5.0100
Infiltration rate																	0.3778 (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) =							0.3778 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
	0.3967	0.3778	0.3778	0.3495	0.3495	0.3117	0.3212	0.3023	0.3117	0.3306	0.3306	0.3589	(22b)				
Effective ac	0.5787	0.5714	0.5714	0.5611	0.5611	0.5486	0.5516	0.5457	0.5486	0.5546	0.5546	0.5644	(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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			30.7100	1.2357	37.9496		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			64.7300	0.1200	7.7676	75.0000	4854.7500 (28a)
EW Brick AAC011	166.2400	38.1000	128.1400	0.2400	30.7536	42.1000	5394.6940 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
Bays	3.6300		3.6300	0.1400	0.5082	9.0000	32.6700 (30)
Total net area of external elements Aum(A, m ²)			295.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	92.2799			(33)
GF Masonry			62.5200			39.0000	2438.2800 (32c)
GF Timber			23.3300			9.0000	209.9700 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17002.2340 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.1314 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4199 (36)
Total fabric heat loss						(33) + (36) =	104.6998 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.9927	Feb 59.2343	Mar 59.2343	Apr 58.1660	May 58.1660	Jun 56.8710	Jul 57.1809	Aug 56.5704	Sep 56.8710	Oct 57.5000	Nov 57.5000	Dec 58.5128 (38)
Heat transfer coeff	164.6925	163.9341	163.9341	162.8658	162.8658	161.5708	161.8807	161.2702	161.5708	162.1998	162.1998	163.2126 (39)
Average = Sum(39)m / 12 =												162.6831 (39)
HLP	Jan 1.3090	Feb 1.3029	Mar 1.3029	Apr 1.2944	May 1.2944	Jun 1.2841	Jul 1.2866	Aug 1.2818	Sep 1.2841	Oct 1.2891	Nov 1.2891	Dec 1.2972 (40)
HLP (average)												1.2930 (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												2.8833 (42)
Average daily hot water use (litres/day)												102.6776 (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 Designed)

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

Energy conte	112.9453	108.8382	104.7311	100.6240	96.5169	92.4098	92.4098	96.5169	100.6240	104.7311	108.8382	112.9453 (44)
Energy content (annual)	167.4946	146.4919	151.1665	131.7906	126.4562	109.1221	101.1177	116.0340	117.4198	136.8415	149.3732	162.2096 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1615.5178 (45)
	25.1242	21.9738	22.6750	19.7686	18.9684	16.3683	15.1677	17.4051	17.6130	20.5262	22.4060	24.3314 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage												
	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	205.4626	180.7855	187.7387	161.7802	151.6299	133.2586	126.0587	141.9055	148.7601	173.4137	186.1164	200.1776 (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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1856 (H8)
Utilisation factor												0.5698 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.6776 (H14)
Volume ratio Veff/V												1.0664 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-959.6006 (H17)
Solar input	-29.5360	-44.3926	-74.7627	-103.3450	-124.4621	-130.9910	-127.8456	-114.1669	-89.1077	-60.6183	-35.9018	-24.4708 (63)
								Solar input (sum of months) =	Sum (63)m =			-959.6006 (63)
Output from w/h												
	175.9266	136.3929	112.9760	58.4352	27.1678	2.2676	0.0000	27.7386	59.6525	112.7954	150.2146	175.7068 (64)
								Total per year (kWh/year) =	Sum (64)m =			1039.2739 (64)
Heat gains from water heating, kWh/month												
	86.0663	76.1435	79.5206	67.8121	62.1856	55.5923	53.5744	59.2785	64.1143	74.7576	79.0611	84.3091 (65)

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
	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959	172.9959 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	65.2157	57.9240	47.1070	35.6630	26.6585	22.5062	24.3188	31.6105	42.4275	53.8715	62.8759	67.0282 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	436.7293	441.2611	429.8409	405.5287	374.8388	345.9947	326.7251	322.1932	333.6134	357.9256	388.6155	417.4596 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829	55.1829 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306	-115.3306 (71)
Water heating gains (Table 5)												
	115.6806	113.3087	106.8826	94.1834	83.5828	77.2115	72.0087	79.6754	89.0477	100.4806	109.8071	113.3186 (72)
Total internal gains												
	733.4737	728.3420	699.6786	651.2233	600.9283	561.5606	538.9007	549.3272	580.9367	628.1259	677.1467	713.6546 (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	13.4200	12.9236	0.4600	0.0000	0.7700	61.4304 (75)
Southeast	7.7800	40.4699	0.4600	0.0000	0.7700	111.5220 (77)
Southwest	3.8600	40.4699	0.4600	0.0000	0.7700	55.3310 (79)
Northwest	5.6500	12.9236	0.4600	0.0000	0.7700	25.8630 (81)
Northwest	3.3300	12.9236	0.4600	0.0000	0.7700	15.2432 (81)

Solar gains	269.3895	444.4771	683.3595	1014.1543	1230.9986	1365.6615	1278.6727	1102.8483	852.3380	548.6176	337.1086	224.2238 (83)
Total gains	1002.8631	1172.8191	1383.0382	1665.3776	1831.9270	1927.2221	1817.5733	1652.1755	1433.2747	1176.7434	1014.2554	937.8784 (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	28.6767	28.8094	28.8094	28.9984	28.9984	29.2308	29.1748	29.2853	29.2308	29.1174	29.1174	28.9367
alpha	2.9118	2.9206	2.9206	2.9332	2.9332	2.9487	2.9450	2.9524	2.9487	2.9412	2.9412	2.9291
util living area												
	0.9614	0.9400	0.8888	0.7755	0.6088	0.3998	0.2716	0.3054	0.5743	0.8335	0.9361	0.9670 (86)
MIT	19.1449	19.4028	19.8766	20.4188	20.7888	20.9578	20.9907	20.9870	20.8714	20.3869	19.6933	19.1011 (87)
Th 2	19.8338	19.8385	19.8385	19.8452	19.8452	19.8533	19.8513	19.8552	19.8533	19.8493	19.8493	19.8430 (88)
util rest of house												
	0.9538	0.9285	0.8676	0.7353	0.5439	0.3151	0.1730	0.1992	0.4842	0.7920	0.9216	0.9604 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT 2	17.4197	17.7903	18.4581	19.1936	19.6499	19.8281	19.8488	19.8513	19.7576	19.1789	18.2193	17.3627 (90)
Living area fraction									fLA = Living area / (4) =			0.1768 (91)
MIT	17.7246	18.0753	18.7088	19.4102	19.8512	20.0278	20.0507	20.0521	19.9545	19.3924	18.4798	17.6699 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5746	17.9253	18.5588	19.2602	19.7012	19.8778	19.9007	19.9021	19.8045	19.2424	18.3298	17.5199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9325	0.9028	0.8381	0.7119	0.5351	0.3170	0.1773	0.2037	0.4800	0.7653	0.8954	0.9409 (94)
Useful gains	935.1631	1058.8342	1159.1689	1185.6065	980.3382	610.9624	322.2135	336.4851	688.0027	900.6160	908.1232	882.4827 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	2054.4786	2020.5406	1829.3075	1524.4557	1091.3948	626.5373	323.8711	338.9999	743.9494	1239.6022	1675.4987	2027.0912 (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												
	832.7707	646.2667	498.5831	243.9714	82.6261	0.0000	0.0000	0.0000	0.0000	252.2058	552.5104	851.5887 (98)
Space heating												3960.5229 (98)
Space heating per m2												31.4777 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4381.1094 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.7707	646.2667	498.5831	243.9714	82.6261	0.0000	0.0000	0.0000	0.0000	252.2058	552.5104	851.5887 (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)	
Fuel for water heating, kWh/month	921.2066	714.8967	551.5300	269.8799	91.4005	0.0000	0.0000	0.0000	0.0000	278.9887	611.1840	942.0229 (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	175.9266	136.3929	112.9760	58.4352	27.1678	2.2676	0.0000	27.7386	59.6525	112.7954	150.2146	175.7068 (64)	
Efficiency of water heater (217)m	88.3317	88.3333	88.2122	88.1141	87.4935	79.7000	79.7000	79.7000	79.7000	86.7989	87.8781	88.3708 (217)	
Fuel for water heating, kWh/month	199.1658	154.4071	128.0729	66.3176	31.0512	2.8452	0.0000	34.8038	74.8462	129.9503	170.9352	198.8290 (219)	
Water heating fuel used												1191.2244 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4381.1094 (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)													460.6917 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)	
Total delivered energy for all uses												4333.8658 (238)	

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4381.1094	3.9200	171.7395 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1191.2244	3.9200	46.6960 (247)	
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)	
Pump for solar water heating	50.0000	16.9600	8.4800 (249)	
Energy for lighting	460.6917	16.9600	78.1333 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775 (252)	
Total energy cost			96.3913 (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	4381.1094	0.2160	946.3196 (261)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1191.2244	0.2160	257.3045 (264)
Space and water heating			1203.6241 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	460.6917	0.5190	239.0990 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			560.8592 (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	4381.1094	1.2200	5344.9534 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1191.2244	1.2200	1453.2937 (264)
Space and water heating			6798.2472 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	460.6917	3.0700	1414.3235 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2996.1506 (272)
Primary energy kWh/m2/year			23.8130 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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	135.1 (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	414.68 (P1)
Transmission heat loss coefficient	104.70 (37)
Summer heat loss coefficient	519.38 (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
North 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)
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	13.4200	98.8453	0.4600	0.0000	0.9000	549.1725
South East	7.7800	119.9223	0.4600	0.0000	0.9000	386.2603
South West	3.8600	119.9223	0.4600	0.0000	0.9000	191.6407
North West	5.6500	98.8453	0.4600	0.0000	0.9000	231.2090
North West	3.3300	98.8453	0.4600	0.0000	0.9000	136.2701
total:						1494.5525

	Jun	Jul	Aug	
Solar gains	1596	1495	1289	(P4)
Internal gains	582	559	569	
Total summer gains	2178	2054	1858	(P5)
Summer gain/loss ratio	4.19	3.95	3.58	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 135.1)	1.05	1.05	1.05	
Threshold temperature	21.25	22.91	22.43	(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 Designed)



Property Reference	4907-P637-6633-657				Issued on Date	19/10/2022
Assessment Reference	Plot 657	Prop Type Ref	Fuller-CB-Opp-DET			
Property	Plot 657, 3 Bed, K, WC, U, B, ES					
SAP Rating		83 B	DER	18.44	TER	18.72
Environmental		84 B	% DER<TER	1.51		
CO ₂ Emissions (t/year)		1.51	DFEE	52.68	TFEE	61.59
General Requirements Compliance		Pass	% DFEE<TFEE	14.47		
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

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) 18.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)52.7 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	0.13 (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:	5.01 (design value)	
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
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Boiler interlock	Yes	OK
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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
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Based on:

Overshading:	Average	
Windows facing North East:	9.24 m ² , No overhang	
Windows facing South West:	12.91 m ² , No overhang	
Windows facing North West:	4.10 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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
Effective ac	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 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	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	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area	0.9767	0.9571	0.9190	0.8385	0.7123	0.5568	0.4291	0.4831	0.7024	0.8918	0.9622	0.9806 (86)
MIT	18.6520	18.9859	19.4865	20.0996	20.5716	20.8507	20.9474	20.9261	20.6988	20.0534	19.2464	18.6072 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house	0.9718	0.9484	0.9023	0.8056	0.6551	0.4706	0.3188	0.3690	0.6224	0.8618	0.9530	0.9765 (89)
MIT 2	16.6322	17.1150	17.8306	18.6912	19.3064	19.6416	19.7300	19.7193	19.4883	18.6556	17.5086	16.5763 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	16.9551	17.4141	18.0953	18.9163	19.5087	19.8348	19.9246	19.9122	19.6818	18.8790	17.7863	16.9009 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8051	17.2641	17.9453	18.7663	19.3587	19.6848	19.7746	19.7622	19.5318	18.7290	17.6363	16.7509 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9545	0.9240	0.8713	0.7749	0.6355	0.4653	0.3206	0.3693	0.6063	0.8300	0.9301	0.9613 (94)
Useful gains	649.0144	786.6955	896.5482	948.4511	869.3443	636.8992	418.1179	435.7199	627.2855	701.8924	644.6126	608.7443 (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	1772.8585	1746.3608	1610.6767	1364.5588	1055.7597	690.2213	430.9265	455.0704	741.7300	1120.6005	1462.1166	1753.7154 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

836.1400	644.8951	531.3116	299.5975	138.6931	0.0000	0.0000	0.0000	0.0000	311.5188	588.6029	851.8585 (98)
Space heating											4202.6175 (98)
Space heating per m2											(98) / (4) = 43.6500 (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		4648.9131 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	836.1400	644.8951	531.3116	299.5975	138.6931	0.0000	0.0000	0.0000	0.0000	311.5188	588.6029	851.8585 (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)	924.9336	713.3795	587.7341	331.4132	153.4216	0.0000	0.0000	0.0000	0.0000	344.6005	651.1094	942.3214 (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	88.0733	87.8225	87.3217	86.2221	84.2462	79.7000	79.7000	79.7000	79.7000	86.2288	87.5763	79.7000 (216)
Fuel for water heating, kWh/month	232.5779	205.4405	216.6637	196.2357	196.4698	185.0425	177.2149	195.1471	195.0179	203.4921	212.4380	226.6263 (219)
Water heating fuel used												2442.3663 (219)
Annual totals kWh/year												
Space heating fuel - main system												4648.9131 (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)
Total delivered energy for all uses												7560.1542 (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	4648.9131	0.2160	1004.1652 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2442.3663	0.2160	527.5511 (264)
Space and water heating			1531.7164 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total CO2, kg/year			1775.0624 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.4400 (273)

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

DER		18.4400 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		35.7469 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		35.7469 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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)												1547.9009 (45)
Distribution loss	Total = Sum(45)m = 1547.9009 (45)											
(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 Designed)

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	53.6193	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												
	0.9975	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 Designed)

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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.3751 (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) =	0.3751 (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	0.4783	0.4689	0.4595	0.4127	0.4033	0.3564	0.3564	0.3470	0.3751	0.4033	0.4220	0.4408 (22b)
	0.6144	0.6099	0.6056	0.5851	0.5813	0.5635	0.5635	0.5602	0.5704	0.5813	0.5891	0.5971 (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	48.8012	48.4484	48.1026	46.4783	46.1744	44.7596	44.7596	44.4976	45.3046	46.1744	46.7892	47.4319 (38)
Average = Sum(39)m / 12 =	137.3004	136.9476	136.6017	134.9774	134.6735	133.2588	133.2588	132.9968	133.8037	134.6735	135.2883	135.9311 (39)
												134.9760 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4261	1.4224	1.4188	1.4019	1.3988	1.3841	1.3841	1.3814	1.3897	1.3988	1.4052	1.4118 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	g Specific data or Table 6c	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, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.0723	27.1420	27.2107	27.5382	27.6003	27.8934	27.8934	27.9483	27.7798	27.6003	27.4749	27.3450	
alpha	2.8048	2.8095	2.8140	2.8359	2.8400	2.8596	2.8596	2.8632	2.8520	2.8400	2.8317	2.8230	
util living area	0.9825	0.9649	0.9292	0.8515	0.7263	0.5717	0.4425	0.5008	0.7237	0.9075	0.9708	0.9858	(86)
MIT	18.6283	18.9662	19.4717	20.0846	20.5646	20.8459	20.9456	20.9219	20.6835	20.0188	19.2045	18.5720	(87)
Th 2	19.7434	19.7462	19.7490	19.7619	19.7643	19.7756	19.7756	19.7777	19.7712	19.7643	19.7594	19.7543	(88)
util rest of house	0.9788	0.9577	0.9144	0.8207	0.6707	0.4858	0.3312	0.3857	0.6461	0.8811	0.9635	0.9828	(89)
MIT 2	17.6093	17.9444	18.4397	19.0313	19.4612	19.6940	19.7570	19.7485	19.5807	18.9882	18.1930	17.5610	(90)
Living area fraction	17.7722	18.1077	18.6047	19.1996	19.6376	19.8782	19.9470	19.9361	19.7570	19.1529	18.3547	17.7226	(92)
Temperature adjustment	17.7722	18.1077	18.6047	19.1996	19.6376	19.8782	19.9470	19.9361	19.7570	19.1529	18.3547	17.7226	(93)
adjusted MIT	17.7722	18.1077	18.6047	19.1996	19.6376	19.8782	19.9470	19.9361	19.7570	19.1529	18.3547	17.7226	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9705	0.9449	0.8972	0.8042	0.6643	0.4935	0.3476	0.4016	0.6451	0.8646	0.9522	0.9757	(94)
Ext temp.	585.5913	732.8583	856.7399	926.6387	862.1075	641.9535	430.3144	446.2923	622.5980	668.9914	588.9072	543.9765	(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	1849.7351	1808.7629	1653.5224	1390.2198	1068.9864	703.3614	446.0192	470.2891	756.9297	1151.8547	1522.6260	1838.1387	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	940.5230	723.0079	592.8062	333.7783	153.9179	0.0000	0.0000	0.0000	0.0000	359.2503	672.2776	962.8566	(98)
												4738.4178	(98)
												49.2150	(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

Calculation Type: New Build (As Designed)



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	1252.6326	986.1150	1010.7757	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8279	0.8787	0.8474	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1037.0408	866.5199	856.5688	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	422.0264	506.8057	405.2408	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1334.0729	(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	105.5066	126.7014	101.3102	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												333.5182	(107)
Energy for space heating												3.4640	(108)
Energy for space cooling												49.2150	(99)
Total												3.4640	(108)
Dwelling Fabric Energy Efficiency (DFEE)												52.6790	(109)
												52.7	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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)
	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 Designed)

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)	
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	0.0000	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	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	1172.1413	922.7495	945.7029	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	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)
Useful loss	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)
Total gains	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)
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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)									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	43.3439	62.1705	46.7477	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												152.2621 (107)
Energy for space heating												1.5815 (108)
Energy for space cooling												51.9780 (99)
Total												1.5815 (108)
Target Fabric Energy Efficiency (TFEE)												53.5595 (109)
												61.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353 (22b)
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948 (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	48.9094	48.0547	48.0547	46.8507	46.8507	45.3913	45.7405	45.0526	45.3913	46.1002	46.1002	47.2416 (38)
Average = Sum(39)m / 12 =	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408 (39)
												135.1440 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4272	1.4183	1.4183	1.4058	1.4058	1.3906	1.3943	1.3871	1.3906	1.3980	1.3980	1.4099 (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 Designed)

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)
												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	(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	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-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	12.9236		0.4600	0.0000	0.7700	42.2963 (75)
Southwest												2.9400	40.4699		0.4600	0.0000	0.7700	42.1433 (79)
Northwest												4.1000	12.9236		0.4600	0.0000	0.7700	18.7679 (81)
Southwest												9.9700	40.4699		0.4600	0.0000	0.7700	142.9144 (79)
Solar gains	246.1218	396.0089	584.7215	832.0586	983.3460	1079.8578	1015.4182	893.6632	716.5617	481.7119	305.8921	206.1755 (83)						
Total gains	905.6443	1050.8993	1215.8807	1426.2318	1539.4166	1601.8527	1517.5029	1404.4946	1248.6745	1051.0354	916.6511	848.5097 (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	27.0510	27.2203	27.2203	27.4624	27.4624	27.7618	27.6895	27.8322	27.7618	27.6156	27.6156	27.3833
alpha	2.8034	2.8147	2.8147	2.8308	2.8308	2.8508	2.8460	2.8555	2.8508	2.8410	2.8410	2.8256
util living area	0.9486	0.9236	0.8692	0.7579	0.5993	0.3970	0.2692	0.2971	0.5496	0.8038	0.9172	0.9553 (86)
MIT	19.1512	19.4172	19.8813	20.4089	20.7753	20.9527	20.9892	20.9858	20.8728	20.4093	19.7226	19.1120 (87)
Th 2	19.7426	19.7493	19.7493	19.7589	19.7589	19.7705	19.7677	19.7732	19.7705	19.7649	19.7649	19.7558 (88)
util rest of house	0.9384	0.9089	0.8441	0.7139	0.5303	0.3070	0.1644	0.1863	0.4551	0.7559	0.8985	0.9463 (89)
MIT 2	17.3686	17.7491	18.3981	19.1094	19.5566	19.7437	19.7652	19.7695	19.6805	19.1381	18.2006	17.3214 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.6536	18.0158	18.6352	19.3171	19.7514	19.9370	19.9608	19.9639	19.8711	19.3413	18.4439	17.6076 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5036	17.8658	18.4852	19.1671	19.6014	19.7870	19.8108	19.8139	19.7211	19.1913	18.2939	17.4576 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9125	0.8793	0.8125	0.6898	0.5208	0.3083	0.1681	0.1901	0.4510	0.7291	0.8684	0.9222 (94)
Useful gains	826.3838	924.0319	987.9441	983.8599	801.7075	493.8311	255.1538	267.0208	563.1490	766.3395	796.0575	782.5221 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	1704.3579	1674.9372	1513.7265	1254.2985	893.5001	507.0369	256.5089	268.9634	605.3301	1021.7881	1385.5550	1677.4281 (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)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
Effective ac	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
HLP	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (40)
HLP (average)												1.4365 (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											

	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	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area	0.9574	0.9322	0.8866	0.7978	0.6681	0.5138	0.3906	0.4370	0.6452	0.8469	0.9357	0.9631 (86)
MIT	18.8994	19.2122	19.6731	20.2268	20.6399	20.8787	20.9587	20.9428	20.7606	20.2047	19.4631	18.8543 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house	0.9491	0.9194	0.8652	0.7605	0.6091	0.4306	0.2881	0.3306	0.5633	0.8092	0.9213	0.9558 (89)
MIT 2	16.9864	17.4342	18.0858	18.8531	19.3818	19.6648	19.7360	19.7290	19.5481	18.8506	17.8132	16.9312 (90)
Living area fraction									fLA = Living area / (4)			0.1598 (91)
MIT	17.2922	17.7184	18.3395	19.0727	19.5829	19.8589	19.9314	19.9231	19.7419	19.0670	18.0769	17.2386 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1422	17.5684	18.1895	18.9227	19.4329	19.7089	19.7814	19.7731	19.5919	18.9170	17.9269	17.0886 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9248	0.8900	0.9326	0.9323	0.5932	0.4272	0.2903	0.3318	0.5518	0.7785	0.8926	0.9335 (94)
Useful gains	814.8397	934.4560	1014.7684	1026.0548	908.7522	650.4180	421.9116	441.8007	659.3575	793.0903	784.9196	774.7115 (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	1820.6502	1789.3494	1645.0512	1386.1846	1065.9929	693.4802	431.8467	456.5430	749.9389	1146.5165	1502.4362	1800.8980 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating	748.3230	574.4884	468.9304	259.2935	116.9870	0.0000	0.0000	0.0000	0.0000	262.9491	516.6119	763.4828 (98)
Space heating per m2												3711.0661 (98)
												(98) / (4) = 38.5445 (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												4105.1616 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	748.3230	574.4884	468.9304	259.2935	116.9870	0.0000	0.0000	0.0000	0.0000	262.9491	516.6119	763.4828 (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)	827.7909	635.4960	518.7283	286.8291	129.4104	0.0000	0.0000	0.0000	0.0000	290.8729	571.4734	844.5606 (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	87.8649	87.5896	87.0407	85.8489	83.8078	79.7000	79.7000	79.7000	79.7000	85.7903	87.2969	79.7000 (216)
Fuel for water heating, kWh/month	233.1294	205.9868	217.3630	197.0888	197.4974	185.0425	177.2149	195.1471	195.0179	204.5323	213.1179	227.1434 (219)
Water heating fuel used												2448.2813 (219)
Annual totals kWh/year												
Space heating fuel - main system												4105.1616 (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)
Total delivered energy for all uses												7022.3176 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4105.1616	3.4800	142.8596 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2448.2813	3.4800	85.2002 (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)
Total energy cost			409.9044 (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] =	1.2186 (257)
SAP value		83.0009
SAP rating (Section 12)		83 (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	4105.1616	0.2160	886.7149 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2448.2813	0.2160	528.8288 (264)
Space and water heating			1415.5437 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total kg/year			1658.8897 (272)
CO2 emissions per m2			17.2300 (273)
EI value			84.2659
EI rating			84 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
 $3.48 / 0.8433 = 4.127$, stars = 4
 $0.216 / 0.8433 = 0.2561$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =		0.4582 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353 (22b)
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948 (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	48.9094	48.0547	48.0547	46.8507	46.8507	45.3913	45.7405	45.0526	45.3913	46.1002	46.1002	47.2416 (38)
Average = Sum(39)m / 12 =	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408 (39)
	135.1440 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4272	1.4183	1.4183	1.4058	1.4058	1.3906	1.3943	1.3871	1.3906	1.3980	1.3980	1.4099 (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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	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 = 24.0726	21.0541	(45)m = 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															
	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)		
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	(65)		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Space heating	653.2127	504.6084	391.1821	194.7157	68.2937	0.0000	0.0000	0.0000	0.0000	190.0538	424.4382	665.8100 (98)
Space heating per m2												3092.3147 (98)
										(98) / (4) =		32.1179 (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												3420.7021 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	653.2127	504.6084	391.1821	194.7157	68.2937	0.0000	0.0000	0.0000	0.0000	190.0538	424.4382	665.8100 (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)	722.5805	558.1951	432.7236	215.3935	75.5461	0.0000	0.0000	0.0000	0.0000	210.2365	469.5113	736.5155 (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	87.5927	87.3127	86.6096	85.0888	82.5541	79.7000	79.7000	79.7000	79.7000	84.9266	86.8468	79.7000 (216)
Fuel for water heating, kWh/month	233.8540	206.6400	218.4450	198.8495	200.4967	185.0425	177.2149	195.1471	195.0179	206.6123	214.2224	227.8377 (219)
Water heating fuel used												2459.3801 (219)
Annual totals kWh/year												3420.7021 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)
Total delivered energy for all uses												6348.9569 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3420.7021	3.9200	134.0915 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2459.3801	3.9200	96.4077 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	393.8748	16.9600	66.8012 (250)
Additional standing charges			88.0000 (251)
Total energy cost			398.0204 (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	3420.7021	0.2160	738.8716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2459.3801	0.2160	531.2261 (264)
Space and water heating			1270.0977 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total kg/year			1513.4437 (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	3420.7021	1.2200	4173.2565 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2459.3801	1.2200	3000.4437 (264)
Space and water heating			7173.7002 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	393.8748	3.0700	1209.1955 (268)
Primary energy kWh/year			8613.1457 (272)
Primary energy kWh/m2/year			89.4593 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 83
Current environmental impact rating: B 84

(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	Recommended
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	-£ 42	-252 kg (16.7%)
U Solar photovoltaic panels	+ 9.4	-£ 309	-947 kg (75.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£42	2.62 kg/m²	B 85 B 87
Solar photovoltaic panels	£309	9.83 kg/m²	A 94 A 95
Total Savings	£351	12.45 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£80	£88	-£8
Mains gas	£318	£268	£50
Space heating	£235	£236	-£1
Water heating	£96	£54	£43
Lighting	£67	£67	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£398	£47	£351
Total cost of uses	£398	£48	£351
Delivered energy	66 kWh/m²	34 kWh/m²	32 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.3 tonnes	1.2 tonnes
CO2 emissions per m²	16 kg/m²	3 kg/m²	12 kg/m²
Primary energy	89 kWh/m²	17 kWh/m²	73 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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		(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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
Effective ac	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
	138.3029 (39)											

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (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 Designed)

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	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area	0.9582	0.9331	0.8880	0.8010	0.6734	0.5192	0.3956	0.4426	0.6495	0.8491	0.9367	0.9638 (86)
MIT	18.8915	19.2050	19.6656	20.2174	20.6321	20.8754	20.9573	20.9410	20.7563	20.1982	19.4558	18.8463 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house	0.9499	0.9204	0.8668	0.7641	0.6146	0.4356	0.2920	0.3351	0.5677	0.8117	0.9225	0.9566 (89)
MIT 2	16.9752	17.4242	18.0756	18.8412	19.3734	19.6621	19.7353	19.7280	19.5440	18.8423	17.8029	16.9197 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.2815	17.7088	18.3298	19.0612	19.5746	19.8560	19.9306	19.9219	19.7378	19.0590	18.0671	17.2277 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1315	17.5588	18.1798	18.9112	19.4246	19.7060	19.7806	19.7719	19.5878	18.9090	17.9171	17.0777 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9259	0.8911	0.8343	0.7356	0.5983	0.4320	0.2942	0.3363	0.5558	0.7809	0.8940	0.9346	(94)
Useful gains	809.6357	929.7938	1010.0235	1020.3224	904.2848	648.8104	421.4590	441.1291	657.1537	789.1778	780.2271	769.3698	(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	1819.1398	1787.9891	1643.6759	1384.6022	1064.8448	693.0952	431.7371	456.3809	749.3822	1145.4144	1501.0827	1799.3678	(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	751.0711	576.7072	471.4374	262.2815	119.4566	0.0000	0.0000	0.0000	0.0000	265.0400	519.0160	766.3185	(98)
Space heating per m2												3731.3282	(98)
												(98) / (4) =	38.7550 (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													4127.5755 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	751.0711	576.7072	471.4374	262.2815	119.4566	0.0000	0.0000	0.0000	0.0000	265.0400	519.0160	766.3185	(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)	830.8308	637.9504	521.5015	290.1344	132.1422	0.0000	0.0000	0.0000	0.0000	293.1859	574.1328	847.6974	(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	88.1923	88.2136	88.2223	88.3325	88.5748	79.7000	79.7000	79.7000	79.7000	86.9479	87.7769	79.7000	(216)
Fuel for water heating, kWh/month	195.1932	148.0177	120.3836	62.6986	24.4543	7.6668	1.0996	39.4035	76.7241	128.0028	169.3022	194.2696	(219)
Water heating fuel used												1167.2160	(219)
Annual totals kWh/year													
Space heating fuel - main system												4127.5755	(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 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												4086.4268	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4127.5755	3.4800	143.6396	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.2160	3.4800	40.6191	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			144.8754	(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] =	0.4307 (257)
SAP value		93.9919
SAP rating (Section 12)		94 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4127.5755	0.2160	891.5563 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.2160	0.2160	252.1187 (264)
Space and water heating			1143.6750 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			516.5337 (272)
CO2 emissions per m2			5.3600 (273)
EI value			95.1008
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353 (22b)
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948 (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	48.9094	48.0547	48.0547	46.8507	46.8507	45.3913	45.7405	45.0526	45.3913	46.1002	46.1002	47.2416 (38)
Average = Sum(39)m / 12 =	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408 (39)
	135.1440 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4272	1.4183	1.4183	1.4058	1.4058	1.3906	1.3943	1.3871	1.3906	1.3980	1.3980	1.4099 (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											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2374 (H8)
Utilisation factor												0.5543 (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												-933.5648 (H17)
Solar input	-28.7347	-43.1881	-72.7343	-100.5411	-121.0852	-127.4369	-124.3769	-111.0694	-86.6900	-58.9736	-34.9277	-23.8068 (63)
								Solar input (sum of months) = Sum (63)m =				-933.5648 (63)
Output from w/h												
	169.9575	131.6828	108.9174	55.9553	25.4919	1.4866	0.0000	26.2196	57.3878	108.9526	145.1689	169.8215 (64)
								Total per year (kWh/year) = Sum (64)m =				1001.0420 (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	12.9236		0.4600	0.0000	0.7700		42.2963 (75)
Southwest						2.9400	40.4699		0.4600	0.0000	0.7700		42.1433 (79)
Northwest						4.1000	12.9236		0.4600	0.0000	0.7700		18.7679 (81)
Southwest						9.9700	40.4699		0.4600	0.0000	0.7700		142.9144 (79)

Solar gains	246.1218	396.0089	584.7215	832.0586	983.3460	1079.8578	1015.4182	893.6632	716.5617	481.7119	305.8921	206.1755 (83)	
Total gains	899.0348	1044.2898	1207.7703	1412.1183	1519.0498	1581.2357	1496.8859	1384.8782	1236.0618	1042.9251	910.0415	841.9002 (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	27.0510	27.2203	27.2203	27.4624	27.4624	27.7618	27.6895	27.8322	27.7618	27.6156	27.6156	27.3833
alpha	2.8034	2.8147	2.8147	2.8308	2.8308	2.8508	2.8460	2.8555	2.8508	2.8410	2.8410	2.8256
util living area	0.9494	0.9246	0.8708	0.7614	0.6048	0.4015	0.2727	0.3011	0.5537	0.8063	0.9185	0.9561 (86)
MIT	19.1435	19.4101	19.8742	20.4009	20.7698	20.9513	20.9889	20.9853	20.8703	20.4037	19.7156	19.1041 (87)
Th 2	19.7426	19.7493	19.7493	19.7589	19.7589	19.7705	19.7677	19.7732	19.7705	19.7649	19.7649	19.7558 (88)
util rest of house												
	0.9393	0.9101	0.8460	0.7177	0.5357	0.3108	0.1666	0.1889	0.4590	0.7587	0.8999	0.9472 (89)
MIT 2	17.3578	17.7393	18.3886	19.0997	19.5513	19.7428	19.7651	19.7694	19.6785	19.1315	18.1912	17.3101 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	17.6432	18.0064	18.6261	19.3077	19.7460	19.9360	19.9607	19.9637	19.8690	19.3348	18.4348	17.5969 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4932	17.8564	18.4761	19.1577	19.5960	19.7860	19.8107	19.8137	19.7190	19.1848	18.2848	17.4469 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9136	0.8805	0.8143	0.6933	0.5258	0.3120	0.1704	0.1927	0.4547	0.7317	0.8700	0.9234	(94)
Useful gains	821.3923	919.5477	983.5436	979.0814	798.7485	493.2936	255.0855	266.9221	561.9994	763.1235	791.7372	777.3800	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1702.9332	1673.6577	1512.4840	1253.0262	892.7727	506.9101	256.4902	268.9370	605.0526	1020.9155	1384.3337	1675.9763	(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	655.8665	506.7619	393.5316	197.2403	69.9541	0.0000	0.0000	0.0000	0.0000	191.7972	426.6695	668.5556	(98)
Space heating												3110.3766	(98)
Space heating per m2												32.3055	(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													3440.6821 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	655.8665	506.7619	393.5316	197.2403	69.9541	0.0000	0.0000	0.0000	0.0000	191.7972	426.6695	668.5556	(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)	725.5160	560.5773	435.3226	218.1861	77.3828	0.0000	0.0000	0.0000	0.0000	212.1651	471.9795	739.5527	(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	169.9575	131.6828	108.9174	55.9553	25.4919	1.4866	0.0000	26.2196	57.3878	108.9526	145.1689	169.8215	(64)
Efficiency of water heater (217)m	87.9694	87.9642	87.8435	87.7952	87.2708	79.7000	79.7000	79.7000	79.7000	86.2072	87.4205	79.7000	(216)
Fuel for water heating, kWh/month	193.2007	149.7004	123.9902	63.7340	29.2101	1.8653	0.0000	32.8979	72.0048	126.3846	166.0582	192.9642	(219)
Water heating fuel used												1152.0102	(219)
Annual totals kWh/year													
Space heating fuel - main system												3440.6821	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses												3287.4075	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3440.6821	3.9200	134.8747	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1152.0102	3.9200	45.1588	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	393.8748	16.9600	66.8012	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			46.6572	(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	3440.6821	0.2160	743.1873	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1152.0102	0.2160	248.8342 (264)
Space and water heating			992.0216 (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	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			314.5787 (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	3440.6821	1.2200	4197.6322 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1152.0102	1.2200	1405.4525 (264)
Space and water heating			5603.0847 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1595.8601 (272)
Primary energy kWh/m2/year			16.5752 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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 West	0.000	1.000	None
North 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 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 Designed)



Property Reference	4907-P637-6633-658				Issued on Date	19/10/2022
Assessment Reference	Plot 658	Prop Type Ref	Fuller-CB-As-DET			
Property	Plot 658, 3 Bed, K, WC, U, B, ES					
SAP Rating	83 B	DER	18.12	TER	18.42	
Environmental	85 B	% DER<TER	1.63			
CO ₂ Emissions (t/year)	1.49	DFEE	51.26	TFEE	60.04	
General Requirements Compliance	Pass	% DFEE<TFEE	14.62			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessc.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

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) 18.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)60.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.3 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: 5.01 (design value)
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 East: 4.10 m², No overhang
Windows facing South West: 12.91 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 0.64 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
Effective ac	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
	138.3029 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 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)
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	717.0301	909.0223	1093.3714	1279.6025	1408.2019	1398.9719	1337.4539	1225.9257	1096.2405	905.4681	736.4199	665.6100	(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	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area	0.9735	0.9504	0.9083	0.8257	0.7012	0.5479	0.4200	0.4682	0.6798	0.8766	0.9566	0.9781 (86)
MIT	18.6988	19.0536	19.5522	20.1418	20.5896	20.8568	20.9503	20.9318	20.7246	20.1086	19.2986	18.6489 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house	0.9680	0.9405	0.8900	0.7914	0.6434	0.4623	0.3114	0.3564	0.5987	0.8438	0.9462	0.9735 (89)
MIT 2	16.6995	17.2110	17.9211	18.7452	19.3266	19.6467	19.7315	19.7226	19.5136	18.7275	17.5825	16.6364 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.0191	17.5056	18.1818	18.9685	19.5285	19.8401	19.9263	19.9159	19.7071	18.9483	17.8568	16.9581 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8691	17.3556	18.0318	18.8185	19.3785	19.6901	19.7763	19.7659	19.5571	18.7983	17.7068	16.8081 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9493	0.9144	0.8582	0.7613	0.6247	0.4574	0.3133	0.3571	0.5845	0.8121	0.9217	0.9571 (94)
Useful gains	680.7119	831.2270	938.3717	974.1776	879.7727	639.8554	419.0747	437.8060	640.7144	735.3085	678.7725	637.0385 (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	1781.9348	1759.2812	1622.8568	1371.7742	1058.4905	690.9380	431.1590	455.5769	745.1945	1130.1447	1471.8956	1761.7019 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	819.3098	623.6524	509.2569	286.2695	132.9661	0.0000	0.0000	0.0000	0.0000	293.7581	571.0486	836.7495 (98)
Space heating												4073.0110 (98)
Space heating per m2										(98) / (4) =		42.3038 (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												4505.5432 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	819.3098	623.6524	509.2569	286.2695	132.9661	0.0000	0.0000	0.0000	0.0000	293.7581	571.0486	836.7495 (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)	906.3162	689.8810	563.3373	316.6698	147.0864	0.0000	0.0000	0.0000	0.0000	324.9537	631.6910	925.6079 (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	88.0361	87.7564	87.2279	86.1057	84.1363	79.7000	79.7000	79.7000	79.7000	86.0785	87.5129	79.7000 (216)
Fuel for water heating, kWh/month	232.6763	205.5952	216.8966	196.5011	196.7264	185.0425	177.2149	195.1471	195.0179	203.8475	212.5919	226.7085 (219)
Water heating fuel used												2443.9658 (219)
Annual totals kWh/year												
Space heating fuel - main system												4505.5432 (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)
Total delivered energy for all uses												7418.3837 (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	4505.5432	0.2160	973.1973 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2443.9658	0.2160	527.8966 (264)
Space and water heating			1501.0939 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total CO2, kg/year			1744.4399 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.1200 (273)

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

DER			18.1200 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			35.4269 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			35.4269 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed)

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	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	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)
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)
Total per year (kWh/year) = Sum(64)m =												2096.5183	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	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	53.6193	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	0.9970	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	
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	(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	1787.2539	1739.7134	1582.7746	1324.9940	1019.0279	671.2185	426.7549	450.3776	726.5945	1107.6702	1469.2658	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 Designed)

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 Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.3751 (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) =	0.3751 (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	0.4783	0.4689	0.4595	0.4127	0.4033	0.3564	0.3564	0.3470	0.3751	0.4033	0.4220	0.4408 (22b)
	0.6144	0.6099	0.6056	0.5851	0.5813	0.5635	0.5635	0.5602	0.5704	0.5813	0.5891	0.5971 (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	48.8012	48.4484	48.1026	46.4783	46.1744	44.7596	44.7596	44.4976	45.3046	46.1744	46.7892	47.4319 (38)
Average = Sum(39)m / 12 =	137.3004	136.9476	136.6017	134.9774	134.6735	133.2588	133.2588	132.9968	133.8037	134.6735	135.2883	135.9311 (39)
												134.9760 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4261	1.4224	1.4188	1.4019	1.3988	1.3841	1.3841	1.3814	1.3897	1.3988	1.4052	1.4118 (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 Designed)

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, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	27.0723	27.1420	27.2107	27.5382	27.6003	27.8934	27.8934	27.9483	27.7798	27.6003	27.4749	27.3450	
alpha	2.8048	2.8095	2.8140	2.8359	2.8400	2.8596	2.8596	2.8632	2.8520	2.8400	2.8317	2.8230	
util living area	0.9797	0.9586	0.9187	0.8386	0.7147	0.5622	0.4326	0.4847	0.6999	0.8926	0.9657	0.9837	(86)
MIT	18.6766	19.0365	19.5404	20.1291	20.5838	20.8525	20.9487	20.9283	20.7118	20.0776	19.2588	18.6148	(87)
Th 2	19.7434	19.7462	19.7490	19.7619	19.7643	19.7756	19.7756	19.7777	19.7712	19.7643	19.7594	19.7543	(88)
util rest of house	0.9754	0.9502	0.9022	0.8061	0.6584	0.4768	0.3232	0.3719	0.6207	0.8632	0.9573	0.9802	(89)
MIT 2	17.6569	18.0128	18.5048	19.0706	19.4760	19.6979	19.7582	19.7511	19.6001	19.0412	18.2458	17.6034	(90)
Living area fraction	17.8199	18.1764	18.6703	19.2398	19.6531	19.8824	19.9485	19.9393	19.7778	19.2069	18.4078	17.7650	(91)
MIT	17.8199	18.1764	18.6703	19.2398	19.6531	19.8824	19.9485	19.9393	19.7778	19.2069	18.4078	17.7650	(92)
Temperature adjustment	17.8199	18.1764	18.6703	19.2398	19.6531	19.8824	19.9485	19.9393	19.7778	19.2069	18.4078	17.7650	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9663	0.9362	0.8845	0.7901	0.6527	0.4848	0.3394	0.3878	0.6212	0.8466	0.9449	0.9724	(94)
Ext temp.	618.8705	780.1311	901.5391	954.3479	873.3562	645.2474	431.4427	448.7867	637.8314	705.7769	625.3829	573.5732	(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	1856.2896	1818.1722	1662.4876	1395.6341	1071.0709	703.9319	446.2124	470.7168	759.7123	1159.1215	1529.8087	1843.9105	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	920.6398	697.5636	566.1457	317.7261	147.0998	0.0000	0.0000	0.0000	0.0000	337.2884	651.1866	945.1309	(98)
												4582.7809	(98)
												47.5985	(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

Calculation Type: New Build (As Designed)



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	1252.6326	986.1150	1010.7757	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8342	0.8844	0.8576	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1044.9348	872.1105	866.8109	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	441.7209	531.4498	437.7338	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1410.9044	(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	110.4302	132.8624	109.4334	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												352.7261	(107)
Energy for space heating												3.6635	(108)
Energy for space cooling												47.5985	(99)
Total												3.6635	(108)
Dwelling Fabric Energy Efficiency (DFEE)												51.2620	(109)
												51.3	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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)	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	53.6193	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	628.5094	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)
												50.5124	(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	1172.1413	922.7495	945.7029	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	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)
Useful loss	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)
Total gains	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)
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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353 (22b)
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948 (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	48.9094	48.0547	48.0547	46.8507	46.8507	45.3913	45.7405	45.0526	45.3913	46.1002	46.1002	47.2416 (38)
Average = Sum(39)m / 12 =	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408 (39)
	135.1440 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4272	1.4183	1.4183	1.4058	1.4058	1.3906	1.3943	1.3871	1.3906	1.3980	1.3980	1.4099 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	12.9236		0.4600		0.0000		0.7700	42.2963 (75)	
Southeast				4.1000	40.4699		0.4600		0.0000		0.7700	58.7712 (77)	
Southwest				2.9400	40.4699		0.4600		0.0000		0.7700	42.1433 (79)	
Southwest				9.9700	40.4699		0.4600		0.0000		0.7700	142.9144 (79)	

Solar gains	286.1252	451.5085	644.9091	884.1628	1018.8445	1107.7126	1046.0268	938.6885	778.3462	542.8343	353.7629	240.8460 (83)	
Total gains	945.6477	1106.3988	1276.0682	1478.3359	1574.9151	1629.7075	1548.1114	1449.5198	1310.4590	1112.1578	964.5219	883.1802 (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	27.0510	27.2203	27.2203	27.4624	27.4624	27.7618	27.6895	27.8322	27.7618	27.6156	27.6156	27.3833
alpha	2.8034	2.8147	2.8147	2.8308	2.8308	2.8508	2.8460	2.8555	2.8508	2.8410	2.8410	2.8256
util living area	0.9434	0.9149	0.8570	0.7449	0.5899	0.3910	0.2641	0.2884	0.5299	0.7853	0.9080	0.9511 (86)
MIT	19.1973	19.4754	19.9327	20.4374	20.7844	20.9546	20.9898	20.9869	20.8844	20.4493	19.7718	19.1531 (87)
Th 2	19.7426	19.7493	19.7493	19.7589	19.7589	19.7705	19.7677	19.7732	19.7705	19.7649	19.7649	19.7558 (88)
util rest of house	0.9323	0.8990	0.8305	0.7000	0.5211	0.3021	0.1612	0.1807	0.4370	0.7352	0.8877	0.9413 (89)
MIT 2	17.4337	17.8299	18.4664	19.1436	19.5655	19.7448	19.7653	19.7698	19.6895	19.1859	18.2678	17.3796 (90)
Living area fraction												
MIT	17.7156	18.0929	18.7008	19.3504	19.7604	19.9382	19.9610	19.9643	19.8805	19.3878	18.5082	17.6631 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5656	17.9429	18.5508	19.2004	19.6104	19.7882	19.8110	19.8143	19.7305	19.2378	18.3582	17.5131 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	856.2038	960.9588	1019.7396	1000.8948	806.6572	494.5240	255.2493	267.2301	568.3691	789.5352	826.6883	809.1918 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1712.8769	1685.4727	1522.6819	1258.8140	894.7129	507.2001	256.5351	269.0193	606.5854	1028.0485	1394.2094	1684.9660 (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 Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	637.3648	486.8733	374.1891	185.7019	65.5134	0.0000	0.0000	0.0000	0.0000	177.4539	408.6152	651.5760 (98)
Space heating												2987.2876 (98)
RHI space heating demand												2987 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
	138.3029 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (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											

	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 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)

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	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area	0.9533	0.9242	0.8750	0.7850	0.6578	0.5060	0.3829	0.4245	0.6247	0.8309	0.9288	0.9597 (86)
MIT	18.9431	19.2741	19.7316	20.2627	20.6546	20.8834	20.9607	20.9469	20.7802	20.2513	19.5106	18.8935 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house	0.9443	0.9101	0.8521	0.7466	0.5985	0.4234	0.2820	0.3203	0.5428	0.7910	0.9131	0.9519 (89)
MIT 2	17.0485	17.5207	18.1647	18.8980	19.3978	19.6686	19.7370	19.7314	19.5664	18.9092	17.8791	16.9870 (90)
Living area fraction									fLa = Living area / (4) =			0.1598 (91)
MIT	17.3513	17.8010	18.4151	19.1161	19.5987	19.8628	19.9326	19.9257	19.7605	19.1237	18.1399	17.2918 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2013	17.6510	18.2651	18.9661	19.4487	19.7128	19.7826	19.7757	19.6105	18.9737	17.9899	17.1418 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9189	0.8797	0.9194	0.7194	0.5835	0.4204	0.2843	0.3218	0.5328	0.7612	0.8835	0.9286 (94)
Useful gains	843.6962	974.3975	1051.5384	1047.9297	917.2372	652.6678	422.5977	443.2677	669.4457	820.9253	815.2067	800.6090 (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 fracti	1829.0352	1801.0077	1655.6898	1392.1986	1068.1647	694.0179	432.0127	456.8966	752.4735	1154.3262	1511.1757	1808.3266 (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 Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

733.0922	555.4820	449.4886	247.8736	112.2901	0.0000	0.0000	0.0000	0.0000	248.0503	501.0977	749.7419 (98)
Space heating											3597.1164 (98)
Space heating per m2										(98) / (4) =	37.3610 (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												3979.1110 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	733.0922	555.4820	449.4886	247.8736	112.2901	0.0000	0.0000	0.0000	0.0000	248.0503	501.0977	749.7419 (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)	810.9427	614.4713	497.2219	274.1965	124.2147	0.0000	0.0000	0.0000	0.0000	274.3919	554.3116	829.3605 (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	87.8250	87.5193	86.9424	85.7307	83.7046	79.7000	79.7000	79.7000	79.7000	85.6367	87.2293	79.7000 (216)
Fuel for water heating, kWh/month	233.2356	206.1522	217.6089	197.3604	197.7409	185.0425	177.2149	195.1471	195.0179	204.8992	213.2830	227.2325 (219)
Water heating fuel used												2449.9350 (219)
Annual totals kWh/year												
Space heating fuel - main system												3979.1110 (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)
Total delivered energy for all uses												6897.9208 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3979.1110	3.4800	138.4731 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2449.9350	3.4800	85.2577 (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)
Total energy cost			405.5754 (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] =	1.2057 (257)
SAP value		83.1804
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3979.1110	0.2160	859.4880 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2449.9350	0.2160	529.1860 (264)
Space and water heating			1388.6739 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total kg/year			1632.0199 (272)
CO2 emissions per m2			16.9500 (273)
EI value			84.5208
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
 $3.48 / 0.8428 = 4.129$, stars = 4
 $0.216 / 0.8428 = 0.2563$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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					5.0100
Infiltration rate					0.4582 (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) =		0.4582 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353 (22b)
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948 (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	48.9094	48.0547	48.0547	46.8507	46.8507	45.3913	45.7405	45.0526	45.3913	46.1002	46.1002	47.2416 (38)
Average = Sum(39)m / 12 =	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408 (39)
	135.1440 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4272	1.4183	1.4183	1.4058	1.4058	1.3906	1.3943	1.3871	1.3906	1.3980	1.3980	1.4099 (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 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 = 24.0726	21.0541	(45)m = 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															
	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)		
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	(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 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	12.9236	0.4600	0.0000	0.7700	42.2963 (75)
Southeast	4.1000	40.4699	0.4600	0.0000	0.7700	58.7712 (77)
Southwest	2.9400	40.4699	0.4600	0.0000	0.7700	42.1433 (79)
Southwest	9.9700	40.4699	0.4600	0.0000	0.7700	142.9144 (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	27.0510	27.2203	27.2203	27.4624	27.4624	27.7618	27.6895	27.8322	27.7618	27.6156	27.6156	27.3833
alpha	2.8034	2.8147	2.8147	2.8308	2.8308	2.8508	2.8460	2.8555	2.8508	2.8410	2.8410	2.8256
util living area	0.9434	0.9149	0.8570	0.7449	0.5899	0.3910	0.2641	0.2884	0.5299	0.7853	0.9080	0.9511 (86)
MIT	19.1973	19.4754	19.9327	20.4374	20.7844	20.9546	20.9898	20.9869	20.8844	20.4493	19.7718	19.1531 (87)
Th 2	19.7426	19.7493	19.7493	19.7589	19.7589	19.7705	19.7677	19.7732	19.7705	19.7649	19.7649	19.7558 (88)
util rest of house	0.9323	0.8990	0.8305	0.7000	0.5211	0.3021	0.1612	0.1807	0.4370	0.7352	0.8877	0.9413 (89)
MIT 2	17.4337	17.8299	18.4664	19.1436	19.5655	19.7448	19.7653	19.7698	19.6895	19.1859	18.2678	17.3796 (90)
Living area fraction										fLA = Living area / (4) =		0.1598 (91)
MIT	17.7156	18.0929	18.7008	19.3504	19.7604	19.9382	19.9610	19.9643	19.8805	19.3878	18.5082	17.6631 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5656	17.9429	18.5508	19.2004	19.6104	19.7882	19.8110	19.8143	19.7305	19.2378	18.3582	17.5131 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9054	0.8685	0.9991	0.6770	0.5122	0.3034	0.1649	0.1844	0.4337	0.7099	0.8571	0.9162 (94)
Useful gains	856.2038	960.9588	1019.7396	1000.8948	806.6572	494.5240	255.2493	267.2301	568.3691	789.5352	826.6883	809.1918 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
Month fracti	1712.8769	1685.4727	1522.6819	1258.8140	894.7129	507.2001	256.5351	269.0193	606.5854	1028.0485	1394.2094	1684.9660 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Space heating	637.3648	486.8733	374.1891	185.7019	65.5134	0.0000	0.0000	0.0000	0.0000	177.4539	408.6152	651.5760 (98)
Space heating per m2												2987.2876 (98)
										(98) / (4) =		31.0271 (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												3304.5217 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	637.3648	486.8733	374.1891	185.7019	65.5134	0.0000	0.0000	0.0000	0.0000	177.4539	408.6152	651.5760 (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)	705.0496	538.5767	413.9260	205.4224	72.4706	0.0000	0.0000	0.0000	0.0000	196.2985	452.0080	720.7699 (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	87.5415	87.2335	86.5002	84.9620	82.4680	79.7000	79.7000	79.7000	79.7000	84.7434	86.7560	79.7000 (216)
Fuel for water heating, kWh/month	233.9907	206.8276	218.7213	199.1462	200.7061	185.0425	177.2149	195.1471	195.0179	207.0589	214.4465	227.9522 (219)
Water heating fuel used												2461.2719 (219)
Annual totals kWh/year												3304.5217 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)
Total delivered energy for all uses												6234.6683 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3304.5217	3.9200	129.5372 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2461.2719	3.9200	96.4819 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	393.8748	16.9600	66.8012 (250)
Additional standing charges			88.0000 (251)
Total energy cost			393.5403 (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	3304.5217	0.2160	713.7767 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2461.2719	0.2160	531.6347 (264)
Space and water heating			1245.4114 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Total kg/year			1488.7574 (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	3304.5217	1.2200	4031.5164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2461.2719	1.2200	3002.7517 (264)
Space and water heating			7034.2681 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	393.8748	3.0700	1209.1955 (268)
Primary energy kWh/year			8473.7136 (272)
Primary energy kWh/m2/year			88.0112 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 83
Current environmental impact rating: B 85

(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	Recommended
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	-£ 42	-253 kg (17.0%)
U Solar photovoltaic panels	+ 9.4	-£ 309	-947 kg (76.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£42	2.62 kg/m²	B 85 B 87
Solar photovoltaic panels	£309	9.83 kg/m²	A 94 A 95
Total Savings	£351	12.46 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£80	£88	-£8
Mains gas	£314	£263	£51
Space heating	£230	£231	-£1
Water heating	£96	£54	£43
Lighting	£67	£67	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£394	£42	£352
Total cost of uses	£393	£43	£351
Delivered energy	65 kWh/m²	33 kWh/m²	32 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.3 tonnes	1.2 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	12 kg/m²
Primary energy	88 kWh/m²	15 kWh/m²	73 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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		(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					5.0100
Infiltration rate					0.4582 (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) =	0.4582 (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	0.5842	0.5728	0.5613	0.5041	0.4926	0.4353	0.4353	0.4239	0.4582	0.4926	0.5155	0.5384 (22b)
Effective ac	0.6707	0.6640	0.6575	0.6270	0.6213	0.5948	0.5948	0.5898	0.6050	0.6213	0.6329	0.6449 (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	53.2718	52.7454	52.2295	49.8059	49.3524	47.2416	47.2416	46.8507	48.0547	49.3524	50.2697	51.2288 (38)
Average = Sum(39)m / 12 =	141.7710	141.2446	140.7286	138.3050	137.8516	135.7408	135.7408	135.3499	136.5538	137.8516	138.7689	139.7279 (39)
	138.3029 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4725	1.4670	1.4617	1.4365	1.4318	1.4099	1.4099	1.4058	1.4183	1.4318	1.4413	1.4513 (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 Designed)

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	Specific data or Table 6b	Specific data or Table 6c	FF 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	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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.2186	26.3163	26.4128	26.8756	26.9640	27.3833	27.3833	27.4624	27.2203	26.9640	26.7858	26.6020
alpha	2.7479	2.7544	2.7609	2.7917	2.7976	2.8256	2.8256	2.8308	2.8147	2.7976	2.7857	2.7735
util living area												
	0.9541	0.9251	0.8765	0.7882	0.6630	0.5113	0.3877	0.4298	0.6288	0.8331	0.9298	0.9604 (86)
MIT	18.9353	19.2671	19.7243	20.2538	20.6472	20.8802	20.9595	20.9452	20.7763	20.2451	19.5034	18.8855 (87)
Th 2	19.7082	19.7123	19.7164	19.7355	19.7391	19.7558	19.7558	19.7589	19.7493	19.7391	19.7318	19.7242 (88)
util rest of house												
	0.9452	0.9112	0.8537	0.7501	0.6039	0.4283	0.2858	0.3246	0.5469	0.7934	0.9143	0.9527 (89)
MIT 2	17.0375	17.5109	18.1549	18.8868	19.3898	19.6660	19.7364	19.7304	19.5629	18.9015	17.8692	16.9757 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.3409	17.7917	18.4058	19.1053	19.5908	19.8601	19.9319	19.9246	19.7568	19.1162	18.1304	17.2810 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1909	17.6417	18.2558	18.9553	19.4408	19.7101	19.7819	19.7746	19.6068	18.9662	17.9804	17.1310 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9200	0.8809	0.8211	0.7226	0.5884	0.4250	0.2880	0.3260	0.5366	0.7635	0.8849	0.9296	(94)
Useful gains	838.5870	969.8857	1047.0006	1042.4844	912.9891	651.1425	422.1764	442.6623	667.4688	817.2565	810.6497	795.3501	(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	1827.5494	1799.6906	1654.3789	1390.7053	1067.0788	693.6535	431.9108	456.7508	751.9787	1153.3001	1509.8605	1806.8169	(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	735.7880	557.6289	451.8894	250.7190	114.6427	0.0000	0.0000	0.0000	0.0000	250.0165	503.4317	752.5312	(98)
Space heating per m2												3616.6475	(98)
												(98) / (4) =	37.5639 (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													4000.7162 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	735.7880	557.6289	451.8894	250.7190	114.6427	0.0000	0.0000	0.0000	0.0000	250.0165	503.4317	752.5312	(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)	813.9248	616.8461	499.8777	277.3440	126.8172	0.0000	0.0000	0.0000	0.0000	276.5669	556.8935	832.4461	(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	88.1560	88.1545	88.1480	88.2562	88.5116	79.7000	79.7000	79.7000	79.7000	86.8100	87.7161	79.7000	(216)
Fuel for water heating, kWh/month	195.2734	148.1169	120.4851	62.7528	24.4717	7.6668	1.0996	39.4035	76.7241	128.2060	169.4196	194.3391	(219)
Water heating fuel used												1167.9588	(219)
Annual totals kWh/year													
Space heating fuel - main system												4000.7162	(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 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												3960.3104	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4000.7162	3.4800	139.2249	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.9588	3.4800	40.6450	(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	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			140.4866	(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] =	0.4176 (257)
SAP value		94.1739
SAP rating (Section 12)		94 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4000.7162	0.2160	864.1547 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.9588	0.2160	252.2791 (264)
Space and water heating			1116.4338 (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	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			489.2926 (272)
CO2 emissions per m2			5.0800 (273)
EI value			95.3592
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	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																	5.0100
Infiltration rate																	0.4582 (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) =							0.4582 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
	0.4811	0.4582	0.4582	0.4239	0.4239	0.3780	0.3895	0.3666	0.3780	0.4009	0.4009	0.4353	(22b)				
Effective ac	0.6157	0.6050	0.6050	0.5898	0.5898	0.5715	0.5759	0.5672	0.5715	0.5804	0.5804	0.5948	(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 48.9094	Feb 48.0547	Mar 48.0547	Apr 46.8507	May 46.8507	Jun 45.3913	Jul 45.7405	Aug 45.0526	Sep 45.3913	Oct 46.1002	Nov 46.1002	Dec 47.2416	(38)
Heat transfer coeff	137.4086	136.5538	136.5538	135.3499	135.3499	133.8905	134.2397	133.5517	133.8905	134.5993	134.5993	135.7408	(39)
Average = Sum(39)m / 12 =												135.1440	(39)
HLP	Jan 1.4272	Feb 1.4183	Mar 1.4183	Apr 1.4058	May 1.4058	Jun 1.3906	Jul 1.3943	Aug 1.3871	Sep 1.3906	Oct 1.3980	Nov 1.3980	Dec 1.4099	(40)
HLP (average)												1.4037	(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 Designed)

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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2374 (H8)
Utilisation factor												0.5543 (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												-933.5648 (H17)
Solar input	-28.7347	-43.1881	-72.7343	-100.5411	-121.0852	-127.4369	-124.3769	-111.0694	-86.6900	-58.9736	-34.9277	-23.8068 (63)
								Solar input (sum of months) = Sum (63)m =				-933.5648 (63)
Output from w/h												
	169.9575	131.6828	108.9174	55.9553	25.4919	1.4866	0.0000	26.2196	57.3878	108.9526	145.1689	169.8215 (64)
								Total per year (kWh/year) = Sum (64)m =				1001.0420 (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	12.9236		0.4600		0.0000		0.7700	42.2963 (75)
Southeast				4.1000	40.4699		0.4600		0.0000		0.7700	58.7712 (77)
Southwest				2.9400	40.4699		0.4600		0.0000		0.7700	42.1433 (79)
Southwest				9.9700	40.4699		0.4600		0.0000		0.7700	142.9144 (79)
Solar gains	286.1252	451.5085	644.9091	884.1628	1018.8445	1107.7126	1046.0268	938.6885	778.3462	542.8343	353.7629	240.8460 (83)
Total gains	939.0382	1099.7893	1267.9579	1464.2224	1554.5482	1609.0905	1527.4944	1429.9034	1297.8463	1104.0475	957.9123	876.5707 (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	27.0510	27.2203	27.2203	27.4624	27.4624	27.7618	27.6895	27.8322	27.7618	27.6156	27.6156	27.3833
alpha	2.8034	2.8147	2.8147	2.8308	2.8308	2.8508	2.8460	2.8555	2.8508	2.8410	2.8410	2.8256
util living area	0.9443	0.9160	0.8587	0.7484	0.5953	0.3954	0.2675	0.2922	0.5338	0.7877	0.9093	0.9519 (86)
MIT	19.1897	19.4686	19.9259	20.4298	20.7792	20.9532	20.9894	20.9864	20.8821	20.4442	19.7651	19.1453 (87)
Th 2	19.7426	19.7493	19.7493	19.7589	19.7589	19.7705	19.7677	19.7732	19.7705	19.7649	19.7649	19.7558 (88)
util rest of house												
	0.9333	0.9002	0.8323	0.7038	0.5263	0.3057	0.1633	0.1831	0.4406	0.7380	0.8892	0.9423 (89)
MIT 2	17.4230	17.8204	18.4574	19.1346	19.5605	19.7440	19.7652	19.7697	19.6877	19.1798	18.2587	17.3686 (90)

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Calculation Type: New Build (As Designed)

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	17.7054	18.0839	18.6921	19.3416	19.7553	19.9373	19.9609	19.9642	19.8786	19.3819	18.4995	17.6526 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5554	17.9339	18.5421	19.1916	19.6053	19.7873	19.8109	19.8142	19.7286	19.2319	18.3495	17.5026 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9066	0.8698	0.8009	0.6805	0.5171	0.3070	0.1671	0.1868	0.4372	0.7124	0.8587	0.9174	(94)
Useful gains	851.3230	956.6289	1015.5425	996.3731	803.8490	494.0148	255.1857	267.1417	567.3563	786.5607	822.5276	804.1469	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
Month fracti	1711.4817	1684.2377	1521.5021	1257.6185	894.0254	507.0801	256.5177	268.9957	606.3425	1027.2491	1393.0345	1683.5391	(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	639.9581	488.9531	376.4339	188.0967	67.0912	0.0000	0.0000	0.0000	0.0000	179.0722	410.7649	654.2678	(98)
Space heating per m2												3004.6379	(98)
												(98) / (4) =	31.2073 (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													3323.7145 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	639.9581	488.9531	376.4339	188.0967	67.0912	0.0000	0.0000	0.0000	0.0000	179.0722	410.7649	654.2678	(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)	707.9182	540.8773	416.4092	208.0715	74.2160	0.0000	0.0000	0.0000	0.0000	198.0887	454.3860	723.7476	(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	169.9575	131.6828	108.9174	55.9553	25.4919	1.4866	0.0000	26.2196	57.3878	108.9526	145.1689	169.8215	(64)
Efficiency of water heater (217)m	87.9230	87.8963	87.7561	87.7005	87.1775	79.7000	79.7000	79.7000	79.7000	86.0309	87.3382	79.7000	(216)
Fuel for water heating, kWh/month	193.3027	149.8161	124.1137	63.8028	29.2413	1.8653	0.0000	32.8979	72.0048	126.6435	166.2148	193.0528	(219)
Water heating fuel used												1152.9557	(219)
Annual totals kWh/year													
Space heating fuel - main system												3323.7145	(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 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses												3171.3853	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3323.7145	3.9200	130.2896	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1152.9557	3.9200	45.1959	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	393.8748	16.9600	66.8012	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			42.1092	(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	3323.7145	0.2160	717.9223	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1152.9557	0.2160	249.0384 (264)
Space and water heating			966.9608 (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	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			289.5179 (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	3323.7145	1.2200	4054.9317 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1152.9557	1.2200	1406.6060 (264)
Space and water heating			5461.5377 (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	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1454.3131 (272)
Primary energy kWh/m2/year			15.1050 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 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			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 124 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.55 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.83 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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)	0.14 (max. 0.35)	OK
Openings	1.27 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Boiler interlock	Yes	OK
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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
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Based on:

Overshading:	Average
Windows facing North:	2.39 m ² , No overhang
Windows facing East:	8.19 m ² , No overhang
Windows facing South:	10.45 m ² , No overhang
Windows facing West:	5.99 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
Floor U-value	0.12 W/m ² K
Door U-value	0.80 W/m ² K
Thermal bridging y-value	0.032 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1613 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4118 (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) =		0.4118 (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	0.5250	0.5147	0.5044	0.4530	0.4427	0.3912	0.3912	0.3809	0.4118	0.4427	0.4633	0.4838 (22b)
	0.6378	0.6325	0.6272	0.6026	0.5980	0.5765	0.5765	0.5725	0.5848	0.5980	0.6073	0.6171 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	65.2526	64.7051	64.1684	61.6476	61.1760	58.9804	58.9804	58.5739	59.8261	61.1760	62.1301	63.1275 (38)
Average = Sum(39)m / 12 =	158.5439	157.9964	157.4597	154.9389	154.4673	152.2718	152.2718	151.8652	153.1175	154.4673	155.4214	156.4189 (39)
												154.9367 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2777	1.2732	1.2689	1.2486	1.2448	1.2271	1.2271	1.2238	1.2339	1.2448	1.2525	1.2605 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (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 Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
								Total per year (kWh/year) = Sum(64)m =				2163.3212 (64)
Heat gains from water heating, kWh/month												
	92.9806	82.3906	87.5583	79.9188	79.3525	72.3911	70.9380	75.8915	75.1466	82.8013	85.7577	91.2256 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9121	23.0149	18.7170	14.1700	10.5922	8.9424	9.6626	12.5598	16.8577	21.4047	24.9825	26.6323 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.4464	293.4603	285.8653	269.6965	249.2862	230.1035	217.2882	214.2743	221.8693	238.0381	258.4484	277.6312 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)	124.9739	122.6051	117.6859	110.9984	106.6566	100.5431	95.3468	102.0047	104.3702	111.2920	119.1079	122.6150 (72)
Total internal gains	510.4999	508.2478	491.4357	464.0323	435.7025	408.7564	391.4650	398.0062	412.2646	439.9023	471.7062	496.0458 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access		Gains	
				m2	Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
North				2.3900	10.6334		0.4600		0.0000		0.7700		9.0016 (74)	
East				4.8600	19.6403		0.4600		0.0000		0.7700		33.8090 (76)	
South				10.4500	46.7521		0.4600		0.0000		0.7700		173.0476 (78)	
West				5.9900	19.6403		0.4600		0.0000		0.7700		41.6699 (80)	
East				3.3300	19.6403		0.4600		0.0000		0.7700		23.1654 (76)	
Solar gains	280.6935	493.5791	708.0348	918.4552	1056.4468	1058.3550	1016.5881	913.9246	781.8699	555.1330	339.2229	238.1535	(83)	
Total gains	791.1934	1001.8269	1199.4705	1382.4875	1492.1493	1467.1114	1408.0531	1311.9307	1194.1346	995.0353	810.9291	734.1994	(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	
29.7615	29.8646	29.9664	30.4539	30.5469	30.9874	30.9874	31.0703	30.8162	30.5469	30.3594	30.1658	
2.9841	2.9910	2.9978	3.0303	3.0365	3.0658	3.0658	3.0714	3.0544	3.0365	3.0240	3.0111	
util living area	0.9808	0.9617	0.9254	0.8524	0.7378	0.5857	0.4489	0.4936	0.7055	0.8961	0.9671	0.9844 (86)
MIT	18.8717	19.2009	19.6627	20.2019	20.6149	20.8672	20.9563	20.9411	20.7536	20.1798	19.4243	18.8235 (87)
Th 2	19.8584	19.8619	19.8653	19.8813	19.8843	19.8984	19.8984	19.9010	19.8930	19.8843	19.8782	19.8719 (88)
util rest of house	0.9769	0.9543	0.9109	0.8237	0.6869	0.5065	0.3468	0.3898	0.6328	0.8692	0.9595	0.9813 (89)
MIT 2	17.0375	17.5143	18.1759	18.9367	19.4822	19.7909	19.8749	19.8668	19.6716	18.9276	17.8525	16.9755 (90)
Living area fraction	17.3662	17.8166	18.4423	19.1634	19.6852	19.9838	20.0687	20.0593	19.8655	19.1520	18.1342	17.3067 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2162	17.6666	18.2923	19.0134	19.5352	19.8338	19.9187	19.9093	19.7155	19.0020	17.9842	17.1567 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9632	0.9339	0.8843	0.7968	0.6689	0.5015	0.3488	0.3907	0.6196	0.8417	0.9406	0.9695 (94)
Useful gains	762.1069	935.5982	1060.7055	1101.5628	998.0606	735.7846	491.1240	512.5272	739.8897	837.5207	762.7318	711.8055 (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												
	2047.7880	2017.0694	1856.8197	1566.9649	1210.2781	796.9566	505.3446	532.9409	859.8304	1297.8418	1691.6381	2026.6745 (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 Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	956.5468	726.7486	592.3090	335.0895	157.8898	0.0000	0.0000	0.0000	0.0000	342.4789	668.8125	978.2625 (98)
Space heating												4758.1377 (98)
Space heating per m2												(98) / (4) = 38.3442 (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												5263.4266 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	956.5468	726.7486	592.3090	335.0895	157.8898	0.0000	0.0000	0.0000	0.0000	342.4789	668.8125	978.2625 (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)	1058.1269	803.9255	655.2090	370.6743	174.6569	0.0000	0.0000	0.0000	0.0000	378.8483	739.8369	1082.1488 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
Efficiency of water heater	88.2345	87.9678	87.4618	86.3937	84.4709	79.7000	79.7000	79.7000	79.7000	86.3572	87.7472	79.7000 (216)
(217)m	88.2345	87.9678	87.4618	86.3937	84.4709	79.7000	79.7000	79.7000	79.7000	86.3572	87.7472	88.3153 (217)
Fuel for water heating, kWh/month	242.5155	214.2679	226.0125	204.6639	204.7990	193.4464	185.3060	203.9980	203.8445	212.3365	221.5195	236.3170 (219)
Water heating fuel used												2549.0268 (219)
Annual totals kWh/year												
Space heating fuel - main system												5263.4266 (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)												457.6163 (232)
Total delivered energy for all uses												8345.0697 (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	5263.4266	0.2160	1136.9002 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2549.0268	0.2160	550.5898 (264)
Space and water heating			1687.4899 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.6163	0.5190	237.5028 (268)
Total CO2, kg/year			1963.9178 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8300 (273)

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

DER		15.8300 ZC1
Total Floor Area	TFA	124.0900
Assumed number of occupants	N	2.8778
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		13.8700 ZC2
CO2 emissions from cooking, equation (L16)		1.5156 ZC3
Total CO2 emissions		31.2155 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		31.2155 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1290 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3790 (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) =	0.3790 (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	0.4833	0.4738	0.4643	0.4169	0.4075	0.3601	0.3601	0.3506	0.3790	0.4075	0.4264	0.4454 (22b)
Effective ac	0.6168	0.6122	0.6078	0.5869	0.5830	0.5648	0.5648	0.5615	0.5718	0.5830	0.5909	0.5992 (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)			26.9900	1.3258	35.7822		(27)
GF B&B J150 P/A=0.50			63.0000	0.1300	8.1900		(28a)
EW Brick AAC011	162.4600	31.0500	131.4100	0.1800	23.6538		(29a)
PR 400mm MW044	61.0900		61.0900	0.1300	7.9417		(30)
PR 300mm MW044	1.9100		1.9100	0.1300	0.2483		(30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2820		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.8690 (36)
Total fabric heat loss						(33) + (36) =	94.1510 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.0985	62.6346	62.1800	60.0443	59.6447	57.7846	57.7846	57.4401	58.5011	59.6447	60.4530	61.2981 (38)
Heat transfer coeff	157.2495	156.7856	156.3309	154.1953	153.7957	151.9356	151.9356	151.5911	152.6521	153.7957	154.6040	155.4491 (39)
Average = Sum(39)m / 12 =												154.1933 (39)
HLP	1.2672	1.2635	1.2598	1.2426	1.2394	1.2244	1.2244	1.2216	1.2302	1.2394	1.2459	1.2527 (40)
HLP (average)												1.2426 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (43)
Daily hot water use	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy conte	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Energy content (annual)										Total = Sum(45)m =		1613.4852 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												180.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
216.5266	190.7848	200.2190	179.2790	175.5398	156.6390	150.2331	165.1307	164.9263	185.9120	196.8394	211.2482	(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												
216.5266	190.7848	200.2190	179.2790	175.5398	156.6390	150.2331	165.1307	164.9263	185.9120	196.8394	211.2482	(64)
Heat gains from water heating, kWh/month												
95.0160	84.2291	89.5938	81.8886	81.3879	74.3608	72.9735	77.9269	77.1163	84.8367	87.7275	93.2610	(65)

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

Metabolic gains (Table 5), Watts												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
25.9133	23.0160	18.7179	14.1706	10.5927	8.9428	9.6630	12.5604	16.8585	21.4057	24.9836	26.6335	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
290.4464	293.4603	285.8653	269.6965	249.2862	230.1035	217.2882	214.2743	221.8693	238.0381	258.4484	277.6312	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	(71)
Water heating gains (Table 5)												
127.7097	125.3409	120.4217	113.7342	109.3924	103.2789	98.0826	104.7405	107.1060	114.0278	121.8437	125.3508	(72)
Total internal gains												
513.2368	510.9846	494.1723	466.7687	438.4387	411.4926	394.2012	400.7425	415.0012	442.6390	474.4431	498.7828	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.3900	10.6334	0.6300	0.7000	0.7700	7.7668	(74)
East	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990	(76)
South	10.4400	46.7521	0.6300	0.7000	0.7700	149.1671	(78)
West	5.9800	19.6403	0.6300	0.7000	0.7700	35.8939	(80)

Solar gains	241.9268	425.4041	610.2261	791.5662	910.4876	912.1308	876.1349	787.6587	673.8566	478.4522	292.3713	205.2629	(83)
Total gains	755.1636	936.3887	1104.3984	1258.3349	1348.9263	1323.6234	1270.3362	1188.4012	1088.8578	921.0912	766.8144	704.0457	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	54.8006	54.9627	55.1226	55.8860	56.0312	56.7172	56.8461	56.4510	56.0312	55.7383	55.4353		
alpha	4.6534	4.6642	4.6748	4.7257	4.7354	4.7811	4.7811	4.7897	4.7634	4.7354	4.7159		
util living area	0.9978	0.9938	0.9819	0.9435	0.8489	0.6810	0.5144	0.5670	0.8125	0.9675	0.9950	0.9984	(86)
MIT	19.6124	19.8183	20.1227	20.4949	20.7876	20.9470	20.9887	20.9824	20.8742	20.4725	19.9690	19.5820	(87)
Th 2	19.8666	19.8695	19.8724	19.8861	19.8886	19.9005	19.9005	19.9027	19.8959	19.8886	19.8835	19.8781	(88)
util rest of house	0.9971	0.9917	0.9755	0.9228	0.7961	0.5850	0.3919	0.4415	0.7313	0.9516	0.9929	0.9979	(89)
MIT 2	18.0271	18.3291	18.7713	19.3053	19.6863	19.8665	19.8966	19.8959	19.7993	19.2865	18.5598	17.9906	(90)
Living area fraction									fLA = Living area / (4) =				0.1792 (91)
MIT	18.3112	18.5960	19.0135	19.5185	19.8837	20.0602	20.0923	20.0906	19.9920	19.4991	18.8123	18.2758	(92)
Temperature adjustment													0.0000
adjusted MIT	18.3112	18.5960	19.0135	19.5185	19.8837	20.0602	20.0923	20.0906	19.9920	19.4991	18.8123	18.2758	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9881	0.9687	0.9143	0.7959	0.5999	0.4139	0.4639	0.7394	0.9441	0.9899	0.9967 (94)
Useful gains	751.7528	925.2849	1069.8376	1150.5184	1073.5614	794.0371	525.8258	551.3418	805.1226	869.6018	759.0721	701.7165 (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												
	2203.2600	2147.3338	1956.2474	1637.3226	1258.6201	829.5967	530.6121	559.4672	899.4208	1368.6412	1810.7749	2188.0752 (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												
	1079.9214	821.2169	659.4889	350.4990	137.6837	0.0000	0.0000	0.0000	0.0000	371.2853	757.2260	1105.8509 (98)
Space heating												5283.1721 (98)
Space heating per m2												(98) / (4) = 42.5753 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5650.4514	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1079.9214	821.2169	659.4889	350.4990	137.6837	0.0000	0.0000	0.0000	0.0000	371.2853	757.2260	1105.8509	(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)	1154.9961	878.3069	705.3357	374.8652	147.2553	0.0000	0.0000	0.0000	0.0000	397.0966	809.8674	1182.7282	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	216.5266	190.7848	200.2190	179.2790	175.5398	156.6390	150.2331	165.1307	164.9263	185.9120	196.8394	211.2482	(64)	
Efficiency of water heater (217)m	88.5177	88.2687	87.7595	86.5718	84.1747	79.8000	79.8000	79.8000	79.8000	86.6246	88.0638	88.5947	(216)	
Fuel for water heating, kWh/month	244.6138	216.1409	228.1451	207.0870	208.5423	196.2895	188.2621	206.9307	206.6746	214.6181	223.5191	238.4434	(219)	
Water heating fuel used												2579.2666	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5650.4514	(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)													457.6373	(232)
Total delivered energy for all uses													8762.3553	(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	5650.4514	0.2160	1220.4975 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2579.2666	0.2160	557.1216 (264)
Space and water heating			1777.6191 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.6373	0.5190	237.5137 (268)
Total CO2, kg/m2/year			2054.0578 (272)
Emissions per m2 for space and water heating			14.3252 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9140 (272b)
Emissions per m2 for pumps and fans			0.3137 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3252 * 1.00) + 1.9140 + 0.3137, rounded to 2 d.p.			16.5500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1290 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3795 (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) =	0.3795 (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	0.4839	0.4744	0.4649	0.4175	0.4080	0.3605	0.3605	0.3511	0.3795	0.4080	0.4270	0.4459 (22b)
Effective ac	0.6171	0.6125	0.6081	0.5871	0.5832	0.5650	0.5650	0.5616	0.5720	0.5832	0.5912	0.5994 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			9.0000	549.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16436.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.4586 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	63.1301	62.6650	62.2091	60.0677	59.6671	57.8021	57.8021	57.4567	58.5205	59.6671	60.4776	61.3249 (38)
Average = Sum(39)m / 12 =	156.4214	155.9563	155.5004	153.3591	152.9584	151.0934	151.0934	150.7480	151.8118	152.9584	153.7689	154.6162 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2605	1.2568	1.2531	1.2359	1.2326	1.2176	1.2176	1.2148	1.2234	1.2326	1.2392	1.2460 (40)
HLP (average)												1.2359 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5478	31.0904	32.0825	27.9703	26.8381	23.1593	21.4605	24.6262	24.9203	29.0422	31.7019	34.4262 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9121	23.0149	18.7170	14.1700	10.5922	8.9424	9.6626	12.5598	16.8577	21.4047	24.9825	26.6323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.4464	293.4603	285.8653	269.6965	249.2862	230.1035	217.2882	214.2743	221.8693	238.0381	258.4484	277.6312	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	(71)
Water heating gains (Table 5)	47.7793	46.2654	43.1216	38.8476	36.0728	32.1657	28.8447	33.0997	34.6116	39.0353	44.0304	46.2717	(72)
Total internal gains	430.3053	428.9081	413.8713	388.8815	362.1186	337.3789	321.9629	326.1012	339.5059	364.6455	393.6286	416.7026	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				2.3900	10.6334		0.4600	0.0000		0.7700		9.0016 (74)	
East				4.8600	19.6403		0.4600	0.0000		0.7700		33.8090 (76)	
South				10.4500	46.7521		0.4600	0.0000		0.7700		173.0476 (78)	
West				5.9900	19.6403		0.4600	0.0000		0.7700		41.6699 (80)	
East				3.3300	19.6403		0.4600	0.0000		0.7700		23.1654 (76)	
Solar gains	280.6935	493.5791	708.0348	918.4552	1056.4468	1058.3550	1016.5881	913.9246	781.8699	555.1330	339.2229	238.1535	(83)
Total gains	710.9988	922.4872	1121.9061	1307.3367	1418.5654	1395.7339	1338.5510	1240.0258	1121.3759	919.7785	732.8516	654.8561	(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	29.1889	29.2760	29.3618	29.7718	29.8498	30.2182	30.2182	30.2875	30.0752	29.8498	29.6924	29.5297	
alpha	2.9459	2.9517	2.9575	2.9848	2.9900	3.0145	3.0145	3.0192	3.0050	2.9900	2.9795	2.9686	
util living area	0.9842	0.9664	0.9319	0.8619	0.7504	0.6015	0.4644	0.5120	0.7242	0.9076	0.9725	0.9874	(86)
MIT	18.7678	19.1080	19.5857	20.1434	20.5789	20.8494	20.9490	20.9308	20.7223	20.1107	19.3272	18.7136	(87)
Th 2	19.8719	19.8748	19.8777	19.8914	19.8940	19.9059	19.9059	19.9082	19.9013	19.8940	19.8888	19.8834	(88)
util rest of house	0.9810	0.9600	0.9188	0.8349	0.7013	0.5229	0.3610	0.4072	0.6538	0.8835	0.9662	0.9849	(89)
MIT 2	17.8431	18.1809	18.6503	19.1932	19.5898	19.8210	19.8866	19.8799	19.7273	19.1776	18.4111	17.7974	(90)
Living area fraction									fLA = Living area / (4) =			0.1792	(91)
MIT	18.0088	18.3470	18.8179	19.3635	19.7671	20.0053	20.0770	20.0682	19.9057	19.3448	18.5753	17.9616	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0088	18.3470	18.8179	19.3635	19.7671	20.0053	20.0770	20.0682	19.9057	19.3448	18.5753	17.9616	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	692.3704	874.8760	1013.2846	1071.8748	985.8731	740.4856	505.8636	525.1405	733.5456	798.8791	700.6210	641.0151	(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	2144.3499	2097.1479	1915.4429	1604.6720	1233.9271	816.7063	525.3550	552.9774	881.3691	1337.5930	1764.5467	2127.7732	(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	1080.2728	821.3667	671.2058	383.6140	184.5522	0.0000	0.0000	0.0000	0.0000	400.8031	766.0265	1106.1480	(98)
Space heating												5413.9890	(98)
Space heating per m2										(98) / (4) =		43.6295	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	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	1420.2782	1118.0913	1145.6852	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8226	0.8780	0.8538	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1168.3707	981.6652	978.1821	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1747.6993	1678.2331	1565.2364	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	417.1166	518.2465	436.7684	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												1372.1315	(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	104.2792	129.5616	109.1921	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												343.0329	(107)
Energy for space heating												2.7644	(108)
Energy for space cooling												43.6295	(99)
Total												2.7644	(108)
Dwelling Fabric Energy Efficiency (DFEE)												46.3939	(109)
												46.4	(109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1290 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3790 (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) =	0.3790 (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	0.4833	0.4738	0.4643	0.4169	0.4075	0.3601	0.3601	0.3506	0.3790	0.4075	0.4264	0.4454 (22b)
Effective ac	0.6168	0.6122	0.6078	0.5869	0.5830	0.5648	0.5648	0.5615	0.5718	0.5830	0.5909	0.5992 (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)			26.9900	1.3258	35.7822		(27)
GF B&B J150 P/A=0.50			63.0000	0.1300	8.1900		(28a)
EW Brick AAC011	162.4600	31.0500	131.4100	0.1800	23.6538		(29a)
PR 400mm MW044	61.0900		61.0900	0.1300	7.9417		(30)
PR 300mm MW044	1.9100		1.9100	0.1300	0.2483		(30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.2820		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.8690 (36)
Total fabric heat loss						(33) + (36) =	94.1510 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	63.0985	62.6346	62.1800	60.0443	59.6447	57.7846	57.7846	57.4401	58.5011	59.6447	60.4530	61.2981 (38)
Heat transfer coeff	157.2495	156.7856	156.3309	154.1953	153.7957	151.9356	151.9356	151.5911	152.6521	153.7957	154.6040	155.4491 (39)
Average = Sum(39)m / 12 =												154.1933 (39)
HLP	1.2672	1.2635	1.2598	1.2426	1.2394	1.2244	1.2244	1.2216	1.2302	1.2394	1.2459	1.2527 (40)
HLP (average)												1.2426 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (43)
Daily hot water use	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy conte	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Energy content (annual)												Total = Sum(45)m = 1613.4852 (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)
	35.5478	31.0904	32.0825	27.9703	26.8381	23.1593	21.4605	24.6262	24.9203	29.0422	31.7019	34.4262 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913	143.8913 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9133	23.0160	18.7179	14.1706	10.5927	8.9428	9.6630	12.5604	16.8585	21.4057	24.9836	26.6335 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.4464	293.4603	285.8653	269.6965	249.2862	230.1035	217.2882	214.2743	221.8693	238.0381	258.4484	277.6312 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891	37.3891 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)	47.7793	46.2654	43.1216	38.8476	36.0728	32.1657	28.8447	33.0997	34.6116	39.0353	44.0304	46.2717 (72)
Total internal gains	430.3065	428.9091	413.8722	388.8821	362.1191	337.3793	321.9633	326.1018	339.5067	364.6465	393.6298	416.7038 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.3900	10.6334	0.6300	0.7000	0.7700	7.7668 (74)
East	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990 (76)
South	10.4400	46.7521	0.6300	0.7000	0.7700	149.1671 (78)
West	5.9800	19.6403	0.6300	0.7000	0.7700	35.8939 (80)

Solar gains	241.9268	425.4041	610.2261	791.5662	910.4876	912.1308	876.1349	787.6587	673.8566	478.4522	292.3713	205.2629 (83)
Total gains	672.2332	854.3132	1024.0983	1180.4483	1272.6067	1249.5102	1198.0983	1113.7605	1013.3633	843.0987	686.0011	621.9667 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.8006	54.9627	55.1226	55.8860	56.0312	56.7172	56.7172	56.8461	56.4510	56.0312	55.7383	55.4353
alpha	4.6534	4.6642	4.6748	4.7257	4.7354	4.7811	4.7811	4.7897	4.7634	4.7354	4.7159	4.6957
util living area	0.9987	0.9958	0.9865	0.9545	0.8701	0.7102	0.5423	0.5995	0.8421	0.9766	0.9969	0.9991 (86)
MIT	19.5515	19.7590	20.0677	20.4499	20.7595	20.9366	20.9860	20.9778	20.8508	20.4220	19.9102	19.5214 (87)
Th 2	19.8666	19.8695	19.8724	19.8861	19.8886	19.9005	19.9005	19.9027	19.8959	19.8886	19.8835	19.8781 (88)
util rest of house	0.9982	0.9943	0.9815	0.9370	0.8213	0.6141	0.4147	0.4695	0.7661	0.9645	0.9955	0.9988 (89)
MIT 2	18.5500	18.7591	19.0671	19.4485	19.7291	19.8721	19.8971	19.8967	19.8151	19.4304	18.9213	18.5289 (90)
Living area fraction									fLA = Living area / (4) =			0.1792 (91)
MIT	18.7295	18.9383	19.2464	19.6280	19.9138	20.0629	20.0923	20.0905	20.0007	19.6081	19.0986	18.7068 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7295	18.9383	19.2464	19.6280	19.9138	20.0629	20.0923	20.0905	20.0007	19.6081	19.0986	18.7068 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	670.5854	847.9553	1001.4190	1100.1970	1046.8241	786.5039	524.5265	548.9558	784.8698	809.7530	682.0210	620.9021 (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	2269.0266	2201.0024	1992.6633	1654.2066	1263.2447	830.0069	530.6001	559.4402	900.7540	1385.4059	1855.0266	2255.0718 (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	1189.2403	909.2477	737.4858	398.8869	161.0169	0.0000	0.0000	0.0000	0.0000	428.2857	844.5640	1215.8222 (98)
Space heating												5884.5495 (98)
Space heating per m2										(98) / (4) =		47.4216 (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	1428.1943	1124.3232	1152.0924	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8653	0.9244	0.9008	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1235.7612	1039.3700	1037.7840	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1576.7890	1514.0682	1417.6544	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	245.5400	353.1754	282.6235	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												881.3389 (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	61.3850	88.2939	70.6559	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												220.3347 (107)
Space cooling per m2												1.7756 (108)
Energy for space heating												47.4216 (99)
Energy for space cooling												1.7756 (108)
Total												49.1972 (109)
Target Fabric Energy Efficiency (TFEE)												56.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) =	0.1613 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4118 (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) =		0.4118 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4324	0.4118	0.4118	0.3809	0.3809	0.3397	0.3500	0.3294	0.3397	0.3603	0.3603	0.3912 (22b)
	0.5935	0.5848	0.5848	0.5725	0.5725	0.5577	0.5613	0.5543	0.5577	0.5649	0.5649	0.5765 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	60.7152	59.8261	59.8261	58.5739	58.5739	57.0560	57.4192	56.7036	57.0560	57.7932	57.7932	58.9804 (38)
Average = Sum(39)m / 12 =	154.0065	153.1175	153.1175	151.8652	151.8652	150.3473	150.7105	149.9949	150.3473	151.0846	151.0846	152.2718 (39)
												151.6511 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2411	1.2339	1.2339	1.2238	1.2238	1.2116	1.2145	1.2088	1.2116	1.2175	1.2175	1.2271 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (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 Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												
	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
	92.9806	82.3906	87.5583	79.9188	79.3525	72.3911	70.9380	75.8915	75.1466	82.8013	85.7577	91.2256 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.7803	57.5373	46.7925	35.4249	26.4805	22.3560	24.1564	31.3994	42.1443	53.5118	62.4562	66.5808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.5021	438.0005	426.6647	402.5321	372.0690	343.4380	324.3108	319.8124	331.1482	355.2808	385.7439	414.3749 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)												
	124.9739	122.6051	117.6859	110.9984	106.6566	100.5431	95.3468	102.0047	104.3702	111.2920	119.1079	122.6150 (72)
Total internal gains												
	738.9577	733.8442	706.8444	664.6567	620.9075	582.0385	559.5154	568.9178	593.3640	635.7860	683.0093	719.2719 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.3900	11.9814		0.4600		0.0000		0.7700		10.1427 (74)
East				4.8600	22.3313		0.4600		0.0000		0.7700		38.4414 (76)
South				10.4500	50.9848		0.4600		0.0000		0.7700		188.7147 (78)
West				5.9900	22.3313		0.4600		0.0000		0.7700		47.3794 (80)
East				3.3300	22.3313		0.4600		0.0000		0.7700		26.3395 (76)
Solar gains	311.0177	492.3273	698.7667	937.1743	1053.6280	1131.3617	1074.2303	984.8715	837.3638	591.4767	385.0958	261.3267	(83)
Total gains	1049.9754	1226.1715	1405.6112	1601.8310	1674.5354	1713.4002	1633.7457	1553.7893	1430.7278	1227.2626	1068.1051	980.5986	(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	30.6383	30.8162	30.8162	31.0703	31.0703	31.3840	31.3084	31.4577	31.3840	31.2308	31.2308	30.9874
alpha	3.0426	3.0544	3.0544	3.0714	3.0714	3.0923	3.0872	3.0972	3.0923	3.0821	3.0821	3.0658
util living area	0.9551	0.9299	0.8772	0.7733	0.6236	0.4188	0.2817	0.3033	0.5502	0.8071	0.9239	0.9618 (86)
MIT	19.3393	19.5985	20.0225	20.4841	20.8030	20.9604	20.9919	20.9898	20.9017	20.5032	19.8701	19.2958 (87)
Th 2	19.8873	19.8930	19.8930	19.9010	19.9010	19.9107	19.9084	19.9130	19.9107	19.9060	19.9060	19.8984 (88)
util rest of house	0.9466	0.9172	0.8549	0.7340	0.5607	0.3348	0.1844	0.2028	0.4649	0.7634	0.9075	0.9544 (89)
MIT 2	17.7281	18.0996	18.6942	19.3210	19.7165	19.8864	19.9061	19.9099	19.8377	19.3674	18.5014	17.6733 (90)
Living area fraction									fLA = Living area / (4) =			0.1792 (91)
MIT	18.0168	18.3682	18.9322	19.5294	19.9112	20.0789	20.1007	20.1034	20.0284	19.5710	18.7467	17.9641 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8668	18.2182	18.7822	19.3794	19.7612	19.9289	19.9507	19.9534	19.8784	19.4210	18.5967	17.8141 (93)

8. Space heating requirement

Utilisation	0.9250	0.8918	0.8276	0.7127	0.5520	0.3363	0.1883	0.2066	0.4622	0.7405	0.8817	0.9346 (94)
Useful gains	971.1891	1093.4528	1163.2387	1141.6921	924.3798	576.1407	307.5925	321.0273	661.2824	908.8351	941.7764	916.4311 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1966.1758	1932.0694	1742.8205	1439.5933	1026.7903	590.7030	309.0613	323.0036	703.3800	1181.6303	1600.9948	1936.0003 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	740.2701	563.5503	431.2089	214.4889	76.1934	0.0000	0.0000	0.0000	0.0000	202.9597	474.6372	758.5595	(98)
Space heating												3461.8680	(98)
RHI space heating demand												3462	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1613 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4118 (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) =	0.4118 (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	0.5250	0.5147	0.5044	0.4530	0.4427	0.3912	0.3912	0.3809	0.4118	0.4427	0.4633	0.4838 (22b)
	0.6378	0.6325	0.6272	0.6026	0.5980	0.5765	0.5765	0.5725	0.5848	0.5980	0.6073	0.6171 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	65.2526	64.7051	64.1684	61.6476	61.1760	58.9804	58.9804	58.5739	59.8261	61.1760	62.1301	63.1275 (38)
Average = Sum(39)m / 12 =	158.5439	157.9964	157.4597	154.9389	154.4673	152.2718	152.2718	151.8652	153.1175	154.4673	155.4214	156.4189 (39)
												154.9367 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2777	1.2732	1.2689	1.2486	1.2448	1.2271	1.2271	1.2238	1.2339	1.2448	1.2525	1.2605 (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											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
Heat gains from water heating, kWh/month												
	92.9806	82.3906	87.5583	79.9188	79.3525	72.3911	70.9380	75.8915	75.1466	82.8013	85.7577	91.2256 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.7803	57.5373	46.7925	35.4249	26.4805	22.3560	24.1564	31.3994	42.1443	53.5118	62.4562	66.5808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.5021	438.0005	426.6647	402.5321	372.0690	343.4380	324.3108	319.8124	331.1482	355.2808	385.7439	414.3749 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)												
	124.9739	122.6051	117.6859	110.9984	106.6566	100.5431	95.3468	102.0047	104.3702	111.2920	119.1079	122.6150 (72)
Total internal gains												
	738.9577	733.8442	706.8444	664.6567	620.9075	582.0385	559.5154	568.9178	593.3640	635.7860	683.0093	719.2719 (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	
North		2.3900	10.6334	0.4600		0.0000	0.7700	9.0016 (74)
East		4.8600	19.6403	0.4600		0.0000	0.7700	33.8090 (76)
South		10.4500	46.7521	0.4600		0.0000	0.7700	173.0476 (78)
West		5.9900	19.6403	0.4600		0.0000	0.7700	41.6699 (80)
East		3.3300	19.6403	0.4600		0.0000	0.7700	23.1654 (76)

Solar gains	280.6935	493.5791	708.0348	918.4552	1056.4468	1058.3550	1016.5881	913.9246	781.8699	555.1330	339.2229	238.1535 (83)
Total gains	1019.6512	1227.4233	1414.8792	1583.1119	1677.3543	1640.3935	1576.1034	1482.8424	1375.2340	1190.9190	1022.2322	957.4254 (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	29.7615	29.8646	29.9664	30.4539	30.5469	30.9874	30.9874	31.0703	30.8162	30.5469	30.3594	30.1658
alpha	2.9841	2.9910	2.9978	3.0303	3.0365	3.0658	3.0658	3.0714	3.0544	3.0365	3.0240	3.0111
util living area	0.9635	0.9381	0.8937	0.8114	0.6913	0.5385	0.4068	0.4452	0.6470	0.8513	0.9423	0.9691 (86)
MIT	19.1065	19.4149	19.8389	20.3235	20.6821	20.8949	20.9667	20.9557	20.8082	20.3201	19.6294	19.0578 (87)
Th 2	19.8584	19.8619	19.8653	19.8813	19.8843	19.8984	19.8984	19.9010	19.8930	19.8843	19.8782	19.8719 (88)
util rest of house	0.9567	0.9270	0.8747	0.7783	0.6381	0.4618	0.3121	0.3485	0.5728	0.8172	0.9300	0.9632 (89)
MIT 2	17.3748	17.8173	18.4180	19.0934	19.5585	19.8151	19.8809	19.8759	19.7256	19.1097	18.1420	17.3131 (90)
Living area fraction												
MIT	17.6852	18.1036	18.6727	19.3139	19.7599	20.0086	20.0755	20.0694	19.9196	19.3267	18.4086	17.6258 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5352	17.9536	18.5227	19.1639	19.6099	19.8586	19.9255	19.9194	19.7696	19.1767	18.2586	17.4758 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9368	0.9019	0.8466	0.7536	0.6237	0.4588	0.3145	0.3502	0.5637	0.7908	0.9057	0.9452 (94)
Ext temp.	955.1769	1107.0044	1197.7826	1192.9868	1046.1597	752.6631	495.6933	519.3574	775.1984	941.7511	925.8840	904.9322 (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	2098.3591	2062.4224	1893.0885	1590.2706	1221.8216	800.7425	506.3761	534.4777	868.1205	1324.8148	1734.2835	2076.5845 (97)
	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)

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Calculation Type: New Build (As Designed)

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Space heating kWh	850.5276	642.0409	517.3075	286.0444	130.6925	0.0000	0.0000	0.0000	0.0000	284.9993	582.0476	871.7093 (98)
Space heating												4165.3692 (98)
Space heating per m2												(98) / (4) = 33.5673 (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												4607.7093 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	850.5276	642.0409	517.3075	286.0444	130.6925	0.0000	0.0000	0.0000	0.0000	284.9993	582.0476	871.7093 (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)	940.8491	710.2223	572.2429	316.4208	144.5713	0.0000	0.0000	0.0000	0.0000	315.2647	643.8580	964.2802 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
Efficiency of water heater (217)m	88.0245	87.7271	87.1646	85.9899	83.9776	79.7000	79.7000	79.7000	79.7000	85.8858	87.4604	79.7000 (216)
Fuel for water heating, kWh/month	243.0941	214.8559	226.7831	205.6250	206.0020	193.4464	185.3060	203.9980	203.8445	213.5019	222.2459	236.8544 (219)
Water heating fuel used												2555.5572 (219)
Annual totals kWh/year												
Space heating fuel - main system												4607.7093 (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)												457.6163 (232)
Total delivered energy for all uses												7695.8828 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4607.7093	3.4800	160.3483 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2555.5572	3.4800	88.9334 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	457.6163	13.1900	60.3596 (250)
Additional standing charges			120.0000 (251)
Total energy cost			439.5338 (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] =	1.0918 (257)
SAP value		84.7701
SAP rating (Section 12)		85 (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	4607.7093	0.2160	995.2652 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2555.5572	0.2160	552.0004 (264)
Space and water heating			1547.2656 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.6163	0.5190	237.5028 (268)
Total kg/year			1823.6934 (272)
CO2 emissions per m2			14.7000 (273)
EI value			85.5476
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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Main heating energy efficiency
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
 $3.48 / 0.8443 = 4.122$, stars = 4
 $0.216 / 0.8443 = 0.2558$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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																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) =	0.1613 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.4118 (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) =					0.4118 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
Adj infilt rate	0.4324	0.4118	0.4118	0.3809	0.3809	0.3397	0.3500	0.3294	0.3397	0.3603	0.3603	0.3912	(22b)				
Effective ac	0.5935	0.5848	0.5848	0.5725	0.5725	0.5577	0.5613	0.5543	0.5577	0.5649	0.5649	0.5765	(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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	60.7152	59.8261	59.8261	58.5739	58.5739	57.0560	57.4192	56.7036	57.0560	57.7932	57.7932	58.9804 (38)
Heat transfer coeff	154.0065	153.1175	153.1175	151.8652	151.8652	150.3473	150.7105	149.9949	150.3473	151.0846	151.0846	152.2718 (39)
Average = Sum(39)m / 12 =												151.6511 (39)
HLP	1.2411	1.2339	1.2339	1.2238	1.2238	1.2116	1.2145	1.2088	1.2116	1.2175	1.2175	1.2271 (40)
HLP (average)												1.2221 (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	2.8778 (42)
Average daily hot water use (litres/day)	102.5484 (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 Designed)

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

Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (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	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
Heat gains from water heating, kWh/month	92.9806	82.3906	87.5583	79.9188	79.3525	72.3911	70.9380	75.8915	75.1466	82.8013	85.7577	91.2256 (65)
												2163.3212 (64)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.7803	57.5373	46.7925	35.4249	26.4805	22.3560	24.1564	31.3994	42.1443	53.5118	62.4562	66.5808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.5021	438.0005	426.6647	402.5321	372.0690	343.4380	324.3108	319.8124	331.1482	355.2808	385.7439	414.3749 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)												
	124.9739	122.6051	117.6859	110.9984	106.6566	100.5431	95.3468	102.0047	104.3702	111.2920	119.1079	122.6150 (72)
Total internal gains	738.9577	733.8442	706.8444	664.6567	620.9075	582.0385	559.5154	568.9178	593.3640	635.7860	683.0093	719.2719 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North				2.3900	11.9814		0.4600		0.0000		0.7700		10.1427 (74)
East				4.8600	22.3313		0.4600		0.0000		0.7700		38.4414 (76)
South				10.4500	50.9848		0.4600		0.0000		0.7700		188.7147 (78)
West				5.9900	22.3313		0.4600		0.0000		0.7700		47.3794 (80)
East				3.3300	22.3313		0.4600		0.0000		0.7700		26.3395 (76)
Solar gains	311.0177	492.3273	698.7667	937.1743	1053.6280	1131.3617	1074.2303	984.8715	837.3638	591.4767	385.0958	261.3267 (83)	
Total gains	1049.9754	1226.1715	1405.6112	1601.8310	1674.5354	1713.4002	1633.7457	1553.7893	1430.7278	1227.2626	1068.1051	980.5986 (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	30.6383	30.8162	30.8162	31.0703	31.0703	31.3840	31.3084	31.4577	31.3840	31.2308	31.2308	30.9874
alpha	3.0426	3.0544	3.0544	3.0714	3.0714	3.0923	3.0872	3.0972	3.0923	3.0821	3.0821	3.0658
util living area	0.9551	0.9299	0.8772	0.7733	0.6236	0.4188	0.2817	0.3033	0.5502	0.8071	0.9239	0.9618 (86)
MIT	19.3393	19.5985	20.0225	20.4841	20.8030	20.9604	20.9919	20.9898	20.9017	20.5032	19.8701	19.2958 (87)
Th 2	19.8873	19.8930	19.8930	19.9010	19.9010	19.9107	19.9084	19.9130	19.9107	19.9060	19.9060	19.8984 (88)
util rest of house	0.9466	0.9172	0.8549	0.7340	0.5607	0.3348	0.1844	0.2028	0.4649	0.7634	0.9075	0.9544 (89)
MIT 2	17.7281	18.0996	18.6942	19.3210	19.7165	19.8864	19.9061	19.9099	19.8377	19.3674	18.5014	17.6733 (90)
Living area fraction												
MIT	18.0168	18.3682	18.9322	19.5294	19.9112	20.0789	20.1007	20.1034	20.0284	19.5710	18.7467	0.1792 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.8668	18.2182	18.7822	19.3794	19.7612	19.9289	19.9507	19.9534	19.8784	19.4210	18.5967	17.8141 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	971.1891	1093.4528	1163.2387	1141.6921	924.3798	576.1407	307.5925	321.0273	661.2824	908.8351	941.7764	916.4311 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
Month fracti	1966.1758	1932.0694	1742.8205	1439.5933	1026.7903	590.7030	309.0613	323.0036	703.3800	1181.6303	1600.9948	1936.0003 (97)
	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 Designed)

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

Space heating kWh	740.2701	563.5503	431.2089	214.4889	76.1934	0.0000	0.0000	0.0000	0.0000	202.9597	474.6372	758.5595 (98)
Space heating												3461.8680 (98)
Space heating per m2												(98) / (4) = 27.8980 (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												3829.5000 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	740.2701	563.5503	431.2089	214.4889	76.1934	0.0000	0.0000	0.0000	0.0000	202.9597	474.6372	758.5595 (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)	818.8828	623.3964	477.0010	237.2664	84.2848	0.0000	0.0000	0.0000	0.0000	224.5129	525.0412	839.1145 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.9823	188.4868	197.6747	176.8168	172.9955	154.1768	147.6889	162.5864	162.4641	183.3677	194.3773	208.7039 (64)
Efficiency of water heater (217)m	87.7580	87.4572	86.7396	85.2296	82.6928	79.7000	79.7000	79.7000	79.7000	84.9846	87.0062	79.7000 (216)
Fuel for water heating, kWh/month	243.8321	215.5189	227.8943	207.4594	209.2028	193.4464	185.3060	203.9980	203.8445	215.7659	223.4062	237.5548 (219)
Water heating fuel used												2567.2294 (219)
Annual totals kWh/year												
Space heating fuel - main system												3829.5000 (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)												457.6163 (232)
Total delivered energy for all uses												6929.3456 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3829.5000	3.9200	150.1164 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2567.2294	3.9200	100.6354 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	457.6163	16.9600	77.6117 (250)
Additional standing charges			88.0000 (251)
Total energy cost			429.0835 (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	3829.5000	0.2160	827.1720 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2567.2294	0.2160	554.5215 (264)
Space and water heating			1381.6935 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.6163	0.5190	237.5028 (268)
Total kg/year			1658.1214 (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	3829.5000	1.2200	4671.9900 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2567.2294	1.2200	3132.0198 (264)
Space and water heating			7804.0098 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	457.6163	3.0700	1404.8820 (268)
Primary energy kWh/year			9439.1418 (272)
Primary energy kWh/m2/year			76.0669 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

(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	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 44	-265 kg (16.0%)
U Solar photovoltaic panels	+ 7.9	-£ 309	-947 kg (67.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£44	2.13 kg/m²	B 86 B 88
Solar photovoltaic panels	£309	7.63 kg/m²	A 94 A 95
Total Savings	£354	9.76 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£90	£99	-£8
Mains gas	£339	£286	£53
Space heating	£251	£252	-£1
Water heating	£101	£55	£45
Lighting	£78	£78	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£429	£76	£354
Total cost of uses	£430	£76	£353
Delivered energy	56 kWh/m²	31 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.7 tonnes	0.4 tonnes	1.2 tonnes
CO2 emissions per m²	13 kg/m²	4 kg/m²	10 kg/m²
Primary energy	76 kWh/m²	19 kWh/m²	57 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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) = 0.1613 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4118 (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) =	0.4118 (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	0.5250	0.5147	0.5044	0.4530	0.4427	0.3912	0.3912	0.3809	0.4118	0.4427	0.4633	0.4838 (22b)
	0.6378	0.6325	0.6272	0.6026	0.5980	0.5765	0.5765	0.5725	0.5848	0.5980	0.6073	0.6171 (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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (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	65.2526	64.7051	64.1684	61.6476	61.1760	58.9804	58.9804	58.5739	59.8261	61.1760	62.1301	63.1275 (38)
Average = Sum(39)m / 12 =	158.5439	157.9964	157.4597	154.9389	154.4673	152.2718	152.2718	151.8652	153.1175	154.4673	155.4214	156.4189 (39)
												154.9367 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2777	1.2732	1.2689	1.2486	1.2448	1.2271	1.2271	1.2238	1.2339	1.2448	1.2525	1.2605 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (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 Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage												
	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	205.2519	180.6012	187.5485	161.6144	151.4708	133.1213	125.9315	141.7595	148.6124	173.2415	185.9284	199.9735 (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												1.1240 (H8)
Utilisation factor												0.5892 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5484 (H14)
Volume ratio Veff/V												1.0678 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-939.5962 (H17)
Solar input	-27.2464	-45.4664	-77.4345	-103.7776	-128.2084	-126.0493	-124.3835	-108.6745	-85.1139	-58.1228	-32.3182	-22.8006 (63)
								Solar input (sum of months) = Sum (63)m =				-939.5962 (63)
Output from w/h												
	178.0055	135.1348	110.1140	57.8368	23.2624	7.0720	1.5480	33.0851	63.4985	115.1188	153.6103	177.1729 (64)
								Total per year (kWh/year) = Sum (64)m =				1055.4588 (64)
Heat gains from water heating, kWh/month												
	85.9963	76.0822	79.4574	67.7569	62.1327	55.5466	53.5321	59.2300	64.0652	74.7003	78.9987	84.2412 (65)

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
	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.7803	57.5373	46.7925	35.4249	26.4805	22.3560	24.1564	31.3994	42.1443	53.5118	62.4562	66.5808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.5021	438.0005	426.6647	402.5321	372.0690	343.4380	324.3108	319.8124	331.1482	355.2808	385.7439	414.3749 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)												
	115.5864	113.2175	106.7976	94.1068	83.5117	77.1481	71.9518	79.6102	88.9795	100.4037	109.7203	113.2274 (72)
Total internal gains												
	729.5701	724.4567	695.9561	647.7652	597.7626	558.6434	536.1203	546.5233	577.9732	624.8976	673.6217	709.8844 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.3900	10.6334	0.4600	0.0000	0.7700	9.0016 (74)
East	4.8600	19.6403	0.4600	0.0000	0.7700	33.8090 (76)
South	10.4500	46.7521	0.4600	0.0000	0.7700	173.0476 (78)
West	5.9900	19.6403	0.4600	0.0000	0.7700	41.6699 (80)
East	3.3300	19.6403	0.4600	0.0000	0.7700	23.1654 (76)

Solar gains	280.6935	493.5791	708.0348	918.4552	1056.4468	1058.3550	1016.5881	913.9246	781.8699	555.1330	339.2229	238.1535 (83)
Total gains	1010.2637	1218.0358	1403.9909	1566.2204	1654.2094	1616.9984	1552.7084	1460.4479	1359.8432	1180.0306	1012.8447	948.0379 (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	29.7615	29.8646	29.9664	30.4539	30.5469	30.9874	30.9874	31.0703	30.8162	30.5469	30.3594	30.1658
alpha	2.9841	2.9910	2.9978	3.0303	3.0365	3.0658	3.0658	3.0714	3.0544	3.0365	3.0240	3.0111
util living area												
	0.9643	0.9392	0.8954	0.8149	0.6969	0.5446	0.4122	0.4511	0.6518	0.8539	0.9436	0.9698 (86)
MIT	19.0971	19.4064	19.8305	20.3140	20.6745	20.8916	20.9655	20.9540	20.8041	20.3129	19.6207	19.0482 (87)
Th 2	19.8584	19.8619	19.8653	19.8813	19.8843	19.8984	19.8984	19.9010	19.8930	19.8843	19.8782	19.8719 (88)
util rest of house												
	0.9576	0.9282	0.8766	0.7821	0.6440	0.4674	0.3165	0.3535	0.5776	0.8201	0.9315	0.9641 (89)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.3615	17.8053	18.4066	19.0813	19.5500	19.8123	19.8802	19.8749	19.7217	19.1006	18.1298	17.2994 (90)
Living area fraction									fLA = Living area / (4) =			0.1792 (91)
MIT	17.6726	18.0922	18.6618	19.3023	19.7515	20.0057	20.0747	20.0683	19.9157	19.3179	18.3970	17.6128 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5226	17.9422	18.5118	19.1523	19.6015	19.8557	19.9247	19.9183	19.7657	19.1679	18.2470	17.4628 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9380	0.9033	0.8485	0.7572	0.6291	0.4642	0.3189	0.3551	0.5682	0.7936	0.9074	0.9463 (94)	
Useful gains	947.5798	1100.2336	1191.2767	1185.8721	1040.7124	750.6678	495.1528	518.6034	772.5980	936.4598	919.0374	897.1309 (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	2096.3557	2060.6257	1891.3720	1588.4731	1220.5278	800.2980	506.2543	534.3086	867.5173	1323.4569	1732.4869	2074.5535 (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	854.6893	645.3835	520.8709	289.8727	133.7826	0.0000	0.0000	0.0000	0.0000	287.9258	585.6837	876.0025 (98)	
Space heating												4194.2110 (98)	
Space heating per m2										(98) / (4) =		33.7998 (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													4639.6139 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	854.6893	645.3835	520.8709	289.8727	133.7826	0.0000	0.0000	0.0000	0.0000	287.9258	585.6837	876.0025 (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)	945.4527	713.9198	576.1846	320.6557	147.9896	0.0000	0.0000	0.0000	0.0000	318.5020	647.8802	969.0293 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	178.0055	135.1348	110.1140	57.8368	23.2624	7.0720	1.5480	33.0851	63.4985	115.1188	153.6103	177.1729 (64)	
Efficiency of water heater (217)m	88.3553	88.3465	88.3305	88.4253	88.6373	79.7000	79.7000	79.7000	79.7000	87.0616	87.9467	79.7000 (216)	
Fuel for water heating, kWh/month	201.4654	152.9600	124.6613	65.4075	26.2444	8.8733	1.9423	41.5120	79.6719	132.2269	174.6629	200.4141 (219)	
Water heating fuel used												1210.0419 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4639.6139 (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)													457.6163 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)	
Total delivered energy for all uses												4705.0328 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4639.6139	3.4800	161.4586 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1210.0419	3.4800	42.1095 (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	457.6163	13.1900	60.3596 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			172.5922 (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] =	0.4287 (257)
SAP value		94.0196

FULL SAP CALCULATION PRINTOUT

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SAP rating (Section 12)
SAP band

94 (258)
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	4639.6139	0.2160	1002.1566 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1210.0419	0.2160	261.3691 (264)
Space and water heating			1263.5257 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	457.6163	0.5190	237.5028 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			669.4663 (272)
CO2 emissions per m2			5.4000 (273)
EI value			94.6946
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	63.0000 (1b)	x 2.3900 (2b)	= 150.5700 (1b) - (3b)
First floor	61.0900 (1c)	x 2.6100 (2c)	= 159.4449 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	124.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.0149 (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																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) =	0.1613 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.4118 (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) =					0.4118 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)				
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)				
Adj infilt rate	0.4324	0.4118	0.4118	0.3809	0.3809	0.3397	0.3500	0.3294	0.3397	0.3603	0.3603	0.3912	(22b)				
Effective ac	0.5935	0.5848	0.5848	0.5725	0.5725	0.5577	0.5613	0.5543	0.5577	0.5649	0.5649	0.5765	(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	0.8000	1.6240		(26)
Half Glaze			2.0300	1.4000	2.8420		(26a)
Window (Uw = 1.30)			23.6900	1.2357	29.2747		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.50			63.0000	0.1200	7.5600	75.0000	4725.0000 (28a)
EW Brick AAC011	162.4600	31.0800	131.3800	0.2400	31.5312	42.1000	5531.0980 (29a)
PR 400mm MW044	61.0900		61.0900	0.1100	6.7199	9.0000	549.8100 (30)
PR 300mm MW044	1.9100		1.9100	0.1400	0.2674	9.0000	17.1900 (30)
Total net area of external elements Aum(A, m ²)			288.4600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.9342		(33)
GF Masonry			62.3800			39.0000	2432.8200 (32c)
GF Timber			23.1800			9.0000	208.6200 (32c)
1F Timber			146.9800			9.0000	1322.8200 (32c)
Internal Floor			61.0900			18.0000	1099.6200 (32d)
Internal Ceiling			61.0900			18.0000	1099.6200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16986.5980 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.8893 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3571 (36)
Total fabric heat loss						(33) + (36) =	93.2913 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.7152	Feb 59.8261	Mar 59.8261	Apr 58.5739	May 58.5739	Jun 57.0560	Jul 57.4192	Aug 56.7036	Sep 57.0560	Oct 57.7932	Nov 57.7932	Dec 58.9804 (38)
Heat transfer coeff	154.0065	153.1175	153.1175	151.8652	151.8652	150.3473	150.7105	149.9949	150.3473	151.0846	151.0846	152.2718 (39)
Average = Sum(39)m / 12 =												151.6511 (39)
HLP	Jan 1.2411	Feb 1.2339	Mar 1.2339	Apr 1.2238	May 1.2238	Jun 1.2116	Jul 1.2145	Aug 1.2088	Sep 1.2116	Oct 1.2175	Nov 1.2175	Dec 1.2271 (40)
HLP (average)												1.2221 (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												2.8778 (42)
Average daily hot water use (litres/day)												102.5484 (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 Designed)

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

Energy conte	112.8032	108.7013	104.5993	100.4974	96.3955	92.2935	92.2935	96.3955	100.4974	104.5993	108.7013	112.8032 (44)
Energy content (annual)	167.2839	146.3076	150.9763	131.6248	126.2971	108.9848	100.9905	115.8880	117.2721	136.6693	149.1853	162.0055 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1613.4852 (45)
	25.0926	21.9461	22.6464	19.7437	18.9446	16.3477	15.1486	17.3832	17.5908	20.5004	22.3778	24.3008 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4514 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7837 (55)
Total storage loss												
	24.2962	21.9449	24.2962	23.5124	24.2962	23.5124	24.2962	24.2962	23.5124	24.2962	23.5124	24.2962 (56)
If cylinder contains dedicated solar storage												
	14.7056	13.2824	14.7056	14.2312	14.7056	14.2312	14.7056	14.7056	14.2312	14.7056	14.2312	14.7056 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	205.2519	180.6012	187.5485	161.6144	151.4708	133.1213	125.9315	141.7595	148.6124	173.2415	185.9284	199.9735 (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												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1871 (H8)
Utilisation factor												0.5693 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5484 (H14)
Volume ratio Veff/V												1.0678 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-958.8313 (H17)
Solar input	-29.5123	-44.3570	-74.7028	-103.2622	-124.3623	-130.8860	-127.7431	-114.0754	-89.0362	-60.5697	-35.8730	-24.4512 (63)
								Solar input (sum of months) =	Sum (63)m =			-958.8313 (63)
Output from w/h												
	175.7395	136.2442	112.8457	58.3522	27.1084	2.2353	0.0000	27.6841	59.5762	112.6718	150.0554	175.5223 (64)
								Total per year (kWh/year) =	Sum (64)m =			1038.0353 (64)
Heat gains from water heating, kWh/month												
	85.9963	76.0822	79.4574	67.7569	62.1327	55.5466	53.5321	59.2300	64.0652	74.7003	78.9987	84.2412 (65)

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
	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696	172.6696 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.7803	57.5373	46.7925	35.4249	26.4805	22.3560	24.1564	31.3994	42.1443	53.5118	62.4562	66.5808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	433.5021	438.0005	426.6647	402.5321	372.0690	343.4380	324.3108	319.8124	331.1482	355.2808	385.7439	414.3749 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448	55.1448 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130	-115.1130 (71)
Water heating gains (Table 5)												
	115.5864	113.2175	106.7976	94.1068	83.5117	77.1481	71.9518	79.6102	88.9795	100.4037	109.7203	113.2274 (72)
Total internal gains												
	729.5701	724.4567	695.9561	647.7652	597.7626	558.6434	536.1203	546.5233	577.9732	624.8976	673.6217	709.8844 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		2.3900	11.9814	0.4600	0.0000	0.7700	10.1427 (74)
East		4.8600	22.3313	0.4600	0.0000	0.7700	38.4414 (76)
South		10.4500	50.9848	0.4600	0.0000	0.7700	188.7147 (78)
West		5.9900	22.3313	0.4600	0.0000	0.7700	47.3794 (80)
East		3.3300	22.3313	0.4600	0.0000	0.7700	26.3395 (76)

Solar gains	311.0177	492.3273	698.7667	937.1743	1053.6280	1131.3617	1074.2303	984.8715	837.3638	591.4767	385.0958	261.3267 (83)
Total gains	1040.5879	1216.7840	1394.7228	1584.9395	1651.3906	1690.0051	1610.3506	1531.3948	1415.3371	1216.3743	1058.7176	971.2110 (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	30.6383	30.8162	30.8162	31.0703	31.0703	31.3840	31.3084	31.4577	31.3840	31.2308	31.2308	30.9874
alpha	3.0426	3.0544	3.0544	3.0714	3.0714	3.0923	3.0872	3.0972	3.0923	3.0821	3.0821	3.0658
util living area												
	0.9561	0.9311	0.8791	0.7771	0.6295	0.4239	0.2856	0.3075	0.5548	0.8100	0.9254	0.9627 (86)
MIT	19.3301	19.5901	20.0145	20.4760	20.7976	20.9590	20.9915	20.9894	20.8994	20.4972	19.8619	19.2864 (87)
Th 2	19.8873	19.8930	19.8930	19.9010	19.9010	19.9107	19.9084	19.9130	19.9107	19.9060	19.9060	19.8984 (88)
util rest of house												
	0.9477	0.9185	0.8571	0.7381	0.5666	0.3391	0.1871	0.2057	0.4692	0.7667	0.9093	0.9554 (89)

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MIT 2	17.7151	18.0879	18.6835	19.3110	19.7110	19.8856	19.9060	19.9097	19.8358	19.3601	18.4901	17.6599 (90)
Living area fraction									fLA = Living area / (4) =			0.1792 (91)
MIT	18.0045	18.3572	18.9221	19.5198	19.9057	20.0779	20.1006	20.1032	20.0264	19.5639	18.7360	17.9514 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8545	18.2072	18.7721	19.3698	19.7557	19.9279	19.9506	19.9532	19.8764	19.4139	18.5860	17.8014 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9263	0.8933	0.8297	0.7166	0.5576	0.3405	0.1910	0.2096	0.4663	0.7436	0.8836	0.9359 (94)
Useful gains	963.9007	1086.9364	1157.1966	1135.7407	920.7459	575.4747	307.5104	320.9177	659.9614	904.5332	935.4894	908.9145 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
	1964.2836	1930.3765	1741.2653	1438.1387	1025.9619	590.5566	309.0405	322.9765	703.0856	1180.5655	1599.3757	1934.0699 (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												
	744.2849	566.7918	434.5471	217.7266	78.2807	0.0000	0.0000	0.0000	0.0000	205.3680	477.9982	762.7156 (98)
Space heating												3487.7129 (98)
Space heating per m2												28.1063 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3858.0895 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	744.2849	566.7918	434.5471	217.7266	78.2807	0.0000	0.0000	0.0000	0.0000	205.3680	477.9982	762.7156 (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)	823.3240	626.9821	480.6937	240.8480	86.5937	0.0000	0.0000	0.0000	0.0000	227.1770	528.7590	843.7120 (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	175.7395	136.2442	112.8457	58.3522	27.1084	2.2353	0.0000	27.6841	59.5762	112.6718	150.0554	175.5223 (64)	
Efficiency of water heater (217)m	88.1397	88.1077	87.9654	87.9056	87.3824	79.7000	79.7000	79.7000	79.7000	86.2956	87.5904	88.1852 (217)	
Fuel for water heating, kWh/month	199.3875	154.6338	128.2842	66.3806	31.0228	2.8047	0.0000	34.7354	74.7505	130.5650	171.3148	199.0384 (219)	
Water heating fuel used												1192.9176 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3858.0895 (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)												457.6163 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)	
Total delivered energy for all uses												3809.4637 (238)	

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3858.0895	3.9200	151.2371 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1192.9176	3.9200	46.7624 (247)	
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)	
Pump for solar water heating	50.0000	16.9600	8.4800 (249)	
Energy for lighting	457.6163	16.9600	77.6117 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775 (252)	
Total energy cost			75.4337 (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	3858.0895	0.2160	833.3473 (261)	

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Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1192.9176	0.2160	257.6702 (264)
Space and water heating			1091.0175 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	457.6163	0.5190	237.5028 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			446.6565 (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	3858.0895	1.2200	4706.8692 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1192.9176	1.2200	1455.3594 (264)
Space and water heating			6162.2287 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	457.6163	3.0700	1404.8820 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2350.6906 (272)
Primary energy kWh/m2/year			18.9434 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	136.9 (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	409.22 (P1)
Transmission heat loss coefficient	93.29 (P7)
Summer heat loss coefficient	502.51 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
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	2.3900	81.1852	0.4600	0.0000	0.9000	80.3295
East	4.8600	117.5071	0.4600	0.0000	0.9000	236.4289
South	10.4500	112.2060	0.4600	0.0000	0.9000	485.4368
West	5.9900	117.5071	0.4600	0.0000	0.9000	291.4011
East	3.3300	117.5071	0.4600	0.0000	0.9000	161.9976
total:						1255.5939

	Jun	Jul	Aug	
Solar gains	1322	1256	1151	(P4)
Internal gains	579	557	566	
Total summer gains	1901	1812	1717	(P5)
Summer gain/loss ratio	3.78	3.61	3.42	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 136.9)	1.04	1.04	1.04	
Threshold temperature	20.83	22.55	22.26	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			