

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-595				Issued on Date	22/03/2023
Assessment Reference	Plot 595	Prop Type Ref	4B-As-SEMI			
Property	Plot 595, 4 Bed, K, WC, Ut, B, En, Staggered					
SAP Rating	85 B	DER	15.32	TER	16.98	
Environmental	87 B	% DER<TER	9.77			
CO ₂ Emissions (t/year)	1.43	DFEE	45.76	TFEE	53.89	
General Requirements Compliance	Pass	% DFEE<TFEE	15.07			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 112 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.98 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.32 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.8 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	0.12 (max. 0.25)	0.12 (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 COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 5.99 m², No overhang
Windows facing South: 6.14 m², No overhang
Windows facing West: 8.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) =	0.1037 (8)	
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3542 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3276 (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	0.4177	0.4095	0.4013	0.3604	0.3522	0.3112	0.3112	0.3030	0.3276	0.3522	0.3685	0.3849	(22b)				
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5537	0.5620	0.5679	0.5741	(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)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss							(33) + (36) = 76.6143 (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	56.0848	55.7613	55.4442	53.9548	53.6762	52.3789	52.3789	52.1387	52.8786	53.6762	54.2399	54.8292 (38)
Heat transfer coeff	132.6991	132.3756	132.0585	130.5691	130.2905	128.9932	128.9932	128.7530	129.4929	130.2905	130.8542	131.4435 (39)
Average = Sum(39)m / 12 =												130.5678 (39)
HLP	1.1852	1.1823	1.1795	1.1662	1.1637	1.1521	1.1521	1.1500	1.1566	1.1637	1.1688	1.1740 (40)
HLP (average)												1.1662 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)										Total =	Sum(45)m =	1594.1535 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month												
	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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												
	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum(64)m =			1759.8765 (64)
	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (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	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	24.8721	22.0912	17.9658	13.6012	10.1671	8.5835	9.2748	12.0557	16.1811	20.5456	23.9798	25.5634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	274.3424	277.1893	270.0154	254.7430	235.4644	217.3453	205.2405	202.3937	209.5676	224.8400	244.1186	262.2377 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305 (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)												
	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437 (71)
Water heating gains (Table 5)												
	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858 (72)
Total internal gains												
	446.2266	443.9478	427.7795	401.5225	374.5082	348.7512	332.1953	338.7221	352.3665	378.8553	409.3042	432.4783 (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			5.9900		10.6334		0.4600		0.0000		0.7700		22.5604 (74)
South			2.8100		46.7521		0.4600		0.0000		0.7700		46.5324 (78)
West			8.6000		19.6403		0.4600		0.0000		0.7700		59.8266 (80)
South			3.3300		46.7521		0.4600		0.0000		0.7700		55.1434 (78)
Solar gains	184.0629	326.6665	478.1144	638.5093	752.8354	762.7705	729.0792	642.2178	533.8253	369.7980	222.9485		155.8632 (83)
Total gains	630.2895	770.6143	905.8939	1040.0319	1127.3437	1111.5217	1061.2745	980.9399	886.1918	748.6533	632.2526		588.3415 (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	34.2457	34.3294	34.4118	34.8044	34.8788	35.2296	35.2296	35.2953	35.0936	34.8788	34.7286	34.5728
alpha	3.2830	3.2886	3.2941	3.3203	3.3253	3.3486	3.3486	3.3530	3.3396	3.3253	3.3152	3.3049
util living area	0.9884	0.9772	0.9534	0.8980	0.7957	0.6455	0.5021	0.5542	0.7727	0.9326	0.9802	0.9907 (86)
MIT	19.0289	19.2934	19.6973	20.1966	20.6084	20.8650	20.9566	20.9393	20.7397	20.1826	19.5096	18.9828 (87)
Th 2	19.9318	19.9341	19.9364	19.9471	19.9491	19.9585	19.9585	19.9602	19.9549	19.9491	19.9451	19.9408 (88)
util rest of house	0.9860	0.9725	0.9434	0.8755	0.7501	0.5670	0.3959	0.4471	0.7063	0.9130	0.9752	0.9887 (89)
MIT 2	17.2988	17.6838	18.2670	18.9784	19.5315	19.8470	19.9347	19.9240	19.7134	18.9747	18.0078	17.2373 (90)
Living area fraction									fLA =	Living area / (4) =		0.1697 (91)
MIT	17.5924	17.9570	18.5097	19.1851	19.7142	20.0197	20.1081	20.0963	19.8876	19.1797	18.2627	17.5335 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4424	17.8070	18.3597	19.0351	19.5642	19.8697	19.9581	19.9463	19.7376	19.0297	18.1127	17.3835 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9771	0.9586	0.9232	0.8513	0.7308	0.5597	0.3959	0.4456	0.6902	0.8900	0.9624	0.9812 (94)
Useful gains	615.8605	738.7198	836.3544	885.3396	823.8818	622.0843	420.1519	437.1113	611.6493	666.3239	608.4577	577.2951 (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												
	1743.9879	1708.5706	1566.1767	1323.3312	1024.6325	679.7597	433.1712	456.6007	730.0232	1098.3117	1441.0571	1732.8870 (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												
	839.3268	651.7397	542.9878	315.3539	149.3585	0.0000	0.0000	0.0000	0.0000	321.3989	599.4716	859.7604 (98)
Space heating												4279.3977 (98)
Space heating per m ²												(98) / (4) = 38.2226 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4728.6163 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	839.3268	651.7397	542.9878	315.3539	149.3585	0.0000	0.0000	0.0000	0.0000	321.3989	599.4716	859.7604	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	927.4329	720.1544	599.9865	348.4574	165.0371	0.0000	0.0000	0.0000	0.0000	355.1370	662.3996	950.0115	(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	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052	(64)
Efficiency of water heater (217)m	89.9195	89.8595	89.7395	89.4735	88.9297	87.3000	87.3000	87.3000	87.3000	89.4608	89.8029	89.9445	(216)
Fuel for water heating, kWh/month	199.5484	175.0809	181.9510	160.5732	156.1072	138.8631	130.3040	147.2140	148.2886	166.6792	179.3532	193.6807	(219)
Water heating fuel used												1977.6435	(219)
Annual totals kWh/year													
Space heating fuel - main system												4728.6163	(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)												439.2492	(232)
Total delivered energy for all uses												7220.5090	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4728.6163	0.2160	1021.3811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.6435	0.2160	427.1710 (264)
Space and water heating			1448.5521 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.2492	0.5190	227.9703 (268)
Total CO ₂ , kg/year			1715.4475 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3200 (273)

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

DER		15.3200	ZC1
Total Floor Area	TFA	111.9600	
Assumed number of occupants	N	2.8261	
CO ₂ emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO ₂ emissions from appliances, equation (L14)		14.5203	ZC2
CO ₂ emissions from cooking, equation (L16)		1.6687	ZC3
Total CO ₂ emissions		31.5090	ZC4
Residual CO ₂ emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO ₂ emissions		31.5090	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (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) =	0.1382 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3882 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3591 (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	0.4578	0.4489	0.4399	0.3950	0.3860	0.3411	0.3411	0.3322	0.3591	0.3860	0.4040	0.4219 (22b)					
Effective ac	0.6048	0.6007	0.5968	0.5780	0.5745	0.5582	0.5582	0.5552	0.5645	0.5745	0.5816	0.5890 (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)			20.7300	1.3258	27.4830		(27)					
GF B&B J150 P/A=0.40			55.9800	0.1300	7.2774		(28a)					
EW Brick AAC015	115.9600	22.8600	93.1000	0.1800	16.7580		(29a)					
Plane Ceiling	55.9800		55.9800	0.1300	7.2774		(30)					
Total net area of external elements Aum(A, m2)			227.9200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		60.9258		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1297 (36)					
Total fabric heat loss						(33) + (36) =	74.0555 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.7639	Feb 57.3752	Mar 56.9942	Apr 55.2046	May 54.8698	Jun 53.3111	Jul 53.3111	Aug 53.0225	Sep 53.9115	Oct 54.8698	Nov 55.5471	Dec 56.2553 (38)
Heat transfer coeff	131.8194	131.4307	131.0497	129.2601	128.9252	127.3666	127.3666	127.0779	127.9669	128.9252	129.6026	130.3107 (39)
Average = Sum(39)m / 12 =												129.2585 (39)
HLP	Jan 1.1774	Feb 1.1739	Mar 1.1705	Apr 1.1545	May 1.1515	Jun 1.1376	Jul 1.1376	Aug 1.1350	Sep 1.1430	Oct 1.1515	Nov 1.1576	Dec 1.1639 (40)
HLP (average)												1.1545 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
Daily hot water use	Jan 111.4517	Feb 107.3989	Mar 103.3461	Apr 99.2933	May 95.2405	Jun 91.1877	Jul 91.1877	Aug 95.2405	Sep 99.2933	Oct 103.3461	Nov 107.3989	Dec 111.4517 (44)
Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)										Total = Sum(45)m =		1594.1535 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.9666	48.5335	44.9693	46.4683	48.5335	48.9666	50.9589	49.3151	50.9589 (61)
Solar input	216.2385	190.5820	200.1263	179.0143	173.3174	152.6483	146.2487	163.0331	164.8336	185.9907	196.7129	211.0234 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	216.2385	190.5820	200.1263	179.0143	173.3174	152.6483	146.2487	163.0331	164.8336	185.9907	196.7129	211.0234 (64)
Heat gains from water heating, kWh/month	67.6952	59.5713	62.3379	55.4825	53.6240	47.0456	44.7941	50.2045	50.7674	57.6378	61.3385	65.9612 (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	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8721	22.0912	17.9658	13.6012	10.1671	8.5835	9.2748	12.0557	16.1811	20.5456	23.9798	25.5634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.3424	277.1893	270.0154	254.7430	235.4644	217.3453	205.2405	202.3937	209.5676	224.8400	244.1186	262.2377	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	(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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	(71)
Water heating gains (Table 5)	90.9882	88.6477	83.7875	77.0591	72.0753	65.3411	60.2071	67.4791	70.5103	77.4702	85.1924	88.6575	(72)
Total internal gains	458.5941	456.3195	440.1600	413.7947	386.0982	359.6612	343.1138	350.3199	364.6504	391.2472	421.6822	444.8500	(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			5.9900	10.6334	0.6300	0.7000	0.7700	19.4657 (74)				
South			6.1400	46.7521	0.6300	0.7000	0.7700	87.7286 (78)				
West			8.6000	19.6403	0.6300	0.7000	0.7700	51.6200 (80)				
Solar gains	158.8142	281.8563	412.5296	550.9225	649.5660	658.1383	629.0685	554.1223	460.5984	319.0714	192.3657	134.4829 (83)
Total gains	617.4083	738.1759	852.6896	964.7172	1035.6642	1017.7995	972.1823	904.4422	825.2488	710.3185	614.0479	579.3329 (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	58.9822	59.1567	59.3286	60.1501	60.3063	61.0443	61.0443	61.1829	60.7579	60.3063	59.9911	59.6651	
alpha	4.9321	4.9438	4.9552	5.0100	5.0204	5.0696	5.0696	5.0789	5.0505	5.0204	4.9994	4.9777	
util living area	0.9986	0.9964	0.9895	0.9640	0.8885	0.7310	0.5609	0.6195	0.8616	0.9802	0.9970	0.9990 (86)	
MIT	19.6772	19.8470	20.1171	20.4685	20.7662	20.9402	20.9873	20.9796	20.8556	20.4595	20.0038	19.6525 (87)	
Th 2	19.9381	19.9409	19.9437	19.9566	19.9590	19.9702	19.9702	19.9723	19.9659	19.9590	19.9541	19.9490 (88)	
util rest of house	0.9982	0.9952	0.9857	0.9499	0.8452	0.6397	0.4376	0.4943	0.7928	0.9700	0.9957	0.9987 (89)	
MIT 2	18.1715	18.4214	18.8159	19.3271	19.7263	19.9298	19.9655	19.9638	19.8473	19.3232	18.6603	18.1430 (90)	
Living area fraction	18.4270	18.6633	19.0367	19.5208	19.9028	20.1013	20.1389	20.1362	20.0184	19.5160	18.8883	18.3992 (92)	
MIT	18.4270	18.6633	19.0367	19.5208	19.9028	20.1013	20.1389	20.1362	20.0184	19.5160	18.8883	18.3992 (93)	
Temperature adjustment												0.0000	
adjusted MIT	18.4270	18.6633	19.0367	19.5208	19.9028	20.1013	20.1389	20.1362	20.0184	19.5160	18.8883	18.3992 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9929	0.9810	0.9423	0.8425	0.6524	0.4585	0.5153	0.7969	0.9639	0.9937	0.9979 (94)
Useful gains	615.6238	732.9504	836.4580	909.0696	872.5407	663.9793	445.7850	466.0671	657.6792	684.6936	610.1778	578.1028 (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	1862.2112	1808.9191	1642.9364	1372.8447	1057.5493	700.6756	450.7412	474.7863	757.3653	1149.5039	1527.7918	1850.3019 (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	927.4610	723.0510	600.0199	333.9180	137.6464	0.0000	0.0000	0.0000	0.0000	345.8189	660.6821	946.5161 (98)
Space heating												4675.1136 (98)
Space heating per m2												41.7570 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5005.4749 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	927.4610	723.0510	600.0199	333.9180	137.6464	0.0000	0.0000	0.0000	0.0000	345.8189	660.6821	946.5161 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	992.9990	774.1445	642.4196	357.5140	147.3730	0.0000	0.0000	0.0000	0.0000	370.2558	707.3684	1013.4006 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	216.2385	190.5820	200.1263	179.0143	173.3174	152.6483	146.2487	163.0331	164.8336	185.9907	196.7129	211.0234 (64)
Efficiency of water heater (217)m	88.3001	88.0888	87.6429	86.5986	84.4778	80.3000	80.3000	80.3000	80.3000	86.5910	87.8645	80.3000 (216)
Fuel for water heating, kWh/month	244.8903	216.3521	228.3429	206.7174	205.1632	190.0975	182.1279	203.0300	205.2722	214.7923	223.8822	238.7855 (219)
Water heating fuel used												2559.4537 (219)
Annual totals kWh/year												
Space heating fuel - main system												5005.4749 (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)												439.2492 (232)
Total delivered energy for all uses												8079.1778 (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	5005.4749	0.2160	1081.1826 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2559.4537	0.2160	552.8420 (264)
Space and water heating			1634.0246 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.2492	0.5190	227.9703 (268)
Total CO2, kg/m2/year			1900.9199 (272)
Emissions per m2 for space and water heating			14.5947 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0362 (272b)
Emissions per m2 for pumps and fans			0.3477 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5947 * 1.00) + 2.0362 + 0.3477, rounded to 2 d.p.			16.9800 (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	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (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) = 0.1382 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3887 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3596 (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	0.4584	0.4494	0.4405	0.3955	0.3865	0.3416	0.3416	0.3326	0.3596	0.3865	0.4045	0.4225 (22b)
Effective ac	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Window (Uw = 1.30)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss						(33) + (36) =	76.6143 (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	57.7897	57.4000	57.0180	55.2238	54.8881	53.3254	53.3254	53.0360	53.9274	54.8881	55.5672	56.2772 (38)
Heat transfer coeff	134.4040	134.0143	133.6323	131.8381	131.5024	129.9397	129.9397	129.6503	130.5417	131.5024	132.1815	132.8915 (39)
Average = Sum(39)m / 12 =												131.8365 (39)
HLP	1.2005	1.1970	1.1936	1.1775	1.1745	1.1606	1.1606	1.1580	1.1660	1.1745	1.1806	1.1870 (40)
HLP (average)												1.1775 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)	Total = Sum (45)m = 1594.1535 (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	35.1219	30.7179	31.6981	27.6351	26.5166	22.8818	21.2033	24.3312	24.6217	28.6943	31.3220	34.0137 (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	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8721	22.0912	17.9658	13.6012	10.1671	8.5835	9.2748	12.0557	16.1811	20.5456	23.9798	25.5634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.3424	277.1893	270.0154	254.7430	235.4644	217.3453	205.2405	202.3937	209.5676	224.8400	244.1186	262.2377 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305 (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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437 (71)
Water heating gains (Table 5)	47.2069	45.7111	42.6049	38.3822	35.6406	31.7803	28.4991	32.7032	34.1969	38.5676	43.5028	45.7173 (72)
Total internal gains	411.8128	410.3829	395.9775	372.1178	346.6635	323.1004	308.4058	312.5440	325.3370	349.3445	376.9926	398.9098 (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				5.9900	10.6334	0.4600	0.0000	0.7700	22.5604 (74)			
South				2.8100	46.7521	0.4600	0.0000	0.7700	46.5324 (78)			
West				8.6000	19.6403	0.4600	0.0000	0.7700	59.8266 (80)			
South				3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)			
Solar gains	184.0629	326.6665	478.1144	638.5093	752.8354	762.7705	729.0792	642.2178	533.8253	369.7980	222.9485	155.8632 (83)
Total gains	595.8757	737.0494	874.0919	1010.6271	1099.4989	1085.8709	1037.4850	954.7618	859.1623	719.1426	599.9410	554.7731 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.8113	33.9096	34.0066	34.4694	34.5574	34.9730	34.9730	35.0510	34.8117	34.5574	34.3798	34.1962
alpha	3.2541	3.2606	3.2671	3.2980	3.3038	3.3315	3.3315	3.3367	3.3208	3.3038	3.2920	3.2797
util living area	0.9902	0.9800	0.9579	0.9054	0.8067	0.6582	0.5143	0.5686	0.7864	0.9395	0.9829	0.9922 (86)
MIT	18.9611	19.2296	19.6415	20.1565	20.5831	20.8544	20.9525	20.9333	20.7200	20.1413	19.4544	18.9196 (87)
Th 2	19.9196	19.9224	19.9251	19.9380	19.9404	19.9517	19.9517	19.9537	19.9473	19.9404	19.9355	19.9305 (88)
util rest of house	0.9881	0.9757	0.9487	0.8840	0.7620	0.5794	0.4059	0.4596	0.7212	0.9215	0.9787	0.9905 (89)
MIT 2	18.0581	18.3263	18.7340	19.2414	19.6354	19.8691	19.9338	19.9265	19.7686	19.2385	18.5610	18.0247 (90)
Living area fraction	fLA = Living area / (4) = 0.1697 (91)											
MIT	18.2114	18.4796	18.8880	19.3967	19.7963	20.0363	20.1067	20.0973	19.9301	19.3917	18.7126	18.1765 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2114	18.4796	18.8880	19.3967	19.7963	20.0363	20.1067	20.0973	19.9301	19.3917	18.7126	18.1765 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9834	0.9681	0.9373	0.8709	0.7551	0.5863	0.4228	0.4757	0.7200	0.9095	0.9719	0.9866 (94)
Ext temp.	585.9721	713.5310	819.2926	880.1630	830.2830	636.6274	438.6947	454.1347	618.5889	654.0799	583.0561	547.3369 (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	1869.7463	1819.8558	1655.4396	1383.8635	1064.6769	706.3946	455.6544	479.3587	761.0677	1156.1334	1534.9755	1857.3631 (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	955.1280	743.4503	622.0933	362.6644	174.3890	0.0000	0.0000	0.0000	0.0000	373.5278	685.3820	974.6595 (98)
Space heating per m2	(98) / (4) = 43.6879 (99)											

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1221.4335	961.5540	985.3426	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8138	0.8737	0.8456	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	993.9938	840.1213	833.2144	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1380.4893	1321.4902	1226.8713	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	278.2768	358.1384	292.8807	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												929.2960	(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	69.5692	89.5346	73.2202	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												232.3240	(107)
Space cooling per m2												2.0751	(108)
Energy for space heating												43.6879	(99)
Energy for space cooling												2.0751	(108)
Total												45.7629	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.8	(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	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (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) =	0.1382 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3882 (18)		
Number of sides sheltered												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3591 (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	0.4578	0.4489	0.4399	0.3950	0.3860	0.3411	0.3411	0.3322	0.3591	0.3860	0.4040	0.4219 (22b)		
Effective ac	0.6048	0.6007	0.5968	0.5780	0.5745	0.5582	0.5582	0.5552	0.5645	0.5745	0.5816	0.5890 (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)			20.7300	1.3258	27.4830		(27)					
GF B&B J150 P/A=0.40			55.9800	0.1300	7.2774		(28a)					
EW Brick AAC015	115.9600	22.8600	93.1000	0.1800	16.7580		(29a)					
Plane Ceiling	55.9800		55.9800	0.1300	7.2774		(30)					
Total net area of external elements Aum(A, m2)			227.9200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		60.9258		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1297 (36)					
Total fabric heat loss						(33) + (36) =	74.0555 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.7639	Feb 57.3752	Mar 56.9942	Apr 55.2046	May 54.8698	Jun 53.3111	Jul 53.3111	Aug 53.0225	Sep 53.9115	Oct 54.8698	Nov 55.5471	Dec 56.2553 (38)
Heat transfer coeff	131.8194	131.4307	131.0497	129.2601	128.9252	127.3666	127.3666	127.0779	127.9669	128.9252	129.6026	130.3107 (39)
Average = Sum(39)m / 12 =												129.2585 (39)
HLP	Jan 1.1774	Feb 1.1739	Mar 1.1705	Apr 1.1545	May 1.1515	Jun 1.1376	Jul 1.1376	Aug 1.1350	Sep 1.1430	Oct 1.1515	Nov 1.1576	Dec 1.1639 (40)
HLP (average)												1.1545 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
Daily hot water use	Jan 111.4517	Feb 107.3989	Mar 103.3461	Apr 99.2933	May 95.2405	Jun 91.1877	Jul 91.1877	Aug 95.2405	Sep 99.2933	Oct 103.3461	Nov 107.3989	Dec 111.4517 (44)
Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)										Total = Sum(45)m =		1594.1535 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.1219	30.7179	31.6981	27.6351	26.5166	22.8818	21.2033	24.3312	24.6217	28.6943	31.3220	34.0137 (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	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	141.3046	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8721	22.0912	17.9658	13.6012	10.1671	8.5835	9.2748	12.0557	16.1811	20.5456	23.9798	25.5634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.3424	277.1893	270.0154	254.7430	235.4644	217.3453	205.2405	202.3937	209.5676	224.8400	244.1186	262.2377	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	37.1305	(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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	(71)
Water heating gains (Table 5)	47.2069	45.7111	42.6049	38.3822	35.6406	31.7803	28.4991	32.7032	34.1969	38.5676	43.5028	45.7173	(72)
Total internal gains	411.8128	410.3829	395.9775	372.1178	346.6635	323.1004	308.4058	312.5440	325.3370	349.3445	376.9926	398.9098	(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	5.9900	10.6334	0.6300	0.7000	0.7700	19.4657 (74)
South	6.1400	46.7521	0.6300	0.7000	0.7700	87.7286 (78)
West	8.6000	19.6403	0.6300	0.7000	0.7700	51.6200 (80)

Solar gains	158.8142	281.8563	412.5296	550.9225	649.5660	658.1383	629.0685	554.1223	460.5984	319.0714	192.3657	134.4829	(83)
Total gains	570.6271	692.2393	808.5070	923.0403	996.2295	981.2387	937.4744	866.6662	785.9354	668.4159	569.3583	533.3927	(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	58.9822	59.1567	59.3286	60.1501	60.3063	61.0443	61.0443	61.1829	60.7579	60.3063	59.9911	59.6651	
alpha	4.9321	4.9438	4.9552	5.0100	5.0204	5.0696	5.0696	5.0789	5.0505	5.0204	4.9994	4.9777	
util living area	0.9990	0.9973	0.9916	0.9695	0.9007	0.7494	0.5793	0.6418	0.8793	0.9845	0.9978	0.9993	(86)
MIT	19.6384	19.8093	20.0820	20.4392	20.7470	20.9329	20.9854	20.9762	20.8388	20.4275	19.9669	19.6142	(87)
Th 2	19.9381	19.9409	19.9437	19.9566	19.9590	19.9702	19.9702	19.9723	19.9659	19.9590	19.9541	19.9490	(88)
util rest of house	0.9987	0.9964	0.9885	0.9573	0.8604	0.6589	0.4531	0.5143	0.8150	0.9763	0.9969	0.9991	(89)
MIT 2	18.6932	18.8659	19.1392	19.4993	19.7848	19.9388	19.9665	19.9654	19.8734	19.4944	19.0341	18.6777	(90)
Living area fraction									fLA = Living area / (4) =				0.1697 (91)
MIT	18.8536	19.0260	19.2992	19.6588	19.9481	20.1075	20.1394	20.1369	20.0372	19.6527	19.1923	18.8366	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8536	19.0260	19.2992	19.6588	19.9481	20.1075	20.1394	20.1369	20.0372	19.6527	19.1923	18.8366	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9952	0.9859	0.9528	0.8599	0.6721	0.4747	0.5360	0.8203	0.9730	0.9960	0.9987	(94)
Ext temp.	569.6129	688.9230	797.1001	879.5155	856.6248	659.5181	445.0140	464.4992	644.6850	650.3898	567.0574	532.7162	(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	1918.4484	1856.5929	1677.3319	1390.6835	1063.3898	701.4679	450.8001	474.8790	759.7693	1167.1247	1567.1999	1907.3127	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1003.5336	784.6742	654.8925	368.0410	153.8331	0.0000	0.0000	0.0000	0.0000	384.4508	720.1026	1022.6998	(98)
Space heating												5092.2276	(98)
Space heating per m2										(98) / (4) =		45.4826	(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	1197.2457	942.5126	965.7922	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8553	0.9190	0.8918	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1023.9593	866.1803	861.3189	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1258.1919	1204.5946	1123.9024	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	168.6475	251.7802	195.3622	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												615.7899	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.1619	62.9451	48.8405	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												153.9475 (107)
Space cooling per m2												1.3750 (108)
Energy for space heating												45.4826 (99)
Energy for space cooling												1.3750 (108)
Total												46.8576 (109)
Target Fabric Energy Efficiency (TFEE)												53.9 (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	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1037 (8)	
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3542 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3276 (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	0.3440	0.3276	0.3276	0.3030	0.3030	0.2703	0.2785	0.2621	0.2703	0.2866	0.2866	0.3112	(22b)				
Effective ac	0.5592	0.5537	0.5537	0.5459	0.5459	0.5365	0.5388	0.5343	0.5365	0.5411	0.5411	0.5484	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1300	1.3000	2.7690			(26)
Window (Uw = 1.30)			17.4000	1.2357	21.5019			(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150			(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000	(28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300	(29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200	(30)
Total net area of external elements Aum(A, m2)			227.9200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353			(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500	(32)
GF Timber			32.9000			9.0000	296.1000	(32c)
1F Timber			98.0000			9.0000	882.0000	(32c)
GF Masonry			47.0000			39.0000	1833.0000	(32c)
Internal Floor			55.9800			18.0000	1007.6400	(32d)
Internal Ceiling			55.9800			9.0000	503.8200	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.1215	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790	(36)
Total fabric heat loss						(33) + (36) =	76.6143	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
Daily hot water use	Jan 111.4517	Feb 107.3989	Mar 103.3461	Apr 99.2933	May 95.2405	Jun 91.1877	Jul 91.1877	Aug 95.2405	Sep 99.2933	Oct 103.3461	Nov 107.3989	Dec 111.4517 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (64)
RHI water heating demand	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (65)
Heat gains from water heating, kWh/month												
	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.1803	55.2280	44.9144	34.0031	25.4177	21.4587	23.1869	30.1392	40.4528	51.3641	59.9494	63.9085 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.4663	413.7153	403.0080	380.2135	351.4394	324.3959	306.3292	302.0802	312.7875	335.5820	364.3561	391.3996 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827 (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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437 (71)
Water heating gains (Table 5)	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858 (72)
Total internal gains	664.5718	659.5238	633.6339	593.3080	551.6470	514.5902	493.1092	502.4052	525.7711	566.3289	611.4245	645.8983 (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				5.9900	11.9814	0.4600	0.0000			0.7700	25.4205 (74)	
South				2.8100	50.9848	0.4600	0.0000			0.7700	50.7453 (78)	
West				8.6000	22.3313	0.4600	0.0000			0.7700	68.0239 (80)	
South				3.3300	50.9848	0.4600	0.0000			0.7700	60.1359 (78)	

Solar gains	204.3256	326.7711	473.8901	654.9262	754.6494	819.2638	774.2121	695.7168	574.4591	395.3565	253.6371	171.3012 (83)
Total gains	868.8973	986.2948	1107.5240	1248.2342	1306.2964	1333.8541	1267.3212	1198.1220	1100.2303	961.6854	865.0616	817.1996 (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	34.9519	35.0936	35.0936	35.2953	35.2953	35.5429	35.4833	35.6009	35.5429	35.4222	35.4222	35.2296
alpha	3.3301	3.3396	3.3396	3.3530	3.3530	3.3695	3.3656	3.3734	3.3695	3.3615	3.3615	3.3486
util living area	0.9669	0.9495	0.9090	0.8194	0.6719	0.4575	0.3089	0.3349	0.6032	0.8491	0.9438	0.9719 (86)
MIT	19.4718	19.6811	20.0593	20.4924	20.8097	20.9636	20.9931	20.9910	20.9025	20.5131	19.9354	19.4310 (87)
Th 2	19.9511	19.9549	19.9549	19.9602	19.9602	19.9667	19.9651	19.9682	19.9667	19.9635	19.9635	19.9585 (88)
util rest of house	0.9602	0.9396	0.8909	0.7843	0.6105	0.3710	0.2078	0.2297	0.5174	0.8110	0.9308	0.9661 (89)
MIT 2	17.9510	18.2525	18.7878	19.3816	19.7797	19.9442	19.9632	19.9654	19.8930	19.4267	18.6272	17.8975 (90)
Living area fraction									fLA = Living area / (4) =			0.1697 (91)
MIT	18.2091	18.4949	19.0036	19.5701	19.9545	20.1172	20.1380	20.1395	20.0643	19.6111	18.8492	18.1578 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0591	18.3449	18.8536	19.4201	19.8045	19.9672	19.9880	19.9895	19.9143	19.4611	18.6992	18.0078 (93)

8. Space heating requirement

Utilisation	0.9434	0.9192	0.8671	0.7632	0.6005	0.3711	0.2101	0.2319	0.5127	0.7887	0.9096	0.9508 (94)
Useful gains	819.7242	906.6444	960.3001	952.6782	784.3954	494.9579	266.2827	277.8972	564.0889	758.4700	786.8568	776.9924 (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	1684.9138	1650.3803	1483.1544	1225.7378	876.1000	507.2303	267.4062	279.4794	602.7556	1008.5141	1372.6165	1665.0142 (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	643.7010	499.7905	389.0036	196.6029	68.2282	0.0000	0.0000	0.0000	0.0000	186.0328	421.7469	660.6883 (98)
Space heating												3065.7942 (98)
RHI space heating demand												3066 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1037 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3542 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3276 (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	0.4177	0.4095	0.4013	0.3604	0.3522	0.3112	0.3112	0.3030	0.3276	0.3522	0.3685	0.3849 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5537	0.5620	0.5679	0.5741 (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)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss						(33) + (36) =	76.6143 (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	56.0848	55.7613	55.4442	53.9548	53.6762	52.3789	52.3789	52.1387	52.8786	53.6762	54.2399	54.8292 (38)
Heat transfer coeff	132.6991	132.3756	132.0585	130.5691	130.2905	128.9932	128.9932	128.7530	129.4929	130.2905	130.8542	131.4435 (39)
Average = Sum(39)m / 12 =												130.5678 (39)
HLP	1.1852	1.1823	1.1795	1.1662	1.1637	1.1521	1.1521	1.1500	1.1566	1.1637	1.1688	1.1740 (40)
HLP (average)												1.1662 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)	Total = Sum(45)m = 1594.1535 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month												
	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (64)
	Total per year (kWh/year) = Sum(64)m = 1759.8765 (64)											
Heat gains from water heating, kWh/month	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (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	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.1803	55.2280	44.9144	34.0031	25.4177	21.4587	23.1869	30.1392	40.4528	51.3641	59.9494	63.9085	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.4663	413.7153	403.0080	380.2135	351.4394	324.3959	306.3292	302.0802	312.7875	335.5820	364.3561	391.3996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	(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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	(71)
Water heating gains (Table 5)	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858	(72)
Total internal gains	664.5718	659.5238	633.6339	593.3080	551.6470	514.5902	493.1092	502.4052	525.7711	566.3289	611.4245	645.8983	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF		Access factor Table 6d	Gains W
North				5.9900	10.6334		0.4600		0.0000		0.7700	22.5604 (74)
South				2.8100	46.7521		0.4600		0.0000		0.7700	46.5324 (78)
West				8.6000	19.6403		0.4600		0.0000		0.7700	59.8266 (80)
South				3.3300	46.7521		0.4600		0.0000		0.7700	55.1434 (78)
Solar gains	184.0629	326.6665	478.1144	638.5093	752.8354	762.7705	729.0792	642.2178	533.8253	369.7980	222.9485	155.8632 (83)
Total gains	848.6346	986.1902	1111.7483	1231.8173	1304.4824	1277.3607	1222.1884	1144.6230	1059.5965	936.1269	834.3729	801.7616 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.2457	34.3294	34.4118	34.8044	34.8788	35.2296	35.2296	35.2953	35.0936	34.8788	34.7286	34.5728
alpha	3.2830	3.2886	3.2941	3.3203	3.3253	3.3486	3.3486	3.3530	3.3396	3.3253	3.3152	3.3049
util living area	0.9732	0.9558	0.9225	0.8536	0.7397	0.5840	0.4446	0.4884	0.7002	0.8867	0.9577	0.9773 (86)
MIT	19.2798	19.5281	19.8981	20.3429	20.6928	20.9006	20.9698	20.9584	20.8110	20.3467	19.7325	19.2319 (87)
Th 2	19.9318	19.9341	19.9364	19.9471	19.9491	19.9585	19.9585	19.9602	19.9549	19.9491	19.9451	19.9408 (88)
util rest of house	0.9679	0.9473	0.9075	0.8251	0.6896	0.5070	0.3473	0.3891	0.6286	0.8581	0.9481	0.9728 (89)
MIT 2	17.6612	18.0190	18.5471	19.1711	19.6298	19.8788	19.9424	19.9364	19.7868	19.1931	18.3254	17.5977 (90)
Living area fraction	fLA = Living area / (4) =											0.1697 (91)
MIT	17.9359	18.2751	18.7764	19.3699	19.8102	20.0522	20.1168	20.1098	19.9606	19.3888	18.5642	17.8750 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7859	18.1251	18.6264	19.2199	19.6602	19.9022	19.9668	19.9598	19.8106	19.2388	18.4142	17.7250 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9527	0.9277	0.8839	0.8017	0.6743	0.5026	0.3481	0.3891	0.6176	0.8340	0.9288	0.9592 (94)
Useful gains	808.4654	914.8751	982.6462	987.6068	879.5535	641.9399	425.4375	445.3249	654.4147	780.7325	774.9700	769.0255 (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	1789.5614	1750.6798	1601.3885	1347.4657	1037.1381	683.9459	434.2936	458.3400	739.4778	1125.5585	1480.5082	1777.7783 (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	729.9354	561.6607	460.3442	259.0984	117.2430	0.0000	0.0000	0.0000	0.0000	256.5506	507.9875	750.5120 (98)
Space heating												3643.3318 (98)
Space heating per m2												(98) / (4) = 32.5414 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4025.7810 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.9354	561.6607	460.3442	259.0984	117.2430	0.0000	0.0000	0.0000	0.0000	256.5506	507.9875	750.5120	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	806.5585	620.6196	508.6677	286.2966	129.5502	0.0000	0.0000	0.0000	0.0000	283.4813	561.3122	829.2951	(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	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052	(64)
Efficiency of water heater	89.8501	89.7799	89.6397	89.3320	88.7366	87.3000	87.3000	87.3000	87.3000	89.2968	89.7084	89.8793	(216)
(217)m	199.7023	175.2361	182.1536	160.8276	156.4470	138.8631	130.3040	147.2140	148.2886	166.9852	179.5421	193.8212	(217)
Fuel for water heating, kWh/month													
Water heating fuel used													193.8212 (219)
Annual totals kWh/year													1979.3848 (219)
Space heating fuel - main system													4025.7810 (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)													439.2492 (232)
Total delivered energy for all uses													6519.4151 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4025.7810	3.4800	140.0972 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.3848	3.4800	68.8826 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	439.2492	13.1900	57.9370 (250)
Additional standing charges			120.0000 (251)
Total energy cost			396.8092 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.0618 (257)
SAP value	85.1879
SAP rating (Section 12)	85 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4025.7810	0.2160	869.5687 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.3848	0.2160	427.5471 (264)
Space and water heating			1297.1158 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.2492	0.5190	227.9703 (268)
Total kg/year			1564.0112 (272)
CO2 emissions per m2			13.9700 (273)
EI value			86.6477
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8879 = 3.920$, stars = 4
Water heating environmental impact	$0.216 / 0.8879 = 0.2433$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1037 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3542 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3276 (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	0.3440	0.3276	0.3276	0.3030	0.3030	0.2703	0.2785	0.2621	0.2703	0.2866	0.2866	0.3112 (22b)
Effective ac	0.5592	0.5537	0.5537	0.5459	0.5459	0.5365	0.5388	0.5343	0.5365	0.5411	0.5411	0.5484 (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)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss						(33) + (36) =	76.6143 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.4039	52.8786	52.8786	52.1387	52.1387	51.2418	51.4565	51.0336	51.2418	51.6775	51.6775	52.3789 (38)
Heat transfer coeff	130.0182	129.4929	129.4929	128.7530	128.7530	127.8561	128.0708	127.6479	127.8561	128.2918	128.2918	128.9932 (39)
Average = Sum(39)m / 12 =												128.6265 (39)
HLP	1.1613	1.1566	1.1566	1.1500	1.1500	1.1420	1.1439	1.1401	1.1420	1.1459	1.1459	1.1521 (40)
HLP (average)												1.1489 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Energy content (annual)										Total = Sum (45)m =		1594.1535 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month												
	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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												
	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (64)
										Total per year (kWh/year) = Sum (64)m =		1759.8765 (64)
Heat gains from water heating, kWh/month												
	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (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	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	62.1803	55.2280	44.9144	34.0031	25.4177	21.4587	23.1869	30.1392	40.4528	51.3641	59.9494	63.9085 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	409.4663	413.7153	403.0080	380.2135	351.4394	324.3959	306.3292	302.0802	312.7875	335.5820	364.3561	391.3996 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827 (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)												
	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437 (71)
Water heating gains (Table 5)												
	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858 (72)
Total internal gains												
	664.5718	659.5238	633.6339	593.3080	551.6470	514.5902	493.1092	502.4052	525.7711	566.3289	611.4245	645.8983 (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				5.9900	11.9814	0.4600		0.0000		0.7700		25.4205 (74)
South				2.8100	50.9848	0.4600		0.0000		0.7700		50.7453 (78)
West				8.6000	22.3313	0.4600		0.0000		0.7700		68.0239 (80)
South				3.3300	50.9848	0.4600		0.0000		0.7700		60.1359 (78)
Solar gains	204.3256	326.7711	473.8901	654.9262	754.6494	819.2638	774.2121	695.7168	574.4591	395.3565	253.6371	171.3012 (83)
Total gains	868.8973	986.2948	1107.5240	1248.2342	1306.2964	1333.8541	1267.3212	1198.1220	1100.2303	961.6854	865.0616	817.1996 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.9519	35.0936	35.0936	35.2953	35.2953	35.5429	35.4833	35.6009	35.5429	35.4222	35.4222	35.2296
alpha	3.3301	3.3396	3.3396	3.3530	3.3530	3.3695	3.3656	3.3734	3.3695	3.3615	3.3615	3.3486
util living area												
	0.9669	0.9495	0.9090	0.8194	0.6719	0.4575	0.3089	0.3349	0.6032	0.8491	0.9438	0.9719 (86)
MIT	19.4718	19.6811	20.0593	20.4924	20.8097	20.9636	20.9931	20.9910	20.9025	20.5131	19.9354	19.4310 (87)
Th 2	19.9511	19.9549	19.9549	19.9602	19.9602	19.9667	19.9651	19.9682	19.9667	19.9635	19.9635	19.9585 (88)
util rest of house												
	0.9602	0.9396	0.8909	0.7843	0.6105	0.3710	0.2078	0.2297	0.5174	0.8110	0.9308	0.9661 (89)
MIT 2	17.9510	18.2525	18.7878	19.3816	19.7797	19.9442	19.9632	19.9654	19.8930	19.4267	18.6272	17.8975 (90)
Living area fraction												
MIT	18.2091	18.4949	19.0036	19.5701	19.9545	20.1172	20.1380	20.1395	20.0643	19.6111	18.8492	18.1578 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0591	18.3449	18.8536	19.4201	19.8045	19.9672	19.9880	19.9895	19.9143	19.4611	18.6992	18.0078 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9434	0.9192	0.8671	0.7632	0.6005	0.3711	0.2101	0.2319	0.5127	0.7887	0.9096	0.9508 (94)
Useful gains	819.7242	906.6444	960.3001	952.6782	784.3954	494.9579	266.2827	277.8972	564.0889	758.4700	786.8568	776.9924 (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												
	1684.9138	1650.3803	1483.1544	1225.7378	876.1000	507.2303	267.4062	279.4794	602.7556	1008.5141	1372.6165	1665.0142 (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												
	643.7010	499.7905	389.0036	196.6029	68.2282	0.0000	0.0000	0.0000	0.0000	186.0328	421.7469	660.6883 (98)
Space heating												3065.7942 (98)
Space heating per m2												(98) / (4) = 27.3829 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3387.6179 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	643.7010	499.7905	389.0036	196.6029	68.2282	0.0000	0.0000	0.0000	0.0000	186.0328	421.7469	660.6883	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	711.2719	552.2547	429.8382	217.2408	75.3903	0.0000	0.0000	0.0000	0.0000	205.5611	466.0187	730.0423	(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	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052	(64)
Efficiency of water heater (217)m	89.7826	89.7127	89.5298	89.1207	88.3292	87.3000	87.3000	87.3000	87.3000	89.0478	89.5924	89.8131	(216)
Fuel for water heating, kWh/month	199.8526	175.3674	182.3773	161.2088	157.1686	138.8631	130.3040	147.2140	148.2886	167.4523	179.7745	193.9642	(219)
Water heating fuel used												1981.8354	(219)
Annual totals kWh/year													
Space heating fuel - main system												3387.6179	(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)													439.2492 (232)
Total delivered energy for all uses													5883.7025 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3387.6179	9.7400	329.9540 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1981.8354	9.7400	193.0308 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	439.2492	36.8500	161.8633 (250)
Additional standing charges			104.0000 (251)
Total energy cost			816.4856 (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	3387.6179	0.2160	731.7255 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.8354	0.2160	428.0764 (264)
Space and water heating			1159.8019 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.2492	0.5190	227.9703 (268)
Total kg/year			1426.6973 (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	3387.6179	1.2200	4132.8939 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.8354	1.2200	2417.8391 (264)
Space and water heating			6550.7330 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	439.2492	3.0700	1348.4951 (268)
Primary energy kWh/year			8129.4781 (272)
Primary energy kWh/m2/year			72.6106 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 85

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current environmental impact rating:

B 87

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 80	-192 kg (13.5%)
U Solar photovoltaic panels	+ 8.5	-£ 672	-947 kg (76.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£80	1.71 kg/m²	B 86 B 88
Solar photovoltaic panels	£672	8.46 kg/m²	A 95 A 96
Total Savings	£752	10.17 kg/m²	

Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 96

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	£190	£208	-£18
Mains gas	£627	£529	£98
Space heating	£462	£462	£0
Water heating	£193	£113	£80
Lighting	£162	£162	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£817	£65	£752
Total cost of uses	£817	£65	£752
Delivered energy	53 kWh/m²	28 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	3 kg/m²	10 kg/m²
Primary energy	73 kWh/m²	13 kWh/m²	60 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	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1037 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3542 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3276 (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	0.4177	0.4095	0.4013	0.3604	0.3522	0.3112	0.3112	0.3030	0.3276	0.3522	0.3685	0.3849 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5537	0.5620	0.5679	0.5741 (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)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss							(33) + (36) = 76.6143 (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	56.0848	55.7613	55.4442	53.9548	53.6762	52.3789	52.3789	52.1387	52.8786	53.6762	54.2399	54.8292 (38)
Heat transfer coeff	132.6991	132.3756	132.0585	130.5691	130.2905	128.9932	128.9932	128.7530	129.4929	130.2905	130.8542	131.4435 (39)
Average = Sum(39)m / 12 =												130.5678 (39)
HLP	1.1852	1.1823	1.1795	1.1662	1.1637	1.1521	1.1521	1.1500	1.1566	1.1637	1.1688	1.1740 (40)
HLP (average)												1.1662 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	1594.1535 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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												1.1377 (H8)
Utilisation factor												0.5848 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.3197 (H14)
Volume ratio Veff/V												0.7402 (H15)
Solar storage volume factor												0.9398 (H16)
Solar input												-876.4736 (H17)
Solar input	-25.4160	-42.4120	-72.2324	-96.8057	-119.5953	-117.5812	-116.0274	-101.3737	-79.3959	-54.2181	-30.1470	-21.2688 (63)
Solar input (sum of months) = Sum(63)m =												-876.4736 (63)
Output from w/h	154.0169	114.9148	91.0495	46.8648	19.2304	3.6463	0.0000	27.1441	50.0600	94.8944	130.9173	152.9364 (64)
Total per year (kWh/year) = Sum(64)m =												885.6749 (64)
Heat gains from water heating, kWh/month	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (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	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.1803	55.2280	44.9144	34.0031	25.4177	21.4587	23.1869	30.1392	40.4528	51.3641	59.9494	63.9085	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.4663	413.7153	403.0080	380.2135	351.4394	324.3959	306.3292	302.0802	312.7875	335.5820	364.3561	391.3996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	(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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	(71)
Water heating gains (Table 5)	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858	(72)
Total internal gains	664.5718	659.5238	633.6339	593.3080	551.6470	514.5902	493.1092	502.4052	525.7711	566.3289	611.4245	645.8983	(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	5.9900	10.6334	0.4600	0.0000	0.7700	22.5604 (74)
South	2.8100	46.7521	0.4600	0.0000	0.7700	46.5324 (78)
West	8.6000	19.6403	0.4600	0.0000	0.7700	59.8266 (80)
South	3.3300	46.7521	0.4600	0.0000	0.7700	55.1434 (78)

Solar gains	184.0629	326.6665	478.1144	638.5093	752.8354	762.7705	729.0792	642.2178	533.8253	369.7980	222.9485	155.8632 (83)
Total gains	848.6346	986.1902	1111.7483	1231.8173	1304.4824	1277.3607	1222.1884	1144.6230	1059.5965	936.1269	834.3729	801.7616 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.2457	34.3294	34.4118	34.8044	34.8788	35.2296	35.2296	35.2953	35.0936	34.8788	34.7286	34.5728
alpha	3.2830	3.2886	3.2941	3.3203	3.3253	3.3486	3.3486	3.3530	3.3396	3.3253	3.3152	3.3049
util living area	0.9732	0.9558	0.9225	0.8536	0.7397	0.5840	0.4446	0.4884	0.7002	0.8867	0.9577	0.9773 (86)
MIT	19.2798	19.5281	19.8981	20.3429	20.6928	20.9006	20.9698	20.9584	20.8110	20.3467	19.7325	19.2319 (87)
Th 2	19.9318	19.9341	19.9364	19.9471	19.9491	19.9585	19.9585	19.9602	19.9549	19.9491	19.9451	19.9408 (88)
util rest of house	0.9679	0.9473	0.9075	0.8251	0.6896	0.5070	0.3473	0.3891	0.6286	0.8581	0.9481	0.9728 (89)
MIT 2	17.6612	18.0190	18.5471	19.1711	19.6298	19.8788	19.9424	19.9364	19.7868	19.1931	18.3254	17.5977 (90)
Living area fraction									fLA = Living area / (4) =			0.1697 (91)
MIT	17.9359	18.2751	18.7764	19.3699	19.8102	20.0522	20.1168	20.1098	19.9606	19.3888	18.5642	17.8750 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7859	18.1251	18.6264	19.2199	19.6602	19.9022	19.9668	19.9598	19.8106	19.2388	18.4142	17.7250 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9527	0.9277	0.8839	0.8017	0.6743	0.5026	0.3481	0.3891	0.6176	0.8340	0.9288	0.9592	(94)
Useful gains	808.4654	914.8751	982.6462	987.6068	879.5535	641.9399	425.4375	445.3249	654.4147	780.7325	774.9700	769.0255	(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	1789.5614	1750.6798	1601.3885	1347.4657	1037.1381	683.9459	434.2936	458.3400	739.4778	1125.5585	1480.5082	1777.7783	(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	729.9354	561.6607	460.3442	259.0984	117.2430	0.0000	0.0000	0.0000	0.0000	256.5506	507.9875	750.5120	(98)
Space heating												3643.3318	(98)
Space heating per m2												(98) / (4) =	32.5414 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4025.7810 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.9354	561.6607	460.3442	259.0984	117.2430	0.0000	0.0000	0.0000	0.0000	256.5506	507.9875	750.5120	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	806.5585	620.6196	508.6677	286.2966	129.5502	0.0000	0.0000	0.0000	0.0000	283.4813	561.3122	829.2951	(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	154.0169	114.9148	91.0495	46.8648	19.2304	3.6463	0.0000	27.1441	50.0600	94.8944	130.9173	152.9364	(64)
Efficiency of water heater	89.9257	89.9401	89.9555	89.9947	90.0350	87.3000	87.3000	87.3000	87.3000	89.6131	89.8253	87.3000	(216)
(217)m	89.9257	89.9401	89.9555	89.9947	90.0350	87.3000	87.3000	87.3000	87.3000	89.6131	89.8253	87.3000	(217)
Fuel for water heating, kWh/month	171.2713	127.7683	101.2162	52.0750	21.3588	4.1767	0.0000	31.0929	57.3425	105.8935	145.7466	170.0390	(219)
Water heating fuel used												987.9808	(219)
Annual totals kWh/year													
Space heating fuel - main system												4025.7810	(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)													439.2492 (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												3850.7717	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4025.7810	3.4800	140.0972	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	987.9808	3.4800	34.3817	(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	439.2492	13.1900	57.9370	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			141.0805	(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] =	0.3775 (257)
SAP value		94.7337
SAP rating (Section 12)		95 (258)
SAP band		A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4025.7810	0.2160	869.5687 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	987.9808	0.2160	213.4039 (264)
Space and water heating			1082.9726 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	439.2492	0.5190	227.9703 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			479.3807 (272)
CO2 emissions per m2			4.2800 (273)
EI value			95.9074
EI rating			96 (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	55.9800 (1b)	x 2.5400 (2b)	= 142.1892 (1b) - (3b)
First floor	55.9800 (1c)	x 2.6300 (2c)	= 147.2274 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 289.4166 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1037 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.3542 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3276 (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	0.3440	0.3276	0.3276	0.3030	0.3030	0.2703	0.2785	0.2621	0.2703	0.2866	0.2866	0.3112 (22b)
Effective ac	0.5592	0.5537	0.5537	0.5459	0.5459	0.5365	0.5388	0.5343	0.5365	0.5411	0.5411	0.5484 (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)			17.4000	1.2357	21.5019		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.40			55.9800	0.1200	6.7176	75.0000	4198.5000 (28a)
EW Brick AAC015	115.9600	22.8600	93.1000	0.2500	23.2750	52.3000	4869.1300 (29a)
Plane Ceiling	55.9800		55.9800	0.1600	8.9568	9.0000	503.8200 (30)
Total net area of external elements Aum(A, m ²)			227.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3353		(33)
E-WM-30			50.3500	0.0000	0.0000	45.0000	2265.7500 (32)
GF Timber			32.9000			9.0000	296.1000 (32c)
1F Timber			98.0000			9.0000	882.0000 (32c)
GF Masonry			47.0000			39.0000	1833.0000 (32c)
Internal Floor			55.9800			18.0000	1007.6400 (32d)
Internal Ceiling			55.9800			9.0000	503.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16359.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.1215 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2790 (36)
Total fabric heat loss						(33) + (36) =	76.6143 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.4039	52.8786	52.8786	52.1387	52.1387	51.2418	51.4565	51.0336	51.2418	51.6775	51.6775	52.3789 (38)
Heat transfer coeff	130.0182	129.4929	129.4929	128.7530	128.7530	127.8561	128.0708	127.6479	127.8561	128.2918	128.2918	128.9932 (39)
Average = Sum(39)m / 12 =												128.6265 (39)
HLP	1.1613	1.1566	1.1566	1.1500	1.1500	1.1420	1.1439	1.1401	1.1420	1.1459	1.1459	1.1521 (40)
HLP (average)												1.1489 (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												2.8261 (42)
Average daily hot water use (litres/day)												101.3197 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4517	107.3989	103.3461	99.2933	95.2405	91.1877	91.1877	95.2405	99.2933	103.3461	107.3989	111.4517 (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)	165.2796	144.5546	149.1674	130.0478	124.7839	107.6790	99.7805	114.4995	115.8670	135.0318	147.3978	160.0645 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1594.1535 (45)
Water storage loss:	24.7919	21.6832	22.3751	19.5072	18.7176	16.1519	14.9671	17.1749	17.3801	20.2548	22.1097	24.0097 (46)
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1532	12.7722	14.1146	13.6227	14.0418	13.5485	13.9749	14.0183	13.5889	14.0806	13.6666	14.1407 (61)
Total heat required for water heating calculated for each month	179.4328	157.3268	163.2820	143.6705	138.8257	121.2275	113.7554	128.5178	129.4559	149.1125	161.0644	174.2052 (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												1.2015 (H8)
Utilisation factor												0.5650 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.3197 (H14)
Volume ratio Veff/V												0.7402 (H15)
Solar storage volume factor												0.9398 (H16)
Solar input												-894.2342 (H17)
Solar input	-27.5241	-41.3686	-69.6700	-96.3053	-115.9840	-122.0681	-119.1370	-106.3901	-83.0378	-56.4891	-33.4562	-22.8039 (63)
Solar input (sum of months) = Sum (63)m =												-894.2342 (63)
Output from w/h	151.9088	115.9582	93.6119	47.3652	22.8417	0.0000	0.0000	22.1278	46.4181	92.6234	127.6081	151.4013 (64)
Total per year (kWh/year) = Sum (64)m =												871.8645 (64)
Heat gains from water heating, kWh/month	58.4938	51.2575	53.1268	46.6466	45.0011	39.1904	36.6707	41.5757	41.9230	48.4182	52.4264	56.7566 (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	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	169.5656	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.1803	55.2280	44.9144	34.0031	25.4177	21.4587	23.1869	30.1392	40.4528	51.3641	59.9494	63.9085	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	409.4663	413.7153	403.0080	380.2135	351.4394	324.3959	306.3292	302.0802	312.7875	335.5820	364.3561	391.3996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	54.7827	(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)	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	-113.0437	(71)
Water heating gains (Table 5)	78.6207	76.2760	71.4070	64.7869	60.4854	54.4311	49.2886	55.8813	58.2264	65.0783	72.8145	76.2858	(72)
Total internal gains	664.5718	659.5238	633.6339	593.3080	551.6470	514.5902	493.1092	502.4052	525.7711	566.3289	611.4245	645.8983	(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				5.9900	11.9814	0.4600		0.0000		0.7700	25.4205 (74)	
South				2.8100	50.9848	0.4600		0.0000		0.7700	50.7453 (78)	
West				8.6000	22.3313	0.4600		0.0000		0.7700	68.0239 (80)	
South				3.3300	50.9848	0.4600		0.0000		0.7700	60.1359 (78)	

Solar gains	204.3256	326.7711	473.8901	654.9262	754.6494	819.2638	774.2121	695.7168	574.4591	395.3565	253.6371	171.3012 (83)
Total gains	868.8973	986.2948	1107.5240	1248.2342	1306.2964	1333.8541	1267.3212	1198.1220	1100.2303	961.6854	865.0616	817.1996 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.9519	35.0936	35.0936	35.2953	35.2953	35.5429	35.4833	35.6009	35.5429	35.4222	35.4222	35.2296	
alpha	3.3301	3.3396	3.3396	3.3530	3.3530	3.3695	3.3656	3.3734	3.3695	3.3615	3.3615	3.3486	
util living area	0.9669	0.9495	0.9090	0.8194	0.6719	0.4575	0.3089	0.3349	0.6032	0.8491	0.9438	0.9719 (86)	
MIT	19.4718	19.6811	20.0593	20.4924	20.8097	20.9636	20.9931	20.9910	20.9025	20.5131	19.9354	19.4310 (87)	
Th 2	19.9511	19.9549	19.9549	19.9602	19.9602	19.9667	19.9651	19.9682	19.9667	19.9635	19.9635	19.9585 (88)	
util rest of house	0.9602	0.9396	0.8909	0.7843	0.6105	0.3710	0.2078	0.2297	0.5174	0.8110	0.9308	0.9661 (89)	
MIT 2	17.9510	18.2525	18.7878	19.3816	19.7797	19.9442	19.9632	19.9654	19.8930	19.4267	18.6272	17.8975 (90)	
Living area fraction	18.2091	18.4949	19.0036	19.5701	19.9545	20.1172	20.1380	20.1395	20.0643	19.6111	18.8492	18.1578 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.0591	18.3449	18.8536	19.4201	19.8045	19.9672	19.9880	19.9895	19.9143	19.4611	18.6992	18.0078 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9434	0.9192	0.8671	0.7632	0.6005	0.3711	0.2101	0.2319	0.5127	0.7887	0.9096	0.9508	(94)
Useful gains	819.7242	906.6444	960.3001	952.6782	784.3954	494.9579	266.2827	277.8972	564.0889	758.4700	786.8568	776.9924	(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	1684.9138	1650.3803	1483.1544	1225.7378	876.1000	507.2303	267.4062	279.4794	602.7556	1008.5141	1372.6165	1665.0142	(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	643.7010	499.7905	389.0036	196.6029	68.2282	0.0000	0.0000	0.0000	0.0000	186.0328	421.7469	660.6883	(98)
Space heating												3065.7942	(98)
Space heating per m2											(98) / (4) =	27.3829	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3387.6179	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	643.7010	499.7905	389.0036	196.6029	68.2282	0.0000	0.0000	0.0000	0.0000	186.0328	421.7469	660.6883	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	711.2719	552.2547	429.8382	217.2408	75.3903	0.0000	0.0000	0.0000	0.0000	205.5611	466.0187	730.0423	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	151.9088	115.9582	93.6119	47.3652	22.8417	0.0000	0.0000	22.1278	46.4181	92.6234	127.6081	151.4013	(64)	
Efficiency of water heater	89.8710	89.8796	89.8611	89.8605	89.6756	87.3000	87.3000	87.3000	87.3000	89.4106	89.7359	89.8857	(216)	
Fuel for water heating, kWh/month	169.0298	129.0151	104.1740	52.7096	25.4715	0.0000	0.0000	25.3468	53.1708	103.5933	142.2040	168.4375	(219)	
Water heating fuel used												973.1525	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3387.6179	(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)													439.2492	(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												3100.8600	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3387.6179	9.7400	329.9540	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.1525	9.7400	94.7851	(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	439.2492	36.8500	161.8633	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			64.4621	(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	3387.6179	0.2160	731.7255	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.1525	0.2160	210.2009	(264)
Space and water heating			941.9264	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	439.2492	0.5190	227.9703	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			288.0329 (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	3387.6179	1.2200	4132.8939 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.1525	1.2200	1187.2461 (264)
Space and water heating			5320.1400 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	439.2492	3.0700	1348.4951 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1452.2150 (272)
Primary energy kWh/m2/year			12.9708 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	146.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	382.03 (P1)
Transmission heat loss coefficient	76.61 (37)
Summer heat loss coefficient	458.64 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.9900	81.1852	0.4600	0.0000	0.9000	201.3279
South	2.8100	112.2060	0.4600	0.0000	0.9000	130.5337
West	8.6000	117.5071	0.4600	0.0000	0.9000	418.3722
South	3.3300	112.2060	0.4600	0.0000	0.9000	154.6894
total:						904.9232

	Jun	Jul	Aug	
Solar gains	958	905	813	(P4)
Internal gains	512	490	499	
Total summer gains	1469	1395	1313	(P5)
Summer gain/loss ratio	3.20	3.04	2.86	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 146.1)	0.98	0.98	0.98	
Threshold temperature	20.18	21.92	21.64	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			