

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-630				Issued on Date	22/03/2023
Assessment Reference	Plot 630	Prop Type Ref	Darwen-As-DET			
Property	Plot 630, 4 Bed, K, WC, B, En					
SAP Rating	84 B	DER	16.81	TER	17.06	
Environmental	85 B	% DER<TER	1.46			
CO ₂ Emissions (t/year)	1.73	DFEE	50.94	TFEE	58.59	
General Requirements Compliance	Pass	% DFEE<TFEE	13.05			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 122 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) 17.06 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)50.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.30 (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 H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.35 kWh/day	
Permitted by DBSCG 2.03	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:	1.03 m ² , No overhang
Windows facing North East:	7.08 m ² , No overhang
Windows facing South East:	6.50 m ² , No overhang
Windows facing South West:	8.16 m ² , No overhang
Windows facing West:	1.03 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
Thermal bridging y-value	0.030 W/m ² K

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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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.4816	0.4722	0.4627	0.4155	0.4061	0.3588	0.3588	0.3494	0.3777	0.4061	0.4249	0.4438 (22b)
Effective ac	0.6160	0.6115	0.6070	0.5863	0.5824	0.5644	0.5644	0.5610	0.5713	0.5824	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18249.9590 (34)
150.0202 (35)
9.0513 (36)
(33) + (36) = 96.8750 (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	63.9102	63.4430	62.9850	60.8339	60.4314	58.5579	58.5579	58.2109	59.2795	60.4314	61.2456	62.0968 (38)
Heat transfer coeff	160.7852	160.3180	159.8600	157.7089	157.3064	155.4329	155.4329	155.0860	156.1546	157.3064	158.1206	158.9718 (39)
Average = Sum(39)m / 12 =												157.7070 (39)
HLP	1.3217	1.3179	1.3141	1.2964	1.2931	1.2777	1.2777	1.2749	1.2836	1.2931	1.2998	1.3068 (40)
HLP (average)												1.2964 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (44)

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Energy content (annual)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7290 (55)
Total storage loss	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (56)
If cylinder contains dedicated solar storage	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Heat gains from water heating, kWh/month	92.2034	81.6917	86.7916	79.1862	78.6016	71.6729	70.2035	75.1473	74.4231	82.0437	85.0137	90.4517 (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	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8608	22.9693	18.6799	14.1419	10.5712	8.9247	9.6434	12.5349	16.8243	21.3623	24.9330	26.5796 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.3459	290.3277	282.8138	266.8175	246.6251	227.6471	214.9687	211.9869	219.5009	235.4971	255.6895	274.6675 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	123.9293	121.5650	116.6554	109.9808	105.6474	99.5457	94.3595	101.0045	103.3654	110.2738	118.0746	121.5749 (72)
Total internal gains	506.1781	503.9041	487.1911	459.9822	431.8858	405.1596	388.0137	394.5683	408.7327	436.1753	467.7391	491.8640 (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				1.0300	10.6334		0.4600		0.0000		0.7700		3.8793 (74)
Northeast				7.0800	11.2829		0.4600		0.0000		0.7700		28.2946 (75)
Southeast				6.5000	36.7938		0.4600		0.0000		0.7700		84.7104 (77)
Southwest				1.5000	36.7938		0.4600		0.0000		0.7700		19.5486 (79)
West				1.0300	19.6403		0.4600		0.0000		0.7700		7.1653 (80)
Southwest				6.6600	36.7938		0.4600		0.0000		0.7700		86.7956 (79)
Solar gains	230.3939	404.4617	584.7250	776.0358	915.5608	929.1343	887.3945	780.3391	650.5759	455.5191	278.1613	195.7362	(83)
Total gains	736.5719	908.3658	1071.9161	1236.0180	1347.4466	1334.2940	1275.4081	1174.9074	1059.3085	891.6944	745.9004	687.6001	(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	31.5292	31.6211	31.7117	32.1442	32.2265	32.6149	32.6149	32.6879	32.4642	32.2265	32.0605	31.8889
alpha	3.1019	3.1081	3.1141	3.1429	3.1484	3.1743	3.1743	3.1792	3.1643	3.1484	3.1374	3.1259
util living area	0.9868	0.9744	0.9492	0.8922	0.7892	0.6398	0.4991	0.5514	0.7663	0.9268	0.9775	0.9893 (86)
MIT	18.8859	19.1673	19.5933	20.1248	20.5655	20.8460	20.9483	20.9284	20.7103	20.1196	19.4055	18.8429 (87)
Th 2	19.8239	19.8269	19.8298	19.8436	19.8462	19.8583	19.8583	19.8606	19.8537	19.8462	19.8410	19.8355 (88)
util rest of house	0.9839	0.9689	0.9378	0.8673	0.7396	0.5550	0.3841	0.4354	0.6941	0.9046	0.9717	0.9869 (89)
MIT 2	17.0231	17.4323	18.0465	18.8031	19.3924	19.7356	19.8317	19.8204	19.5930	18.8143	17.7901	16.9674 (90)
Living area fraction	17.2871	17.6781	18.2657	18.9904	19.5586	19.8930	19.9900	19.9774	19.7514	18.9992	18.0190	17.2332 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1371	17.5281	18.1157	18.8404	19.4086	19.7430	19.8400	19.8274	19.6014	18.8492	17.8690	17.0832 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9733	0.9526	0.9147	0.8400	0.7176	0.5456	0.3821	0.4318	0.6753	0.8783	0.9564	0.9778 (94)
Ext temp.	716.9027	865.2822	980.5137	1038.2764	966.8616	727.9451	487.3076	507.2847	715.3108	783.2068	713.3762	672.3666 (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	2064.0208	2024.5182	1856.8925	1567.6841	1212.6190	799.3882	503.5995	531.5488	859.0654	1297.6600	1702.7994	2048.0695 (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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Space heating kWh	1002.2559	779.0066	652.0258	381.1735	182.8435	0.0000	0.0000	0.0000	0.0000	382.7532	712.3847	1023.5229 (98)
Space heating												5115.9662 (98)
Space heating per m2												(98) / (4) = 42.0548 (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												5659.2547 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1002.2559	779.0066	652.0258	381.1735	182.8435	0.0000	0.0000	0.0000	0.0000	382.7532	712.3847	1023.5229 (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)	1108.6901	861.7330	721.2675	421.6521	202.2605	0.0000	0.0000	0.0000	0.0000	423.3996	788.0362	1132.2156 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Efficiency of water heater	88.3231	88.1058	87.6737	86.7257	84.8780	79.7000	79.7000	79.7000	79.7000	86.6475	87.8821	79.7000 (216)
(217)m	88.3231	88.1058	87.6737	86.7257	84.8780	79.7000	79.7000	79.7000	79.7000	86.6475	87.8821	88.3991 (217)
Fuel for water heating, kWh/month	240.9579	212.7528	224.1784	202.6529	202.5427	192.1655	184.0106	202.6664	202.5435	210.3538	219.9294	234.7912 (219)
Water heating fuel used												2529.5452 (219)
Annual totals kWh/year												
Space heating fuel - main system												5659.2547 (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)												456.7098 (232)
Total delivered energy for all uses												8720.5097 (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	5659.2547	0.2160	1222.3990 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2529.5452	0.2160	546.3818 (264)
Space and water heating			1768.7808 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Total CO2, kg/year			2044.7382 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8100 (273)

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

DER			16.8100 ZC1
Total Floor Area		TFA	121.6500
Assumed number of occupants		N	2.8695
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.9971 ZC2
CO2 emissions from cooking, equation (L16)			1.5443 ZC3
Total CO2 emissions			32.3515 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			32.3515 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) =	0.1272 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3772 (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) =					0.3772	(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	0.4810	0.4715	0.4621	0.4149	0.4055	0.3584	0.3584	0.3489	0.3772	0.4055	0.4244	0.4432	(22b)				
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5711	0.5822	0.5900	0.5982	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1300	1.0000	2.1300			(26)					
TER Opening Type (Uw = 1.40)			23.8000	1.3258	31.5530			(27)					
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846			(28a)					
EW Brick AAC015	177.3600	25.9300	151.4300	0.1800	27.2574			(29a)					
Plane Ceiling	60.2300		60.2300	0.1300	7.8299			(30)					
Bay	1.1800		1.1800	0.1300	0.1534			(30)					
Total net area of external elements Aum(A, m2)			300.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.9083			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.6285	(36)					
Total fabric heat loss						(33) + (36) =	90.5368	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.8783	Feb 63.4124	Mar 62.9556	Apr 60.8102	May 60.4088	Jun 58.5402	Jul 58.5402	Aug 58.1942	Sep 59.2600	Oct 60.4088	Nov 61.2208	Dec 62.0698	(38)
Heat transfer coeff	154.4152	153.9492	153.4924	151.3470	150.9456	149.0770	149.0770	148.7310	149.7968	150.9456	151.7576	152.6066	(39)
Average = Sum(39)m / 12 =												151.3451	(39)
HLP	Jan 1.2693	Feb 1.2655	Mar 1.2618	Apr 1.2441	May 1.2408	Jun 1.2255	Jul 1.2255	Aug 1.2226	Sep 1.2314	Oct 1.2408	Nov 1.2475	Dec 1.2545	(40)
HLP (average)												1.2441	(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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
Daily hot water use	Jan 112.5849	Feb 108.4909	Mar 104.3969	Apr 100.3029	May 96.2089	Jun 92.1149	Jul 92.1149	Aug 96.2089	Sep 100.3029	Oct 104.3969	Nov 108.4909	Dec 112.5849 (44)
Energy conte	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Energy content (annual)										Total = Sum(45)m =		1610.3627 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage												
25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(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												
215.3379	189.7204	199.0618	178.1872	174.4304	155.5910	149.1727	164.0415	163.8623	184.7825	195.7137	210.0697	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												(63)
Output from w/h												
215.3379	189.7204	199.0618	178.1872	174.4304	155.5910	149.1727	164.0415	163.8623	184.7825	195.7137	210.0697	(64)
Heat gains from water heating, kWh/month												
94.2164	83.5099	88.8046	81.1343	80.6147	73.6210	72.2165	77.1604	76.3712	84.0568	86.9618	92.4648	(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	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
25.8608	22.9693	18.6799	14.1419	10.5712	8.9247	9.6434	12.5349	16.8243	21.3623	24.9330	26.5796	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
287.3459	290.3277	282.8138	266.8175	246.6251	227.6471	214.9687	211.9869	219.5009	235.4971	255.6895	274.6675	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	(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)												
-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	(71)
Water heating gains (Table 5)												
126.6350	124.2707	119.3611	112.6865	108.3531	102.2514	97.0652	103.7102	106.0711	112.9795	120.7803	124.2806	(72)
Total internal gains												
508.8838	506.6098	489.8968	462.6879	434.5915	407.8653	390.7194	397.2740	411.4384	438.8810	470.4448	494.5697	(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		1.0300	10.6334	0.6300		0.7000	0.7700	3.3472 (74)
Northeast		7.0800	11.2829	0.6300		0.7000	0.7700	24.4134 (75)
Southeast		6.5000	36.7938	0.6300		0.7000	0.7700	73.0904 (77)
Southwest		8.1600	36.7938	0.6300		0.7000	0.7700	91.7565 (79)
West		1.0300	19.6403	0.6300		0.7000	0.7700	6.1824 (80)

Solar gains	198.7898	348.9801	504.5160	669.5839	789.9697	801.6814	765.6671	673.2969	561.3339	393.0337	240.0048	168.8863 (83)
Total gains	707.6736	855.5899	994.4128	1132.2719	1224.5612	1209.5467	1156.3865	1070.5709	972.7722	831.9147	710.4496	663.4559 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7091	54.8747	55.0380	55.8182	55.9666	56.6681	56.6681	56.8000	56.3958	55.9666	55.6672	55.3575
alpha	4.6473	4.6583	4.6692	4.7212	4.7311	4.7779	4.7779	4.7867	4.7597	4.7311	4.7111	4.6905
util living area												
0.9982	0.9954	0.9870	0.9579	0.8768	0.7169	0.5502	0.6098	0.8505	0.9761	0.9961	0.9987	(86)
MIT	19.5853	19.7698	20.0587	20.4332	20.7493	20.9338	20.9850	20.9761	20.8431	20.4245	19.9367	19.5596 (87)
Th 2	19.8649	19.8680	19.8709	19.8849	19.8875	19.8997	19.8997	19.9020	19.8950	19.8875	19.8822	19.8767 (88)
util rest of house												
0.9976	0.9938	0.9822	0.9415	0.8293	0.6208	0.4212	0.4784	0.7762	0.9638	0.9944	0.9982	(89)
MIT 2	17.9864	18.2577	18.6789	19.2217	19.6424	19.8560	19.8943	19.8923	19.7691	19.2199	18.5120	17.9569 (90)
Living area fraction												
MIT	18.2130	18.4720	18.8745	19.3934	19.7992	20.0088	20.0489	20.0459	19.9213	19.3906	18.7139	18.1841 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2130	18.4720	18.8745	19.3934	19.7992	20.0088	20.0489	20.0459	19.9213	19.3906	18.7139	18.1841 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9961	0.9907	0.9762	0.9321	0.8248	0.6312	0.4394	0.4967	0.7783	0.9560	0.9917	0.9971 (94)
Useful gains	704.9456	847.6467	970.7238	1055.3841	1010.0584	763.4831	508.1575	531.7401	757.1538	795.3103	704.5493	661.5473 (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												
	2148.3708	2089.3948	1899.3888	1588.1495	1222.5452	806.3211	514.1534	542.2604	872.0143	1326.9067	1762.4938	2134.0617 (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												
	1073.9084	834.4548	690.9268	383.5911	158.0902	0.0000	0.0000	0.0000	0.0000	395.5077	761.7200	1095.5508 (98)
Space heating												5393.7496 (98)
Space heating per m2												(98) / (4) = 44.3383 (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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5768.7162	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1073.9084	834.4548	690.9268	383.5911	158.0902	0.0000	0.0000	0.0000	0.0000	395.5077	761.7200	1095.5508	(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)	1148.5651	892.4650	738.9591	410.2579	169.0804	0.0000	0.0000	0.0000	0.0000	423.0029	814.6738	1171.7121	(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	215.3379	189.7204	199.0618	178.1872	174.4304	155.5910	149.1727	164.0415	163.8623	184.7825	195.7137	210.0697	(64)	
Efficiency of water heater (217)m	88.5176	88.3066	87.8649	86.8081	84.5528	79.8000	79.8000	79.8000	79.8000	86.7942	88.0857	88.5888	(216)	
Fuel for water heating, kWh/month	243.2713	214.8428	226.5545	205.2657	206.2976	194.9762	186.9332	205.5657	205.3412	212.8974	222.1856	237.1290	(219)	
Water heating fuel used												2561.2603	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5768.7162	(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)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													456.7098	(232)
Total delivered energy for all uses													8861.6864	(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	5768.7162	0.2160	1246.0427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2561.2603	0.2160	553.2322 (264)
Space and water heating			1799.2749 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Total CO2, kg/m2/year			2075.2323 (272)
Emissions per m2 for space and water heating			14.7906 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9485 (272b)
Emissions per m2 for pumps and fans			0.3200 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7906 * 1.00) + 1.9485 + 0.3200, rounded to 2 d.p.			17.0600 (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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.4816	0.4722	0.4627	0.4155	0.4061	0.3588	0.3588	0.3494	0.3777	0.4061	0.4249	0.4438 (22b)
Effective ac	0.6160	0.6115	0.6070	0.5863	0.5824	0.5644	0.5644	0.5610	0.5713	0.5824	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18249.9590 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0202 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0513 (36)
Total fabric heat loss						(33) + (36) =	96.8750 (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	63.9102	63.4430	62.9850	60.8339	60.4314	58.5579	58.5579	58.2109	59.2795	60.4314	61.2456	62.0968 (38)
Heat transfer coeff	160.7852	160.3180	159.8600	157.7089	157.3064	155.4329	155.4329	155.0860	156.1546	157.3064	158.1206	158.9718 (39)
Average = Sum(39)m / 12 =												157.7070 (39)
HLP	1.3217	1.3179	1.3141	1.2964	1.2931	1.2777	1.2777	1.2749	1.2836	1.2931	1.2998	1.3068 (40)
HLP (average)												1.2964 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Energy content (annual)										Total =	Sum(45)m =	1610.3627 (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	35.4790	31.0302	32.0204	27.9161	26.7862	23.1145	21.4189	24.5785	24.8721	28.9860	31.6405	34.3596 (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	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8608	22.9693	18.6799	14.1419	10.5712	8.9247	9.6434	12.5349	16.8243	21.3623	24.9330	26.5796 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.3459	290.3277	282.8138	266.8175	246.6251	227.6471	214.9687	211.9869	219.5009	235.4971	255.6895	274.6675 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	47.6869	46.1759	43.0381	38.7724	36.0030	32.1034	28.7889	33.0357	34.5446	38.9597	43.9452	46.1822 (72)
Total internal gains	426.9357	425.5149	410.5739	385.7739	359.2414	334.7173	319.4431	323.5996	336.9118	361.8612	390.6097	413.4713 (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				1.0300	10.6334		0.4600		0.0000		0.7700		3.8793 (74)
Northeast				7.0800	11.2829		0.4600		0.0000		0.7700		28.2946 (75)
Southeast				6.5000	36.7938		0.4600		0.0000		0.7700		84.7104 (77)
Southwest				1.5000	36.7938		0.4600		0.0000		0.7700		19.5486 (79)
West				1.0300	19.6403		0.4600		0.0000		0.7700		7.1653 (80)
Southwest				6.6600	36.7938		0.4600		0.0000		0.7700		86.7956 (79)
Solar gains	230.3939	404.4617	584.7250	776.0358	915.5608	929.1343	887.3945	780.3391	650.5759	455.5191	278.1613	195.7362	(83)
Total gains	657.3295	829.9766	995.2989	1161.8097	1274.8022	1263.8516	1206.8375	1103.9386	987.4877	817.3803	668.7710	609.2074	(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	31.5292	31.6211	31.7117	32.1442	32.2265	32.6149	32.6149	32.6879	32.4642	32.2265	32.0605	31.8889
alpha	3.1019	3.1081	3.1141	3.1429	3.1484	3.1743	3.1743	3.1792	3.1643	3.1484	3.1374	3.1259
util living area	0.9904	0.9799	0.9577	0.9057	0.8084	0.6631	0.5220	0.5782	0.7919	0.9403	0.9832	0.9924 (86)
MIT	18.8041	19.0896	19.5238	20.0699	20.5297	20.8289	20.9412	20.9180	20.6779	20.0568	19.3278	18.7610 (87)
Th 2	19.8239	19.8269	19.8298	19.8436	19.8462	19.8583	19.8583	19.8606	19.8537	19.8462	19.8410	19.8355 (88)
util rest of house	0.9882	0.9754	0.9479	0.8831	0.7609	0.5783	0.4038	0.4596	0.7228	0.9214	0.9788	0.9907 (89)
MIT 2	17.8305	18.1157	18.5454	19.0831	19.5076	19.7640	19.8374	19.8286	19.6524	19.0836	18.3645	17.7959 (90)
Living area fraction									fLA =	Living area / (4) =		0.1417 (91)
MIT	17.9685	18.2537	18.6841	19.2230	19.6524	19.9149	19.9938	19.9830	19.7977	19.2215	18.5010	17.9327 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9685	18.2537	18.6841	19.2230	19.6524	19.9149	19.9938	19.9830	19.7977	19.2215	18.5010	17.9327 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9833	0.9671	0.9355	0.8683	0.7517	0.5830	0.4187	0.4735	0.7189	0.9081	0.9715	0.9866 (94)
Useful gains	646.3513	802.6896	931.0915	1008.7631	958.3133	736.7712	505.3449	522.6746	709.8877	742.2360	649.7138	601.0382 (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	2197.6928	2140.8423	1947.7465	1628.0263	1250.9663	826.1148	527.5115	555.6686	889.7203	1356.2142	1802.7375	2183.1122 (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	1154.1980	899.2386	756.3913	445.8695	217.7338	0.0000	0.0000	0.0000	0.0000	456.7997	830.1770	1177.0630 (98)
Space heating												5937.4711 (98)
Space heating per m2										(98) / (4) =		48.8078 (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	1461.0693	1150.2035	1178.6533	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7921	0.8546	0.8229	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1157.3785	982.9866	969.8754	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1592.6639	1523.4363	1405.3316	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	313.4055	402.0945	323.9794	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1039.4794 (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	78.3514	100.5236	80.9949	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													259.8699 (107)
Space cooling per m2													2.1362 (108)
Energy for space heating													48.8078 (99)
Energy for space cooling													2.1362 (108)
Total													50.9440 (109)
Dwelling Fabric Energy Efficiency (DFEE)													50.9 (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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) =	0.1272 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3772 (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) =					0.3772	(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	0.4810	0.4715	0.4621	0.4149	0.4055	0.3584	0.3584	0.3489	0.3772	0.4055	0.4244	0.4432	(22b)				
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5711	0.5822	0.5900	0.5982	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1300	1.0000	2.1300			(26)					
TER Opening Type (Uw = 1.40)			23.8000	1.3258	31.5530			(27)					
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846			(28a)					
EW Brick AAC015	177.3600	25.9300	151.4300	0.1800	27.2574			(29a)					
Plane Ceiling	60.2300		60.2300	0.1300	7.8299			(30)					
Bay	1.1800		1.1800	0.1300	0.1534			(30)					
Total net area of external elements Aum(A, m2)			300.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.9083			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.6285	(36)					
Total fabric heat loss						(33) + (36) =	90.5368	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.8783	Feb 63.4124	Mar 62.9556	Apr 60.8102	May 60.4088	Jun 58.5402	Jul 58.5402	Aug 58.1942	Sep 59.2600	Oct 60.4088	Nov 61.2208	Dec 62.0698	(38)
Heat transfer coeff	154.4152	153.9492	153.4924	151.3470	150.9456	149.0770	149.0770	148.7310	149.7968	150.9456	151.7576	152.6066	(39)
Average = Sum(39)m / 12 =												151.3451	(39)
HLP	Jan 1.2693	Feb 1.2655	Mar 1.2618	Apr 1.2441	May 1.2408	Jun 1.2255	Jul 1.2255	Aug 1.2226	Sep 1.2314	Oct 1.2408	Nov 1.2475	Dec 1.2545	(40)
HLP (average)												1.2441	(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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
Daily hot water use	Jan 112.5849	Feb 108.4909	Mar 104.3969	Apr 100.3029	May 96.2089	Jun 92.1149	Jul 92.1149	Aug 96.2089	Sep 100.3029	Oct 104.3969	Nov 108.4909	Dec 112.5849 (44)
Energy conte	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Energy content (annual)										Total = Sum(45)m =		1610.3627 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.4790	31.0302	32.0204	27.9161	26.7862	23.1145	21.4189	24.5785	24.8721	28.9860	31.6405	34.3596 (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	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	143.4735	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8608	22.9693	18.6799	14.1419	10.5712	8.9247	9.6434	12.5349	16.8243	21.3623	24.9330	26.5796	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.3459	290.3277	282.8138	266.8175	246.6251	227.6471	214.9687	211.9869	219.5009	235.4971	255.6895	274.6675	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	37.3474	(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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	(71)
Water heating gains (Table 5)	47.6869	46.1759	43.0381	38.7724	36.0030	32.1034	28.7889	33.0357	34.5446	38.9597	43.9452	46.1822	(72)
Total internal gains	426.9357	425.5149	410.5739	385.7739	359.2414	334.7173	319.4431	323.5996	336.9118	361.8612	390.6097	413.4713	(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	1.0300	10.6334	0.6300	0.7000	0.7700	3.3472 (74)
Northeast	7.0800	11.2829	0.6300	0.7000	0.7700	24.4134 (75)
Southeast	6.5000	36.7938	0.6300	0.7000	0.7700	73.0904 (77)
Southwest	8.1600	36.7938	0.6300	0.7000	0.7700	91.7565 (79)
West	1.0300	19.6403	0.6300	0.7000	0.7700	6.1824 (80)

Solar gains	198.7898	348.9801	504.5160	669.5839	789.9697	801.6814	765.6671	673.2969	561.3339	393.0337	240.0048	168.8863	(83)
Total gains	625.7255	774.4950	915.0898	1055.3578	1149.2111	1136.3986	1085.1102	996.8965	898.2456	754.8949	630.6145	582.3575	(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	54.7091	54.8747	55.0380	55.8182	55.9666	56.6681	56.6681	56.8000	56.3958	55.9666	55.6672	55.3575	
alpha	4.6473	4.6583	4.6692	4.7212	4.7311	4.7779	4.7779	4.7867	4.7597	4.7311	4.7111	4.6905	
util living area	0.9989	0.9969	0.9907	0.9672	0.8969	0.7477	0.5817	0.6462	0.8789	0.9835	0.9976	0.9993	(86)
MIT	19.5238	19.7097	20.0019	20.3848	20.7166	20.9205	20.9811	20.9696	20.8143	20.3716	19.8771	19.4985	(87)
Th 2	19.8649	19.8680	19.8709	19.8849	19.8875	19.8997	19.8997	19.9020	19.8950	19.8875	19.8822	19.8767	(88)
util rest of house	0.9986	0.9959	0.9871	0.9538	0.8541	0.6527	0.4476	0.5110	0.8120	0.9746	0.9966	0.9990	(89)
MIT 2	18.5210	18.7088	19.0015	19.3870	19.6943	19.8629	19.8950	19.8933	19.7894	19.3815	18.8875	18.5050	(90)
Living area fraction									fLA = Living area / (4) =			0.1417	(91)
MIT	18.6631	18.8507	19.1433	19.5284	19.8392	20.0128	20.0489	20.0458	19.9347	19.5219	19.0277	18.6458	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6631	18.8507	19.1433	19.5284	19.8392	20.0128	20.0489	20.0458	19.9347	19.5219	19.0277	18.6458	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9945	0.9840	0.9483	0.8519	0.6635	0.4667	0.5301	0.8149	0.9705	0.9955	0.9986	(94)
Ext temp.	624.4699	770.2025	900.4268	1000.8471	979.0012	754.0394	506.4207	528.4289	731.9735	732.6370	627.7479	581.5248	(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	2217.8847	2147.6940	1940.6521	1608.5835	1228.5798	806.9208	514.1510	542.2444	874.0172	1346.7148	1810.1255	2204.5197	(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	1185.5006	925.6743	773.9276	437.5703	185.6865	0.0000	0.0000	0.0000	0.0000	456.8739	851.3119	1207.5082	(98)
Space heating per m2										(98) / (4) =		49.5195	(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	1401.3242	1103.1701	1130.3557	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8390	0.9054	0.8744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1175.7201	998.8104	988.3481	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1443.6928	1381.1575	1280.2174	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	192.9403	284.4663	217.1508	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												694.5574 (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	48.2351	71.1166	54.2877	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												173.6394 (107)
Space cooling per m2												1.4274 (108)
Energy for space heating												49.5195 (99)
Energy for space cooling												1.4274 (108)
Total												50.9469 (109)
Target Fabric Energy Efficiency (TFEE)												58.6 (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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.3966	0.3777	0.3777	0.3494	0.3494	0.3116	0.3211	0.3022	0.3116	0.3305	0.3305	0.3588 (22b)
Effective ac	0.5786	0.5713	0.5713	0.5610	0.5610	0.5486	0.5515	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18249.9590 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0202 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0513 (36)
Total fabric heat loss						(33) + (36) =	96.8750 (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	60.0382	59.2795	59.2795	58.2109	58.2109	56.9157	57.2256	56.6150	56.9157	57.5448	57.5448	58.5579 (38)
Heat transfer coeff	156.9132	156.1546	156.1546	155.0860	155.0860	153.7907	154.1006	153.4900	153.7907	154.4198	154.4198	155.4329 (39)
Average = Sum(39)m / 12 =												154.9032 (39)
HLP	1.2899	1.2836	1.2836	1.2749	1.2749	1.2642	1.2668	1.2617	1.2642	1.2694	1.2694	1.2777 (40)
HLP (average)												1.2734 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7290 (55)
Total storage loss	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (56)
If cylinder contains dedicated solar storage	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
RHI water heating demand	92.2034	81.6917	86.7916	79.1862	78.6016	71.6729	70.2035	75.1473	74.4231	82.0437	85.0137	2150.3437 (64)
Heat gains from water heating, kWh/month												2150 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6520	57.4233	46.6998	35.3547	26.4281	22.3117	24.1086	31.3373	42.0608	53.4058	62.3325	66.4489 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	428.8745	433.3249	422.1101	398.2351	368.0972	339.7719	320.8488	316.3984	327.6132	351.4882	381.6261	409.9514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	123.9293	121.5650	116.6554	109.9808	105.6474	99.5457	94.3595	101.0045	103.3654	110.2738	118.0746	121.5749 (72)
Total internal gains	732.9315	727.7889	700.9410	659.0463	615.6484	577.1050	554.7926	564.2158	588.5151	630.6436	677.5089	713.4509 (73)

6. Solar gains

[Jan]												
Area	m2											
Solar flux	Table 6a											
Specific data	g											
Specific data	or Table 6b											
FF	or Table 6c											
Access factor	Table 6d											
Gains	W											
North	1.0300	11.9814	0.4600	0.0000	0.7700	4.3711 (74)						
Northeast	7.0800	12.9236	0.4600	0.0000	0.7700	32.4089 (75)						
Southeast	6.5000	40.4699	0.4600	0.0000	0.7700	93.1739 (77)						
Southwest	1.5000	40.4699	0.4600	0.0000	0.7700	21.5017 (79)						
West	1.0300	22.3313	0.4600	0.0000	0.7700	8.1470 (80)						
Southwest	6.6600	40.4699	0.4600	0.0000	0.7700	95.4674 (79)						
Solar gains	255.0700	403.6039	578.6509	795.7993	918.3445	998.8370	943.0714	845.4970	699.3654	485.9380	315.6126	214.5420 (83)
Total gains	988.0015	1131.3928	1279.5919	1454.8456	1533.9928	1575.9420	1497.8639	1409.7128	1287.8805	1116.5816	993.1215	927.9929 (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	32.3072	32.4642	32.4642	32.6879	32.6879	32.9632	32.8969	33.0278	32.9632	32.8289	32.8289	32.6149
alpha	3.1538	3.1643	3.1643	3.1792	3.1792	3.1975	3.1931	3.2019	3.1975	3.1886	3.1886	3.1743
util living area	0.9668	0.9491	0.9090	0.8204	0.6749	0.4614	0.3132	0.3406	0.6089	0.8501	0.9435	0.9717 (86)
MIT	19.3242	19.5490	19.9528	20.4232	20.7755	20.9543	20.9907	20.9879	20.8819	20.4503	19.8287	19.2862 (87)
Th 2	19.8488	19.8537	19.8537	19.8606	19.8606	19.8690	19.8670	19.8709	19.8690	19.8649	19.8649	19.8583 (88)
util rest of house	0.9597	0.9385	0.8898	0.7830	0.6088	0.3669	0.2014	0.2240	0.5159	0.8094	0.9296	0.9655 (89)
MIT 2	17.6711	17.9953	18.5665	19.2115	19.6524	19.8421	19.8646	19.8676	19.7828	19.2680	18.4083	17.6229 (90)
Living area fraction									fLA = Living area / (4) =			0.1417 (91)
MIT	17.9054	18.2155	18.7630	19.3832	19.8116	19.9997	20.0242	20.0263	19.9386	19.4356	18.6096	17.8587 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7554	18.0655	18.6130	19.2332	19.6616	19.8497	19.8742	19.8763	19.7886	19.2856	18.4596	17.7087 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9412	0.9160	0.8631	0.7588	0.5961	0.3653	0.2021	0.2246	0.5086	0.7839	0.9061	0.9487 (94)
Ext temp.	929.8868	1036.3748	1104.4539	1103.9058	914.3559	575.6332	302.7286	316.5815	655.0274	875.3252	899.8359	880.3572 (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)
	1985.7945	1946.5442	1750.9533	1447.4551	1033.1197	592.0554	304.2234	318.6965	705.6829	1186.8036	1615.1640	1959.8002 (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													
	785.5953	611.6338	480.9956	247.3555	88.3603	0.0000	0.0000	0.0000	0.0000	231.7399	515.0363	803.1056	(98)
Space heating												3763.8222	(98)
RHI space heating demand												3764	(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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) =	0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =		0.3777 (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	0.4816	0.4722	0.4627	0.4155	0.4061	0.3588	0.3588	0.3494	0.3777	0.4061	0.4249	0.4438 (22b)
Effective ac	0.6160	0.6115	0.6070	0.5863	0.5824	0.5644	0.5644	0.5610	0.5713	0.5824	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18249.9590 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0202 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0513 (36)
Total fabric heat loss						(33) + (36) =	96.8750 (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	63.9102	63.4430	62.9850	60.8339	60.4314	58.5579	58.5579	58.2109	59.2795	60.4314	61.2456	62.0968 (38)
Heat transfer coeff	160.7852	160.3180	159.8600	157.7089	157.3064	155.4329	155.4329	155.0860	156.1546	157.3064	158.1206	158.9718 (39)
Average = Sum(39)m / 12 =												157.7070 (39)
HLP	1.3217	1.3179	1.3141	1.2964	1.2931	1.2777	1.2777	1.2749	1.2836	1.2931	1.2998	1.3068 (40)
HLP (average)												1.2964 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7290 (55)
Total storage loss	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (56)
If cylinder contains dedicated solar storage	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Heat gains from water heating, kWh/month	92.2034	81.6917	86.7916	79.1862	78.6016	71.6729	70.2035	75.1473	74.4231	82.0437	85.0137	90.4517 (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	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6520	57.4233	46.6998	35.3547	26.4281	22.3117	24.1086	31.3373	42.0608	53.4058	62.3325	66.4489 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	428.8745	433.3249	422.1101	398.2351	368.0972	339.7719	320.8488	316.3984	327.6132	351.4882	381.6261	409.9514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	123.9293	121.5650	116.6554	109.9808	105.6474	99.5457	94.3595	101.0045	103.3654	110.2738	118.0746	121.5749 (72)
Total internal gains	732.9315	727.7889	700.9410	659.0463	615.6484	577.1050	554.7926	564.2158	588.5151	630.6436	677.5089	713.4509 (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					1.0300	10.6334	0.4600		0.0000	0.7700		3.8793 (74)
Northeast					7.0800	11.2829	0.4600		0.0000	0.7700		28.2946 (75)
Southeast					6.5000	36.7938	0.4600		0.0000	0.7700		84.7104 (77)
Southwest					1.5000	36.7938	0.4600		0.0000	0.7700		19.5486 (79)
West					1.0300	19.6403	0.4600		0.0000	0.7700		7.1653 (80)
Southwest					6.6600	36.7938	0.4600		0.0000	0.7700		86.7956 (79)
Solar gains	230.3939	404.4617	584.7250	776.0358	915.5608	929.1343	887.3945	780.3391	650.5759	455.5191	278.1613	195.7362 (83)
Total gains	963.3254	1132.2506	1285.6659	1435.0821	1531.2092	1506.2393	1442.1870	1344.5549	1239.0910	1086.1626	955.6702	909.1871 (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	31.5292	31.6211	31.7117	32.1442	32.2265	32.6149	32.6149	32.6879	32.4642	32.2265	32.0605	31.8889
alpha	3.1019	3.1081	3.1141	3.1429	3.1484	3.1743	3.1743	3.1792	3.1643	3.1484	3.1374	3.1259
util living area	0.9729	0.9551	0.9221	0.8539	0.7414	0.5874	0.4498	0.4948	0.7044	0.8867	0.9572	0.9770 (86)
MIT	19.1131	19.3794	19.7750	20.2580	20.6436	20.8799	20.9615	20.9475	20.7769	20.2683	19.6070	19.0684 (87)
Th 2	19.8239	19.8269	19.8298	19.8436	19.8462	19.8583	19.8583	19.8606	19.8537	19.8462	19.8410	19.8355 (88)
util rest of house	0.9673	0.9460	0.9060	0.8235	0.6877	0.5040	0.3428	0.3859	0.6274	0.8562	0.9469	0.9722 (89)
MIT 2	17.3506	17.7347	18.2993	18.9776	19.4823	19.7652	19.8391	19.8321	19.6604	19.0108	18.0766	17.2933 (90)
Living area fraction	17.6004	17.9678	18.5084	19.1591	19.6469	19.9232	19.9982	19.9902	19.8186	19.1890	18.2935	17.5449 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4504	17.8178	18.3584	19.0091	19.4969	19.7732	19.8482	19.8402	19.6686	19.0390	18.1435	17.3949 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	915.6527	1046.4989	1130.8703	1143.6531	1024.7832	748.9582	493.0044	516.1234	759.9091	900.3428	884.5085	870.1944 (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	2114.3898	2070.9502	1895.6888	1594.2916	1226.5031	804.0860	504.8768	533.5269	869.5636	1327.5078	1746.2004	2097.6149 (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	891.8604	688.4313	569.0250	324.4597	150.0796	0.0000	0.0000	0.0000	0.0000	317.8108	620.4182	913.2009 (98)
Space heating												4475.2858 (98)
Space heating per m2												(98) / (4) = 36.7882 (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												4950.5374 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	891.8604	688.4313	569.0250	324.4597	150.0796	0.0000	0.0000	0.0000	0.0000	317.8108	620.4182	913.2009 (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)	986.5712	761.5390	629.4524	358.9156	166.0172	0.0000	0.0000	0.0000	0.0000	351.5606	686.3033	1010.1780 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Efficiency of water heater (217)m	88.1208	87.8752	87.3880	86.3279	84.3536	79.7000	79.7000	79.7000	79.7000	86.1829	87.6063	79.7000 (216)
Fuel for water heating, kWh/month	241.5112	213.3112	224.9114	203.5867	203.8016	192.1655	184.0106	202.6664	202.5435	211.4877	220.6218	235.3028 (219)
Water heating fuel used												2535.9204 (219)
Annual totals kWh/year												
Space heating fuel - main system												4950.5374 (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)												456.7098 (232)
Total delivered energy for all uses												8018.1676 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4950.5374	3.4800	172.2787 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2535.9204	3.4800	88.2500 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	456.7098	13.1900	60.2400 (250)
Additional standing charges			120.0000 (251)
Total energy cost			450.6613 (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] =	1.1358 (257)
SAP value		84.1559
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	4950.5374	0.2160	1069.3161 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2535.9204	0.2160	547.7588 (264)
Space and water heating			1617.0749 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Total kg/year			1893.0323 (272)
CO2 emissions per m2			15.5600 (273)
EI value			84.7785
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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8457 = 4.115$, stars = 4
Water heating environmental impact	$0.216 / 0.8457 = 0.2554$, 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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.3966	0.3777	0.3777	0.3494	0.3494	0.3116	0.3211	0.3022	0.3116	0.3305	0.3305	0.3588 (22b)
Effective ac	0.5786	0.5713	0.5713	0.5610	0.5610	0.5486	0.5515	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18249.9590 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0202 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0513 (36)
Total fabric heat loss						(33) + (36) =	96.8750 (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	60.0382	59.2795	59.2795	58.2109	58.2109	56.9157	57.2256	56.6150	56.9157	57.5448	57.5448	58.5579 (38)
Heat transfer coeff	156.9132	156.1546	156.1546	155.0860	155.0860	153.7907	154.1006	153.4900	153.7907	154.4198	154.4198	155.4329 (39)
Average = Sum(39)m / 12 =												154.9032 (39)
HLP	1.2899	1.2836	1.2836	1.2749	1.2749	1.2642	1.2668	1.2617	1.2642	1.2694	1.2694	1.2777 (40)
HLP (average)												1.2734 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (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)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7290 (55)
Total storage loss	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (56)
If cylinder contains dedicated solar storage	22.5990	20.4120	22.5990	21.8700	22.5990	21.8700	22.5990	22.5990	21.8700	22.5990	21.8700	22.5990 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Heat gains from water heating, kWh/month	92.2034	81.6917	86.7916	79.1862	78.6016	71.6729	70.2035	75.1473	74.4231	82.0437	85.0137	90.4517 (65)
Total per year (kWh/year) = Sum(64)m =												2150.3437 (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	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6520	57.4233	46.6998	35.3547	26.4281	22.3117	24.1086	31.3373	42.0608	53.4058	62.3325	66.4489 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	428.8745	433.3249	422.1101	398.2351	368.0972	339.7719	320.8488	316.3984	327.6132	351.4882	381.6261	409.9514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	123.9293	121.5650	116.6554	109.9808	105.6474	99.5457	94.3595	101.0045	103.3654	110.2738	118.0746	121.5749 (72)
Total internal gains	732.9315	727.7889	700.9410	659.0463	615.6484	577.1050	554.7926	564.2158	588.5151	630.6436	677.5089	713.4509 (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					1.0300	11.9814		0.4600	0.0000	0.7700		4.3711 (74)	
Northeast					7.0800	12.9236		0.4600	0.0000	0.7700		32.4089 (75)	
Southeast					6.5000	40.4699		0.4600	0.0000	0.7700		93.1739 (77)	
Southwest					1.5000	40.4699		0.4600	0.0000	0.7700		21.5017 (79)	
West					1.0300	22.3313		0.4600	0.0000	0.7700		8.1470 (80)	
Southwest					6.6600	40.4699		0.4600	0.0000	0.7700		95.4674 (79)	

Solar gains	255.0700	403.6039	578.6509	795.7993	918.3445	998.8370	943.0714	845.4970	699.3654	485.9380	315.6126	214.5420 (83)	
Total gains	988.0015	1131.3928	1279.5919	1454.8456	1533.9928	1575.9420	1497.8639	1409.7128	1287.8805	1116.5816	993.1215	927.9929 (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	32.3072	32.4642	32.4642	32.6879	32.6879	32.9632	32.8969	33.0278	32.9632	32.8289	32.8289	32.6149
alpha	3.1538	3.1643	3.1643	3.1792	3.1792	3.1975	3.1931	3.2019	3.1975	3.1886	3.1886	3.1743
util living area	0.9668	0.9491	0.9090	0.8204	0.6749	0.4614	0.3132	0.3406	0.6089	0.8501	0.9435	0.9717 (86)
MIT	19.3242	19.5490	19.9528	20.4232	20.7755	20.9543	20.9907	20.9879	20.8819	20.4503	19.8287	19.2862 (87)
Th 2	19.8488	19.8537	19.8537	19.8606	19.8606	19.8690	19.8670	19.8709	19.8690	19.8649	19.8649	19.8583 (88)
util rest of house	0.9597	0.9385	0.8898	0.7830	0.6088	0.3669	0.2014	0.2240	0.5159	0.8094	0.9296	0.9655 (89)
MIT 2	17.6711	17.9953	18.5665	19.2115	19.6524	19.8421	19.8646	19.8676	19.7828	19.2680	18.4083	17.6229 (90)
Living area fraction	17.9054	18.2155	18.7630	19.3832	19.8116	19.9997	20.0242	20.0263	19.9386	19.4356	18.6096	0.1417 (91)
MIT	17.9054	18.2155	18.7630	19.3832	19.8116	19.9997	20.0242	20.0263	19.9386	19.4356	18.6096	17.8587 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7554	18.0655	18.6130	19.2332	19.6616	19.8497	19.8742	19.8763	19.7886	19.2856	18.4596	17.7087 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	929.8868	1036.3748	1104.4539	1103.9058	914.3559	575.6332	302.7286	316.5815	655.0274	875.3252	899.8359	880.3572 (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	1985.7945	1946.5442	1750.9533	1447.4551	1033.1197	592.0554	304.2234	318.6965	705.6829	1186.8036	1615.1640	1959.8002 (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	785.5953	611.6338	480.9956	247.3555	88.3603	0.0000	0.0000	0.0000	0.0000	231.7399	515.0363	803.1056 (98)
Space heating												3763.8222 (98)
Space heating per m2												(98) / (4) = 30.9398 (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												4163.5202 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	785.5953	611.6338	480.9956	247.3555	88.3603	0.0000	0.0000	0.0000	0.0000	231.7399	515.0363	803.1056 (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)	869.0213	676.5861	532.0748	273.6233	97.7436	0.0000	0.0000	0.0000	0.0000	256.3495	569.7304	888.3911 (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	212.8216	187.4476	196.5455	175.7521	171.9141	153.1559	146.6564	161.5252	161.4271	182.2662	193.2785	207.5534 (64)
Efficiency of water heater	87.8850	87.6400	87.0113	85.6250	83.0367	79.7000	79.7000	79.7000	79.7000	85.3551	87.2053	79.7000 (216)
(217)m	87.8850	87.6400	87.0113	85.6250	83.0367	79.7000	79.7000	79.7000	79.7000	85.3551	87.2053	87.9745 (217)
Fuel for water heating, kWh/month	242.1592	213.8838	225.8850	205.2580	207.0340	192.1655	184.0106	202.6664	202.5435	213.5388	221.6362	235.9246 (219)
Water heating fuel used												2546.7055 (219)
Annual totals kWh/year												
Space heating fuel - main system												4163.5202 (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)												456.7098 (232)
Total delivered energy for all uses												7241.9355 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4163.5202	9.7400	405.5269 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2546.7055	9.7400	248.0491 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	456.7098	36.8500	168.2976 (250)
Additional standing charges			104.0000 (251)
Total energy cost			953.5111 (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	4163.5202	0.2160	899.3204 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2546.7055	0.2160	550.0884 (264)
Space and water heating			1449.4087 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Total kg/year			1725.3662 (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	4163.5202	1.2200	5079.4946 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2546.7055	1.2200	3106.9807 (264)
Space and water heating			8186.4753 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	456.7098	3.0700	1402.0992 (268)
Primary energy kWh/year			9818.8245 (272)
Primary energy kWh/m2/year			80.7137 (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	+ 1.4	-£ 111	-261 kg (15.1%)
U Solar photovoltaic panels	+ 8.0	-£ 672	-947 kg (64.7%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£111	2.15 kg/m²	B 86	B 87
Solar photovoltaic panels	£672	7.78 kg/m²	A 94	A 94
Total Savings	£783	9.93 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 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£196	£214	-£18
Mains gas	£758	£628	£129
Space heating	£537	£540	-£3
Water heating	£248	£134	£114
Lighting	£168	£168	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£954	£170	£783
Total cost of uses	£953	£170	£783
Delivered energy	60 kWh/m²	34 kWh/m²	26 kWh/m²
Carbon dioxide emissions	1.7 tonnes	0.5 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	4 kg/m²	10 kg/m²
Primary energy	81 kWh/m²	23 kWh/m²	58 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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.4816	0.4722	0.4627	0.4155	0.4061	0.3588	0.3588	0.3494	0.3777	0.4061	0.4249	0.4438 (22b)
Effective ac	0.6160	0.6115	0.6070	0.5863	0.5824	0.5644	0.5644	0.5610	0.5713	0.5824	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18249.9590 (34)
150.0202 (35)
9.0513 (36)
(33) + (36) = 96.8750 (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	63.9102	63.4430	62.9850	60.8339	60.4314	58.5579	58.5579	58.2109	59.2795	60.4314	61.2456	62.0968 (38)
Heat transfer coeff	160.7852	160.3180	159.8600	157.7089	157.3064	155.4329	155.4329	155.0860	156.1546	157.3064	158.1206	158.9718 (39)
Average = Sum(39)m / 12 =												157.7070 (39)
HLP	1.3217	1.3179	1.3141	1.2964	1.2931	1.2777	1.2777	1.2749	1.2836	1.2931	1.2998	1.3068 (40)
HLP (average)												1.2964 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	24.2538 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4539 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7851 (55)
Total storage loss	24.3384	21.9831	24.3384	23.5533	24.3384	23.5533	24.3384	24.3384	23.5533	24.3384	23.5533	24.3384 (56)
If cylinder contains dedicated solar storage	14.7311	13.3056	14.7311	14.2559	14.7311	14.2559	14.7311	14.7311	14.2559	14.7311	14.2559	14.7311 (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	204.9537	180.3412	187.2819	161.3844	151.2519	132.9351	125.7616	141.5609	148.4102	173.0026	185.6645	199.6856 (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												1.1262 (H8)
Utilisation factor												0.5885 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.3499 (H14)
Volume ratio Veff/V												1.0699 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-938.4673 (H17)
Solar input	-27.2137	-45.4118	-77.3415	-103.6529	-128.0544	-125.8979	-124.2341	-108.5439	-85.0117	-58.0530	-32.2793	-22.7732 (63)
Solar input (sum of months) = Sum(63)m =												-938.4673 (63)
Output from w/h	177.7400	134.9294	109.9404	57.7316	23.1976	7.0373	1.5275	33.0169	63.3986	114.9497	153.3851	176.9123 (64)
Total per year (kWh/year) = Sum(64)m =												1053.7664 (64)
Heat gains from water heating, kWh/month	85.9091	76.0065	79.3807	67.6920	62.0719	55.4963	53.4876	59.1759	64.0096	74.6329	78.9225	84.1574 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6520	57.4233	46.6998	35.3547	26.4281	22.3117	24.1086	31.3373	42.0608	53.4058	62.3325	66.4489 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	428.8745	433.3249	422.1101	398.2351	368.0972	339.7719	320.8488	316.3984	327.6132	351.4882	381.6261	409.9514 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863 (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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788 (71)
Water heating gains (Table 5)	115.4692	113.1049	106.6945	94.0167	83.4300	77.0782	71.8920	79.5375	88.9022	100.3130	109.6145	113.1148 (72)
Total internal gains	724.4714	719.3289	690.9801	643.0823	593.4310	554.6375	532.3250	542.7488	574.0519	620.6827	669.0488	704.9908 (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
North	1.0300	10.6334	0.4600	0.0000	0.7700	3.8793 (74)
Northeast	7.0800	11.2829	0.4600	0.0000	0.7700	28.2946 (75)
Southeast	6.5000	36.7938	0.4600	0.0000	0.7700	84.7104 (77)
Southwest	1.5000	36.7938	0.4600	0.0000	0.7700	19.5486 (79)
West	1.0300	19.6403	0.4600	0.0000	0.7700	7.1653 (80)
Southwest	6.6600	36.7938	0.4600	0.0000	0.7700	86.7956 (79)

Solar gains	230.3939	404.4617	584.7250	776.0358	915.5608	929.1343	887.3945	780.3391	650.5759	455.5191	278.1613	195.7362 (83)
Total gains	954.8653	1123.7906	1275.7051	1419.1181	1508.9918	1483.7718	1419.7195	1323.0879	1224.6278	1076.2018	947.2101	900.7270 (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	31.5292	31.6211	31.7117	32.1442	32.2265	32.6149	32.6149	32.6879	32.4642	32.2265	32.0605	31.8889
alpha	3.1019	3.1081	3.1141	3.1429	3.1484	3.1743	3.1743	3.1792	3.1643	3.1484	3.1374	3.1259
util living area	0.9735	0.9560	0.9234	0.8570	0.7471	0.5939	0.4559	0.5015	0.7092	0.8889	0.9581	0.9776 (86)
MIT	19.1048	19.3717	19.7670	20.2480	20.6350	20.8760	20.9600	20.9455	20.7722	20.2612	19.5992	19.0600 (87)
Th 2	19.8239	19.8269	19.8298	19.8436	19.8462	19.8583	19.8583	19.8606	19.8537	19.8462	19.8410	19.8355 (88)
util rest of house	0.9680	0.9470	0.9076	0.8270	0.6938	0.5102	0.3479	0.3916	0.6325	0.8588	0.9481	0.9729 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.3388	17.7237	18.2882	18.9648	19.4726	19.7619	19.8383	19.8309	19.6558	19.0016	18.0656	17.2812 (90)
Living area fraction									fLA = Living area / (4) =			0.1417 (91)
MIT	17.5891	17.9573	18.4978	19.1466	19.6373	19.9198	19.9973	19.9889	19.8140	19.1801	18.2829	17.5333 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4391	17.8073	18.3478	18.9966	19.4873	19.7698	19.8473	19.8389	19.6640	19.0301	18.1329	17.3833 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9515	0.9254	0.8813	0.8004	0.6749	0.5032	0.3468	0.3894	0.6180	0.8315	0.9269	0.9580 (94)	
Useful gains	908.5195	1039.9677	1124.2640	1135.8212	1018.4443	746.5735	492.3628	515.1969	756.8141	894.8413	877.9565	862.9065 (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	2112.5683	2069.2683	1893.9840	1592.3281	1225.0002	803.5572	504.7333	533.3204	868.8450	1326.1134	1744.5290	2095.7754 (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	895.8123	691.6900	572.6717	328.6849	153.6776	0.0000	0.0000	0.0000	0.0000	320.8665	623.9322	917.2545 (98)	
Space heating												4504.5897 (98)	
Space heating per m2												37.0291 (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													4982.9533 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	895.8123	691.6900	572.6717	328.6849	153.6776	0.0000	0.0000	0.0000	0.0000	320.8665	623.9322	917.2545 (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)	990.9428	765.1438	633.4864	363.5895	169.9973	0.0000	0.0000	0.0000	0.0000	354.9408	690.1905	1014.6620 (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	177.7400	134.9294	109.9404	57.7316	23.1976	7.0373	1.5275	33.0169	63.3986	114.9497	153.3851	176.9123 (64)	
Efficiency of water heater (217)m	88.4343	88.4614	88.4867	88.6224	88.8358	79.7000	79.7000	79.7000	79.7000	87.3084	88.0670	88.4794 (217)	
Fuel for water heating, kWh/month	200.9853	152.5290	124.2452	65.1433	26.1128	8.8297	1.9166	41.4265	79.5465	131.6594	174.1688	199.9476 (219)	
Water heating fuel used												1206.5107 (219)	
Annual totals kWh/year													
Space heating fuel - main system													4982.9533 (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)													456.7098 (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													5043.9344 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4982.9533	3.4800	173.4068 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1206.5107	3.4800	41.9866 (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	456.7098	13.1900	60.2400 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			184.2980 (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] =	0.4645 (257)
SAP value		93.5205

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

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	4982.9533	0.2160	1076.3179 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1206.5107	0.2160	260.6063 (264)
Space and water heating			1336.9242 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			742.3944 (272)
CO2 emissions per m2			6.1000 (273)
EI value			94.0306
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	61.4200 (1b)	x 2.5400 (2b)	= 156.0068 (1b) - (3b)
First floor	60.2300 (1c)	x 2.6300 (2c)	= 158.4049 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	121.6500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.4117 (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) = 0.1272 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3777 (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) =	0.3777 (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	0.3966	0.3777	0.3777	0.3494	0.3494	0.3116	0.3211	0.3022	0.3116	0.3305	0.3305	0.3588 (22b)
Effective ac	0.5786	0.5713	0.5713	0.5610	0.5610	0.5486	0.5515	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			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.1400	1.2357	21.1806		(27)
French Door (Uw = 1.30)			6.6600	1.2357	8.2300		(27)
GF B&B J150 P/A=0.60			61.4200	0.1300	7.9846	75.0000	4606.5000 (28a)
EW Brick AAC015	177.3600	25.9300	151.4300	0.2500	37.8575	52.3000	7919.7890 (29a)
Plane Ceiling	60.2300		60.2300	0.1600	9.6368	9.0000	542.0700 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			300.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.8237		(33)
GF Timber			40.9400			9.0000	368.4600 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			55.0000			39.0000	2145.0000 (32c)
Internal Floor			60.2300			18.0000	1084.1400 (32d)
Internal Ceiling			60.2300			9.0000	542.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18249.9590 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							150.0202 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0513 (36)
Total fabric heat loss						(33) + (36) =	96.8750 (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	60.0382	59.2795	59.2795	58.2109	58.2109	56.9157	57.2256	56.6150	56.9157	57.5448	57.5448	58.5579 (38)
Heat transfer coeff	156.9132	156.1546	156.1546	155.0860	155.0860	153.7907	154.1006	153.4900	153.7907	154.4198	154.4198	155.4329 (39)
Average = Sum(39)m / 12 =												154.9032 (39)
HLP	1.2899	1.2836	1.2836	1.2749	1.2749	1.2642	1.2668	1.2617	1.2642	1.2694	1.2694	1.2777 (40)
HLP (average)												1.2734 (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												2.8695 (42)
Average daily hot water use (litres/day)												102.3499 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.5849	108.4909	104.3969	100.3029	96.2089	92.1149	92.1149	96.2089	100.3029	104.3969	108.4909	112.5849 (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)	166.9602	146.0244	150.6841	131.3701	126.0527	108.7739	100.7950	115.6638	117.0451	136.4048	148.8965	161.6920 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0440	21.9037	22.6026	19.7055	18.9079	16.3161	15.1193	17.3496	17.5568	20.4607	22.3345	1610.3627 (45)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4539 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7851 (55)
Total storage loss	24.3384	21.9831	24.3384	23.5533	24.3384	23.5533	24.3384	24.3384	23.5533	24.3384	23.5533	24.3384 (56)
If cylinder contains dedicated solar storage	14.7311	13.3056	14.7311	14.2559	14.7311	14.2559	14.7311	14.7311	14.2559	14.7311	14.2559	14.7311 (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	204.9537	180.3412	187.2819	161.3844	151.2519	132.9351	125.7616	141.5609	148.4102	173.0026	185.6645	199.6856 (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												1.1894 (H8)
Utilisation factor												0.5686 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.3499 (H14)
Volume ratio Veff/V												1.0699 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-957.6479 (H17)
Solar input	-29.4759	-44.3023	-74.6106	-103.1347	-124.2089	-130.7244	-127.5855	-113.9346	-88.9264	-60.4949	-35.8288	-24.4210 (63)
Solar input (sum of months) = Sum(63)m =												-957.6479 (63)
Output from w/h	175.4778	136.0389	112.6713	58.2497	27.0431	2.2107	0.0000	27.6263	59.4839	112.5077	149.8357	175.2646 (64)
Total per year (kWh/year) = Sum(64)m =												1036.4097 (64)
Heat gains from water heating, kWh/month	85.9091	76.0065	79.3807	67.6920	62.0719	55.4963	53.4876	59.1759	64.0096	74.6329	78.9225	84.1574 (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	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	172.1682	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6520	57.4233	46.6998	35.3547	26.4281	22.3117	24.1086	31.3373	42.0608	53.4058	62.3325	66.4489	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	428.8745	433.3249	422.1101	398.2351	368.0972	339.7719	320.8488	316.3984	327.6132	351.4882	381.6261	409.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	55.0863	(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)	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	-114.7788	(71)
Water heating gains (Table 5)	115.4692	113.1049	106.6945	94.0167	83.4300	77.0782	71.8920	79.5375	88.9022	100.3130	109.6145	113.1148	(72)
Total internal gains	724.4714	719.3289	690.9801	643.0823	593.4310	554.6375	532.3250	542.7488	574.0519	620.6827	669.0488	704.9908	(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	
North	1.0300	11.9814	0.4600	0.0000	0.7700	4.3711 (74)	
Northeast	7.0800	12.9236	0.4600	0.0000	0.7700	32.4089 (75)	
Southeast	6.5000	40.4699	0.4600	0.0000	0.7700	93.1739 (77)	
Southwest	1.5000	40.4699	0.4600	0.0000	0.7700	21.5017 (79)	
West	1.0300	22.3313	0.4600	0.0000	0.7700	8.1470 (80)	
Southwest	6.6600	40.4699	0.4600	0.0000	0.7700	95.4674 (79)	

Solar gains	255.0700	403.6039	578.6509	795.7993	918.3445	998.8370	943.0714	845.4970	699.3654	485.9380	315.6126	214.5420 (83)
Total gains	979.5414	1122.9328	1269.6310	1438.8816	1511.7755	1553.4745	1475.3964	1388.2458	1273.4173	1106.6207	984.6614	919.5328 (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	32.3072	32.4642	32.4642	32.6879	32.6879	32.9632	32.8969	33.0278	32.9632	32.8289	32.8289	32.6149	
alpha	3.1538	3.1643	3.1643	3.1792	3.1792	3.1975	3.1931	3.2019	3.1975	3.1886	3.1886	3.1743	
util living area	0.9675	0.9500	0.9105	0.8240	0.6810	0.4672	0.3178	0.3455	0.6138	0.8527	0.9446	0.9723 (86)	
MIT	19.3160	19.5414	19.9451	20.4145	20.7693	20.9526	20.9903	20.9873	20.8791	20.4442	19.8213	19.2779 (87)	
Th 2	19.8488	19.8537	19.8537	19.8606	19.8606	19.8690	19.8670	19.8709	19.8690	19.8649	19.8649	19.8583 (88)	
util rest of house	0.9606	0.9396	0.8916	0.7870	0.6151	0.3718	0.2044	0.2274	0.5206	0.8125	0.9310	0.9664 (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	17.6595	17.9846	18.5560	19.2007	19.6461	19.8411	19.8645	19.8674	19.7805	19.2604	18.3979	17.6111 (90)
Living area fraction									fLA = Living area / (4) =			0.1417 (91)
MIT	17.8943	18.2052	18.7529	19.3727	19.8053	19.9986	20.0240	20.0261	19.9362	19.4282	18.5996	17.8473 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7443	18.0552	18.6029	19.2227	19.6553	19.8486	19.8740	19.8761	19.7862	19.2782	18.4496	17.6973 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9423	0.9173	0.8650	0.7625	0.6020	0.3700	0.2051	0.2280	0.5131	0.7868	0.9076	0.9497 (94)
Useful gains	922.9864	1030.0418	1098.2450	1097.2142	910.0400	574.8383	302.6382	316.4541	653.3935	870.7170	893.7212	873.2847 (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												
	1984.0537	1944.9402	1749.3806	1445.8227	1032.1369	591.8818	304.2005	318.6650	705.3190	1185.6676	1613.6242	1958.0337 (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												
	789.4340	614.8117	484.4449	250.9981	90.8400	0.0000	0.0000	0.0000	0.0000	234.3232	518.3301	807.0532 (98)
Space heating												3790.2353 (98)
Space heating per m2											(98) / (4) =	31.1569 (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													4192.7382 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	789.4340	614.8117	484.4449	250.9981	90.8400	0.0000	0.0000	0.0000	0.0000	234.3232	518.3301	807.0532 (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	873.2677	680.1014	535.8903	277.6528	100.4868	0.0000	0.0000	0.0000	0.0000	259.2071	573.3740	892.7580 (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	175.4778	136.0389	112.6713	58.2497	27.0431	2.2107	0.0000	27.6263	59.4839	112.5077	149.8357	175.2646 (64)	
Efficiency of water heater (217)m	88.2455	88.2533	88.1665	88.1704	87.6990	79.7000	79.7000	79.7000	79.7000	86.6274	87.7579	79.7000 (216)	
Fuel for water heating, kWh/month	198.8519	154.1459	127.7938	66.0650	30.8363	2.7738	0.0000	34.6628	74.6347	129.8755	170.7375	198.5207 (219)	
Water heating fuel used												1188.8979 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4192.7382 (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)													456.7098 (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												4139.1863 (238)	

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4192.7382	9.7400	408.3727 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1188.8979	9.7400	115.7987 (247)	
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)	
Pump for solar water heating	50.0000	36.8500	18.4250 (249)	
Energy for lighting	456.7098	36.8500	168.2976 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028 (252)	
Total energy cost			170.3286 (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	4192.7382	0.2160	905.6314 (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)	1188.8979	0.2160	256.8019 (264)
Space and water heating			1162.4334 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	456.7098	0.5190	237.0324 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			517.6019 (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	4192.7382	1.2200	5115.1406 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1188.8979	1.2200	1450.4554 (264)
Space and water heating			6565.5960 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	456.7098	3.0700	1402.0992 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2751.2751 (272)
Primary energy kWh/m2/year			22.6163 (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	150.0 (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	415.02 (P1)
Transmission heat loss coefficient	96.88 (37)
Summer heat loss coefficient	511.90 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	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)
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)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0300	81.1852	0.4600	0.0000	0.9000	34.6190
North East	7.0800	98.8453	0.4600	0.0000	0.9000	289.7273
South East	6.5000	119.9223	0.4600	0.0000	0.9000	322.7110
South West	1.5000	119.9223	0.4600	0.0000	0.9000	74.4718
West	1.0300	117.5071	0.4600	0.0000	0.9000	50.1074
South West	6.6600	119.9223	0.4600	0.0000	0.9000	330.6547
total:						1102.2912

	Jun	Jul	Aug	
Solar gains	1167	1102	988	(P4)
Internal gains	574	552	561	
Total summer gains	1742	1654	1549	(P5)
Summer gain/loss ratio	3.40	3.23	3.03	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 150.0)	0.95	0.95	0.95	
Threshold temperature	20.35	22.08	21.78	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Assessment of likelihood of high internal temperature: Medium