

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-649				Issued on Date	22/03/2023
Assessment Reference	Plot 649	Prop Type Ref	Islington-As-DET			
Property	Plot 649, 3 Bed, K, WC, Ut, B, En					
SAP Rating	84 B	DER	17.80	TER	18.81	
Environmental	85 B	% DER<TER	5.39			
CO ₂ Emissions (t/year)	1.48	DFEE	52.62	TFEE	59.97	
General Requirements Compliance	Pass	% DFEE<TFEE	12.24			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, [REDACTED]				Assessor ID	Q919-0001
	[REDACTED]					
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 101 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.81 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 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: 8.35 m², No overhang
Windows facing South: 7.68 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.029 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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
Heat gains from water heating, kWh/month										Total per year (kWh/year) =	Sum (64)m =	1730.0840 (64)
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	426.0099	423.7000	408.2077	383.1607	357.5269	333.0462	317.3011	323.7796	336.7949	362.0692	391.0739	413.0199 (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				5.0200	10.6334	0.4600	0.0000			0.7700			18.9071 (74)
South				7.6800	46.7521	0.4600	0.0000			0.7700			127.1776 (78)
North				3.3300	10.6334	0.4600	0.0000			0.7700			12.5419 (74)
Solar gains	158.6266	268.3848	367.4427	463.9059	533.4557	537.2807	514.6813	460.5652	399.9431	296.1959	189.5452	136.1106	(83)
Total gains	584.6365	692.0848	775.6504	847.0665	890.9826	870.3269	831.9824	784.3448	736.7380	658.2651	580.6191	549.1305	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9901	0.9824	0.9681	0.9361	0.8701	0.7492	0.6092	0.6535	0.8370	0.9501	0.9836	0.9919 (86)
MIT	18.8908	19.1263	19.4927	19.9805	20.4291	20.7720	20.9172	20.8937	20.6387	20.0582	19.3962	18.8638 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9877	0.9782	0.9602	0.9187	0.8306	0.6665	0.4793	0.5281	0.7733	0.9330	0.9791	0.9900 (89)
MIT 2	17.0066	17.3512	17.8840	18.5933	19.2148	19.6581	19.8038	19.7892	19.5057	18.7156	17.7577	16.9766 (90)
Living area fraction												
	fLA =	Living area / (4) =										
MIT	17.3343	17.6600	18.1638	18.8346	19.4260	19.8518	19.9975	19.9813	19.7027	18.9491	18.0427	17.3049 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1843	17.5100	18.0138	18.6846	19.2760	19.7018	19.8475	19.8313	19.5527	18.7991	17.8927	17.1549 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9796	0.9660	0.9427	0.8957	0.8071	0.6543	0.4792	0.5257	0.7535	0.9116	0.9674	0.9830 (94)
Useful gains	572.6811	668.5384	731.2367	758.7135	719.1262	569.4573	398.7061	412.3225	555.1104	600.0460	561.6722	539.7847 (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												
	1754.7207	1710.6539	1555.9607	1298.3446	1001.8153	663.7753	422.5192	445.0769	713.9064	1084.2164	1437.1675	1737.6179 (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												
	879.4375	700.3016	613.5947	388.5344	210.3207	0.0000	0.0000	0.0000	0.0000	360.2228	630.3566	891.1879 (98)
Space heating												4673.9561 (98)
Space heating per m2												(98) / (4) = 46.3778 (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													5164.5924 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	879.4375	700.3016	613.5947	388.5344	210.3207	0.0000	0.0000	0.0000	0.0000	360.2228	630.3566	891.1879	(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)	971.7541	773.8140	678.0052	429.3198	232.3985	0.0000	0.0000	0.0000	0.0000	398.0362	696.5266	984.7380	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.9493	89.9040	89.8174	89.6242	89.2130	87.3000	87.3000	87.3000	87.3000	89.5506	89.8390	87.3000	(216)
Fuel for water heating, kWh/month	196.0514	171.9922	178.6924	157.5877	152.9944	136.5557	128.1658	144.7599	145.8047	163.6966	176.2178	190.3072	(219)
Water heating fuel used												1942.8258	(219)
Annual totals kWh/year													
Space heating fuel - main system												5164.5924	(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)												423.5919	(232)
Total delivered energy for all uses												7606.0101	(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	5164.5924	0.2160	1115.5520 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.8258	0.2160	419.6504 (264)
Space and water heating			1535.2023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/year			1793.9715 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8000 (273)

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

DER		17.8000	ZC1
Total Floor Area	TFA	100.7800	
Assumed number of occupants	N	2.7466	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1457	ZC2
CO2 emissions from cooking, equation (L16)		1.8349	ZC3
Total CO2 emissions		34.7805	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.7805	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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Heat gains from water heating, kWh/month	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250 (72)
Total internal gains	438.3799	436.0741	420.5905	395.1201	368.8166	343.6684	327.9314	335.0769	348.7656	374.4631	403.4541	425.3940 (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				8.3500	10.6334		0.6300		0.7000		0.7700	27.1350 (74)
South				7.6800	46.7521		0.6300		0.7000		0.7700	109.7321 (78)
Solar gains	136.8672	231.5694	317.0392	400.2701	460.2795	463.5798	444.0804	397.3877	345.0814	255.5656	163.5445	117.4398 (83)
Total gains	575.2471	667.6435	737.6296	795.3902	829.0961	807.2482	772.0119	732.4646	693.8470	630.0287	566.9987	542.8338 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026
util living area	0.9984	0.9964	0.9916	0.9767	0.9318	0.8160	0.6560	0.7045	0.8996	0.9829	0.9966	0.9988 (86)
MIT	19.5778	19.7362	19.9876	20.3274	20.6469	20.8837	20.9694	20.9569	20.7914	20.3807	19.9229	19.5588 (87)
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799 (88)
util rest of house	0.9978	0.9951	0.9884	0.9668	0.8994	0.7285	0.5137	0.5667	0.8395	0.9738	0.9952	0.9983 (89)
MIT 2	17.9765	18.2102	18.5786	19.0798	19.5243	19.8216	19.8942	19.8897	19.7218	19.1627	18.4948	17.9579 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	18.2551	18.4756	18.8237	19.2968	19.7196	20.0063	20.0812	20.0754	19.9078	19.3746	18.7432	18.2364 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2551	18.4756	18.8237	19.2968	19.7196	20.0063	20.0812	20.0754	19.9078	19.3746	18.7432	18.2364 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	573.2239	662.7729	725.8603	763.1722	740.3639	595.5204	415.5576	432.0266	582.8394	609.5998	562.9879	541.3765 (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	1782.4316	1727.9672	1563.2812	1297.6942	997.9306	663.1636	427.0252	449.6309	716.3778	1091.8738	1457.7999	1768.7425 (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	899.6505	715.8106	623.0411	384.8558	191.6296	0.0000	0.0000	0.0000	0.0000	358.8118	644.2647	913.1603 (98)
Space heating												4731.2244 (98)
Space heating per m2												46.9461 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Designed)

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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												5065.5508 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	899.6505	715.8106	623.0411	384.8558	191.6296	0.0000	0.0000	0.0000	0.0000	358.8118	644.2647	913.1603 (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)	963.2233	766.3925	667.0676	412.0512	205.1709	0.0000	0.0000	0.0000	0.0000	384.1668	689.7909	977.6877 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419 (64)
Efficiency of water heater (217)m	88.2732	88.0962	87.7451	86.9715	85.3519	80.3000	80.3000	80.3000	80.3000	86.7100	87.8433	80.3000 (216)
Fuel for water heating, kWh/month	241.4774	213.2775	224.9103	201.9970	199.2798	186.5567	178.7355	199.2482	201.4487	211.5967	220.8106	235.5059 (219)
Water heating fuel used												2514.8443 (219)
Annual totals kWh/year												
Space heating fuel - main system												5065.5508 (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)												423.5919 (232)
Total delivered energy for all uses												8078.9870 (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	5065.5508	0.2160	1094.1590 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2514.8443	0.2160	543.2064 (264)
Space and water heating			1637.3653 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total CO2, kg/m2/year			1896.1345 (272)
Emissions per m2 for space and water heating			16.2469 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1814 (272b)
Emissions per m2 for pumps and fans			0.3862 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2469 * 1.00) + 2.1814 + 0.3862, rounded to 2 d.p.			18.8100 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4040 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4040 (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	0.5152	0.5051	0.4950	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747 (22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.3927	53.9497	53.5155	51.4761	51.0946	49.3183	49.3183	48.9894	50.0025	51.0946	51.8665	52.6735 (38)
Heat transfer coeff	133.9196	133.4767	133.0425	131.0031	130.6215	128.8453	128.8453	128.5163	129.5294	130.6215	131.3934	132.2004 (39)
Average = Sum(39)m / 12 =												131.0013 (39)
HLP	1.3288	1.3244	1.3201	1.2999	1.2961	1.2785	1.2785	1.2752	1.2853	1.2961	1.3038	1.3118 (40)
HLP (average)												1.2999 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1564.4598 (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)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658 (72)
Total internal gains	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348 (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	5.0200	10.6334	0.4600	0.0000	0.7700	18.9071 (74)
South	7.6800	46.7521	0.4600	0.0000	0.7700	127.1776 (78)
North	3.3300	10.6334	0.4600	0.0000	0.7700	12.5419 (74)

Solar gains	158.6266	268.3848	367.4427	463.9059	533.4557	537.2807	514.6813	460.5652	399.9431	296.1959	189.5452	136.1106 (83)
Total gains	550.7218	659.0031	744.2988	818.0695	863.5162	845.0134	808.4954	758.5139	710.0717	629.1621	548.7673	516.0454 (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	33.2500	33.3603	33.4692	33.9902	34.0895	34.5595	34.5595	34.6479	34.3769	34.0895	33.8892	33.6824
alpha	3.2167	3.2240	3.2313	3.2660	3.2726	3.3040	3.3040	3.3099	3.2918	3.2726	3.2593	3.2455
util living area	0.9917	0.9846	0.9712	0.9407	0.8767	0.7582	0.6184	0.6649	0.8464	0.9551	0.9860	0.9933 (86)
MIT	18.8857	19.1215	19.4879	19.9726	20.4228	20.7671	20.9152	20.8900	20.6299	20.0448	19.3824	18.8541 (87)
Th 2	19.8183	19.8217	19.8251	19.8409	19.8439	19.8577	19.8577	19.8603	19.8524	19.8439	19.8379	19.8316 (88)
util rest of house	0.9897	0.9809	0.9640	0.9243	0.8387	0.6769	0.4887	0.5402	0.7851	0.9395	0.9821	0.9917 (89)
MIT 2	17.9006	18.1372	18.5022	18.9879	19.4158	19.7242	19.8266	19.8160	19.6152	19.0667	18.4098	17.8787 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	18.0719	18.3084	18.6737	19.1592	19.5909	19.9056	20.0159	20.0028	19.7917	19.2369	18.5789	18.0484 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0719	18.3084	18.6737	19.1592	19.5909	19.9056	20.0159	20.0028	19.7917	19.2369	18.5789	18.0484 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9855	0.9744	0.9545	0.9121	0.8287	0.6808	0.5085	0.5577	0.7812	0.9287	0.9761	0.9882 (94)
Ext temp.	542.7581	642.1376	710.4220	746.1566	715.5874	575.2813	411.1177	423.0495	554.6974	584.2963	535.6532	509.9350 (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	1844.3314	1789.7092	1619.6172	1343.9836	1030.7255	683.5997	440.1262	463.0242	737.2408	1128.1599	1508.2582	1830.7606 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	968.3706	771.1681	676.4413	430.4355	234.4628	0.0000	0.0000	0.0000	0.0000	404.6346	700.2756	982.6942 (98)
												5168.4825 (98)
												51.2848 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1211.1455	953.4549	976.7241	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7271	0.8028	0.7740	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.5723	765.4082	755.9834	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1093.6098	1048.6784	992.2667	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	153.3870	210.7530	175.7947	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			539.9348 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	38.3467	52.6883	43.9487	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												134.9837 (107)
Energy for space heating												1.3394 (108)
Energy for space cooling												51.2848 (99)
Total												1.3394 (108)
Dwelling Fabric Energy Efficiency (DFEE)												52.6242 (109)
												52.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1535 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4035 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5145	0.5044	0.4943	0.4439	0.4338	0.3834	0.3834	0.3733	0.4035	0.4338	0.4540	0.4742 (22b)
Effective ac	0.6324	0.6272	0.6222	0.5985	0.5941	0.5735	0.5735	0.5697	0.5814	0.5941	0.6031	0.6124 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1300	1.2000	2.5560		(26a)
TER Opening Type (Uw = 1.40)			16.0300	1.3258	21.2519		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507		(28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.1800	23.1768		(29a)
Plane Ceiling	50.3900		50.3900	0.1300	6.5507		(30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.2161		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1458 (36)
Total fabric heat loss						(33) + (36) =	73.3619 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.3645	53.9226	53.4895	51.4551	51.0745	49.3026	49.3026	48.9745	49.9851	51.0745	51.8445	52.6495 (38)
Heat transfer coeff	127.7264	127.2845	126.8514	124.8170	124.4364	122.6645	122.6645	122.3364	123.3470	124.4364	125.2064	126.0114 (39)
Average = Sum(39)m / 12 =												124.8152 (39)
HLP	1.2674	1.2630	1.2587	1.2385	1.2347	1.2172	1.2172	1.2139	1.2239	1.2347	1.2424	1.2504 (40)
HLP (average)												1.2385 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)
Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m												1564.4598 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9855	21.3037	17.3254	13.1164	9.8047	8.2775	8.9441	11.6259	15.6043	19.8133	23.1250	24.6522	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains	392.0952	390.6183	376.8561	354.1636	330.0605	307.7327	293.8141	297.9487	310.1286	332.9662	359.2221	379.9348	(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				8.3500	10.6334		0.6300		0.7000		0.7700		27.1350	(74)
South				7.6800	46.7521		0.6300		0.7000		0.7700		109.7321	(78)
Solar gains	136.8672	231.5694	317.0392	400.2701	460.2795	463.5798	444.0804	397.3877	345.0814	255.5656	163.5445	117.4398	(83)	
Total gains	528.9623	622.1877	693.8952	754.4337	790.3400	771.3125	737.8945	695.3364	655.2100	588.5318	522.7667	497.3745	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	54.7938	54.9840	55.1717	56.0710	56.2425	57.0549	57.0549	57.2079	56.7392	56.2425	55.8966	55.5395		
alpha	4.6529	4.6656	4.6781	4.7381	4.7495	4.8037	4.8037	4.8139	4.7826	4.7495	4.7264	4.7026		
util living area	0.9989	0.9973	0.9935	0.9810	0.9417	0.8349	0.6792	0.7306	0.9155	0.9869	0.9976	0.9992	(86)	
MIT	19.5359	19.6954	19.9491	20.2936	20.6210	20.8701	20.9645	20.9496	20.7690	20.3454	19.8830	19.5174	(87)	
Th 2	19.8665	19.8699	19.8733	19.8893	19.8923	19.9063	19.9063	19.9089	19.9009	19.8923	19.8863	19.8799	(88)	
util rest of house	0.9985	0.9964	0.9909	0.9726	0.9127	0.7509	0.5352	0.5927	0.8614	0.9797	0.9966	0.9989	(89)	
MIT 2	18.5343	18.6961	18.9515	19.3043	19.6188	19.8402	19.8965	19.8931	19.7619	19.3603	18.8965	18.5264	(90)	
Living area fraction									fLA = Living area / (4) =			0.1739	(91)	
MIT	18.7085	18.8699	19.1250	19.4764	19.7931	20.0194	20.0823	20.0769	19.9371	19.5317	19.0681	18.6987	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7085	18.8699	19.1250	19.4764	19.7931	20.0194	20.0823	20.0769	19.9371	19.5317	19.0681	18.6987	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9951	0.9886	0.9685	0.9094	0.7610	0.5605	0.6164	0.8636	0.9764	0.9955	0.9984	(94)
Ext temp.	527.8216	619.1658	685.9666	730.6567	718.7703	586.9780	413.5656	428.6162	565.8505	574.6547	520.4148	496.5771	(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	1840.3482	1778.1576	1601.4988	1320.1152	1007.0752	664.7664	427.1529	449.8143	719.9881	1111.4224	1498.4836	1827.0069	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	976.5198	778.8425	681.1559	424.4101	214.4988	0.0000	0.0000	0.0000	0.0000	399.3552	704.2096	989.8398	(98)
												5168.8317	(98)
												51.2883	(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	1153.0466	907.7176	929.7567	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7675	0.8525	0.8229	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	884.9974	773.7913	765.0784	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1007.4659	966.1580	918.4228	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	88.1773	143.1208	114.0882	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												345.3863	(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	22.0443	35.7802	28.5220	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.3466 (107)
Space cooling per m2												0.8568 (108)
Energy for space heating												51.2883 (99)
Energy for space cooling												0.8568 (108)
Total												52.1451 (109)
Target Fabric Energy Efficiency (TFEE)												60.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
RHI water heating demand	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =												1730 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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			5.0200	11.9814	0.4600	0.0000	0.7700	21.3040 (74)				
South			7.6800	50.9848	0.4600	0.0000	0.7700	138.6918 (78)				
North			3.3300	11.9814	0.4600	0.0000	0.7700	14.1319 (74)				
Solar gains	174.1277	265.3246	360.3382	472.6284	533.1003	576.1644	545.3399	496.3794	426.3820	312.9927	213.1786	147.9724 (83)
Total gains	807.9445	894.1253	964.3615	1038.2286	1059.1838	1067.0973	1015.9298	976.1540	928.4570	853.7181	796.7916	764.2014 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area	0.9718	0.9597	0.9333	0.8738	0.7589	0.5510	0.3814	0.4054	0.6771	0.8807	0.9531	0.9756 (86)
MIT	19.3526	19.5407	19.8905	20.3269	20.7044	20.9325	20.9859	20.9828	20.8539	20.4172	19.8390	19.3296 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house	0.9655	0.9507	0.9176	0.8425	0.6956	0.4439	0.2462	0.2680	0.5813	0.8442	0.9407	0.9701 (89)
MIT 2	17.6952	17.9697	18.4685	19.0808	19.5699	19.8223	19.8562	19.8605	19.7543	19.2189	18.4116	17.6706 (90)
Living area fraction	17.9835	18.2426	18.7158	19.2976	19.7673	20.0154	20.0527	20.0557	19.9456	19.4273	18.6598	17.9592 (92)
MIT	17.9835	18.2426	18.7158	19.2976	19.7673	20.0154	20.0527	20.0557	19.9456	19.4273	18.6598	17.9592 (92)
Temperature adjustment	17.8335	18.0926	18.5658	19.1476	19.6173	19.8654	19.9027	19.9057	19.7956	19.2773	18.5098	17.8092 (93)
adjusted MIT	17.8335	18.0926	18.5658	19.1476	19.6173	19.8654	19.9027	19.9057	19.7956	19.2773	18.5098	17.8092 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9496	0.9318	0.8948	0.8189	0.6808	0.4442	0.2515	0.2731	0.5749	0.8209	0.9206	0.9557 (94)
Ext temp.	767.2508	833.1460	862.8690	850.1573	721.1258	474.0014	255.4744	266.5914	533.8146	700.7828	733.5199	730.3111 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1678.1294	1635.6058	1461.9011	1199.5130	858.3334	495.6945	257.5305	269.3102	589.3351	990.0193	1355.2875	1653.5378 (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	677.6937	539.2530	445.6799	251.5361	102.0825	0.0000	0.0000	0.0000	0.0000	215.1920	447.6727	686.8807 (98)
RHI space heating demand												3366 (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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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	5.0200			10.6334		0.4600		0.0000		0.7700		18.9071 (74)
South	7.6800			46.7521		0.4600		0.0000		0.7700		127.1776 (78)
North	3.3300			10.6334		0.4600		0.0000		0.7700		12.5419 (74)
Solar gains	158.6266	268.3848	367.4427	463.9059	533.4557	537.2807	514.6813	460.5652	399.9431	296.1959	189.5452	136.1106 (83)
Total gains	792.4434	897.1855	971.4660	1029.5061	1059.5391	1028.2136	985.2712	940.3398	902.0181	836.9213	773.1582	752.3396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area												
	0.9769	0.9646	0.9435	0.8996	0.8179	0.6802	0.5356	0.5740	0.7662	0.9111	0.9644	0.9802 (86)
MIT	19.1337	19.3575	19.6993	20.1476	20.5438	20.8318	20.9435	20.9280	20.7326	20.2304	19.6149	19.1048 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house												
	0.9718	0.9569	0.9306	0.8750	0.7700	0.5936	0.4132	0.4534	0.6918	0.8843	0.9552	0.9758 (89)
MIT 2	17.3576	17.6823	18.1749	18.8186	19.3542	19.7140	19.8194	19.8115	19.6058	18.9473	18.0698	17.3254 (90)
Living area fraction												
	17.6666	17.9737	18.4401	19.0498	19.5611	19.9084	20.0149	20.0057	19.8018	19.1704	18.3386	17.6349 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5166	17.8237	18.2901	18.8998	19.4111	19.7584	19.8649	19.8557	19.6518	19.0204	18.1886	17.4849 (93)

8. Space heating requirement

Utilisation	0.9574	0.9386	0.9082	0.8504	0.7496	0.5861	0.4152	0.4539	0.6774	0.8600	0.9370	0.9628 (94)
Useful gains	758.6871	842.1058	882.3151	875.4742	794.1925	602.6382	409.0784	426.8387	611.0702	719.7430	724.4120	724.3770 (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												
	1799.9640	1753.2104	1593.2915	1326.9049	1019.6840	671.1439	424.7863	448.2491	726.8761	1113.4826	1476.5677	1781.8928 (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												
	774.7100	612.2623	528.9665	325.0301	167.7657	0.0000	0.0000	0.0000	0.0000	292.9423	541.5521	786.7917 (98)
Space heating												4030.0207 (98)
Space heating per m2												(98) / (4) = 39.9883 (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													4453.0615 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	774.7100	612.2623	528.9665	325.0301	167.7657	0.0000	0.0000	0.0000	0.0000	292.9423	541.5521	786.7917	(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)	856.0331	676.5329	584.4933	359.1493	185.3764	0.0000	0.0000	0.0000	0.0000	323.6931	598.4001	869.3831	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8891	89.8360	89.7343	89.5062	89.0359	87.3000	87.3000	87.3000	87.3000	89.4070	89.7558	87.3000	(216)
Fuel for water heating, kWh/month	196.1828	172.1222	178.8578	157.7954	153.2987	136.5557	128.1658	144.7599	145.8047	163.9595	176.3811	190.4290	(219)
Water heating fuel used												1944.3127	(219)
Annual totals kWh/year													
Space heating fuel - main system												4453.0615	(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)												423.5919	(232)
Total delivered energy for all uses												6895.9661	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4453.0615	3.4800	154.9665 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.3127	3.4800	67.6621 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	423.5919	13.1900	55.8718 (250)
Additional standing charges			120.0000 (251)
Total energy cost			408.3929 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1766 (257)
SAP value		83.5864
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4453.0615	0.2160	961.8613 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.3127	0.2160	419.9715 (264)
Space and water heating			1381.8328 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1640.6020 (272)
CO2 emissions per m2			16.2800 (273)
EI value			84.9197
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As 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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Energy content (annual)										Total =	Sum (45)m =	1564.4598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month												
Solar input	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (64)
								Total per year (kWh/year) =	Sum (64)m =			1730.0840 (64)
Heat gains from water heating, kWh/month												
	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652 (71)
Water heating gains (Table 5)												
	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509 (72)
Total internal gains												
	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290 (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			5.0200		11.9814		0.4600		0.0000		0.7700		21.3040 (74)
South			7.6800		50.9848		0.4600		0.0000		0.7700		138.6918 (78)
North			3.3300		11.9814		0.4600		0.0000		0.7700		14.1319 (74)
Solar gains	174.1277	265.3246	360.3382	472.6284	533.1003	576.1644	545.3399	496.3794	426.3820	312.9927	213.1786		147.9724 (83)
Total gains	807.9445	894.1253	964.3615	1038.2286	1059.1838	1067.0973	1015.9298	976.1540	928.4570	853.7181	796.7916		764.2014 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816
util living area	0.9718	0.9597	0.9333	0.8738	0.7589	0.5510	0.3814	0.4054	0.6771	0.8807	0.9531	0.9756 (86)
MIT	19.3526	19.5407	19.8905	20.3269	20.7044	20.9325	20.9859	20.9828	20.8539	20.4172	19.8390	19.3296 (87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479 (88)
util rest of house												
	0.9655	0.9507	0.9176	0.8425	0.6956	0.4439	0.2462	0.2680	0.5813	0.8442	0.9407	0.9701 (89)
MIT 2	17.6952	17.9692	18.4685	19.0808	19.5699	19.8223	19.8562	19.8605	19.7543	19.2189	18.4116	17.6706 (90)
Living area fraction									fLA =	Living area / (4) =		0.1739 (91)
MIT	17.9835	18.2426	18.7158	19.2976	19.7673	20.0154	20.0527	20.0557	19.9456	19.4273	18.6598	17.9592 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8335	18.0926	18.5658	19.1476	19.6173	19.8654	19.9027	19.9057	19.7956	19.2773	18.5098	17.8092 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9496	0.9318	0.8948	0.8189	0.6808	0.4442	0.2515	0.2731	0.5749	0.8209	0.9206	0.9557 (94)
Useful gains	767.2508	833.1460	862.8690	850.1573	721.1258	474.0014	255.4744	266.5914	533.8146	700.7828	733.5199	730.3111 (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												
	1678.1294	1635.6058	1461.9011	1199.5130	858.3334	495.6945	257.5305	269.3102	589.3351	990.0193	1355.2875	1653.5378 (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												
	677.6937	539.2530	445.6799	251.5361	102.0825	0.0000	0.0000	0.0000	0.0000	215.1920	447.6727	686.8807 (98)
Space heating												3365.9906 (98)
Space heating per m2										(98) / (4) =		33.3994 (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													3719.3266 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	677.6937	539.2530	445.6799	251.5361	102.0825	0.0000	0.0000	0.0000	0.0000	215.1920	447.6727	686.8807	(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)	748.8328	595.8597	492.4640	277.9404	112.7983	0.0000	0.0000	0.0000	0.0000	237.7812	494.6660	758.9842	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166	(64)
Efficiency of water heater (217)m	89.8202	89.7667	89.6301	89.3227	88.6411	87.3000	87.3000	87.3000	87.3000	89.1755	89.6416	87.3000	(216)
Fuel for water heating, kWh/month	196.3332	172.2551	179.0657	158.1197	153.9815	136.5557	128.1658	144.7599	145.8047	164.3851	176.6058	190.5733	(219)
Water heating fuel used												1946.6055	(219)
Annual totals kWh/year													
Space heating fuel - main system												3719.3266	(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)												423.5919	(232)
Total delivered energy for all uses												6164.5240	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3719.3266	9.7400	362.2624 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.6055	9.7400	189.5994 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	423.5919	36.8500	156.0936 (250)
Additional standing charges			104.0000 (251)
Total energy cost			839.5929 (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	3719.3266	0.2160	803.3745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.6055	0.2160	420.4668 (264)
Space and water heating			1223.8413 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Total kg/year			1482.6105 (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	3719.3266	1.2200	4537.5785 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.6055	1.2200	2374.8587 (264)
Space and water heating			6912.4372 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Primary energy kWh/year			8443.1143 (272)
Primary energy kWh/m2/year			83.7777 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(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	+ 1.1	-£ 79	-189 kg (12.8%)
U Solar photovoltaic panels	+ 9.2	-£ 672	-947 kg (73.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	1.88 kg/m ²	B 85 B 87
Solar photovoltaic panels	£672	9.39 kg/m ²	A 94 A 95
Total Savings	£751	11.27 kg/m ²	

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

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	£184	£202	-£18
Mains gas	£656	£559	£97
Space heating	£494	£494	£0
Water heating	£190	£111	£79
Lighting	£156	£156	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£840	£89	£751
Total cost of uses	£840	£89	£751
Delivered energy	61 kWh/m ²	34 kWh/m ²	27 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	3 kg/m ²	11 kg/m ²
Primary energy	84 kWh/m ²	18 kWh/m ²	66 kWh/m ²

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	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.5641	0.5530	0.5420	0.4867	0.4756	0.4203	0.4203	0.4092	0.4424	0.4756	0.4977	0.5199 (22b)
Effective ac	0.6591	0.6529	0.6469	0.6184	0.6131	0.5883	0.5883	0.5837	0.5979	0.6131	0.6239	0.6351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	56.6632	56.1320	55.6114	53.1661	52.7086	50.5788	50.5788	50.1844	51.3992	52.7086	53.6341	54.6017 (38)
Heat transfer coeff	136.1901	135.6590	135.1384	132.6931	132.2355	130.1058	130.1058	129.7114	130.9261	132.2355	133.1611	134.1287 (39)
Average = Sum(39)m / 12 =												132.6909 (39)
HLP	1.3514	1.3461	1.3409	1.3167	1.3121	1.2910	1.2910	1.2871	1.2991	1.3121	1.3213	1.3309 (40)
HLP (average)												1.3166 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1593 (H8)
Utilisation factor												0.5779 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-869.6671 (H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037 (63)
Solar input (sum of months) = Sum (63)m =												-869.6671 (63)
Output from w/h	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129 (64)
Total per year (kWh/year) = Sum (64)m =												863.6545 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(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				5.0200	10.6334	0.4600	0.0000	0.7700	18.9071 (74)			
South				7.6800	46.7521	0.4600	0.0000	0.7700	127.1776 (78)			
North				3.3300	10.6334	0.4600	0.0000	0.7700	12.5419 (74)			
Solar gains	158.6266	268.3848	367.4427	463.9059	533.4557	537.2807	514.6813	399.9431	296.1959	189.5452	136.1106 (83)	
Total gains	792.4434	897.1855	971.4660	1029.5061	1059.5391	1028.2136	985.2712	940.3398	902.0181	836.9213	773.1582	752.3396 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.6956	32.8236	32.9501	33.5573	33.6734	34.2246	34.2246	34.3287	34.0102	33.6734	33.4394	33.1981
alpha	3.1797	3.1882	3.1967	3.2372	3.2449	3.2816	3.2816	3.2886	3.2673	3.2449	3.2293	3.2132
util living area	0.9769	0.9646	0.9435	0.8996	0.8179	0.6802	0.5356	0.5740	0.7662	0.9111	0.9644	0.9802 (86)
MIT	19.1337	19.3575	19.6993	20.1476	20.5438	20.8318	20.9435	20.9280	20.7326	20.2304	19.6149	19.1048 (87)
Th 2	19.8008	19.8049	19.8089	19.8278	19.8314	19.8479	19.8479	19.8510	19.8415	19.8314	19.8242	19.8167 (88)
util rest of house	0.9718	0.9569	0.9306	0.8750	0.7700	0.5936	0.4132	0.4534	0.6918	0.8843	0.9552	0.9758 (89)
MIT 2	17.3576	17.6823	18.1749	18.8186	19.3542	19.7140	19.8194	19.8115	19.6058	18.9473	18.0698	17.3254 (90)
Living area fraction									fLA = Living area / (4) =			0.1739 (91)
MIT	17.6666	17.9737	18.4401	19.0498	19.5611	19.9084	20.0149	20.0057	19.8018	19.1704	18.3386	17.6349 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5166	17.8237	18.2901	18.8998	19.4111	19.7584	19.8649	19.8557	19.6518	19.0204	18.1886	17.4849 (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	0.9574	0.9386	0.9082	0.8504	0.7496	0.5861	0.4152	0.4539	0.6774	0.8600	0.9370	0.9628	(94)
Useful gains	758.6871	842.1058	882.3151	875.4742	794.1925	602.6382	409.0784	426.8387	611.0702	719.7430	724.4120	724.3770	(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	1799.9640	1753.2104	1593.2915	1326.9049	1019.6840	671.1439	424.7863	448.2491	726.8761	1113.4826	1476.5677	1781.8928	(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	774.7100	612.2623	528.9665	325.0301	167.7657	0.0000	0.0000	0.0000	0.0000	292.9423	541.5521	786.7917	(98)
Space heating												4030.0207	(98)
Space heating per m2											(98) / (4) =	39.9883	(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													4453.0615 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	774.7100	612.2623	528.9665	325.0301	167.7657	0.0000	0.0000	0.0000	0.0000	292.9423	541.5521	786.7917	(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)	856.0331	676.5329	584.4933	359.1493	185.3764	0.0000	0.0000	0.0000	0.0000	323.6931	598.4001	869.3831	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.1282	112.5452	88.8253	45.1827	17.8243	2.5450	0.0000	25.7890	48.5082	92.7942	128.3994	150.1129	(64)
Efficiency of water heater	89.9617	89.9878	90.0255	90.0969	90.1825	87.3000	87.3000	87.3000	87.3000	89.7090	89.8687	87.3000	(216)
(217)m	89.9617	89.9878	90.0255	90.0969	90.1825	87.3000	87.3000	87.3000	87.3000	89.7090	89.8687	89.9716	(217)
Fuel for water heating, kWh/month	167.9917	125.0671	98.6668	50.1490	19.7647	2.9152	0.0000	29.5406	55.5649	103.4392	142.8745	166.8448	(219)
Water heating fuel used												962.8186	(219)
Annual totals kWh/year													
Space heating fuel - main system												4453.0615	(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)												423.5919	(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												4237.2326	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4453.0615	3.4800	154.9665 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	962.8186	3.4800	33.5061 (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	423.5919	13.1900	55.8718 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			153.0090 (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] =	0.4408 (257)
SAP value			93.8505
SAP rating (Section 12)			94 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4453.0615	0.2160	961.8613 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	962.8186	0.2160	207.9688 (264)
Space and water heating			1169.8301 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	423.5919	0.5190	219.8442 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			558.1120 (272)
CO2 emissions per m2			5.5400 (273)
EI value			94.8699
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.3900 (1b)	x 2.5400 (2b)	= 127.9906 (1b) - (3b)
First floor	50.3900 (1c)	x 2.6300 (2c)	= 132.5257 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.5163 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1919 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4424 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4424 (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	0.4645	0.4424	0.4424	0.4092	0.4092	0.3650	0.3761	0.3539	0.3650	0.3871	0.3871	0.4203 (22b)
Effective ac	0.6079	0.5979	0.5979	0.5837	0.5837	0.5666	0.5707	0.5626	0.5666	0.5749	0.5749	0.5883 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	1.3000	2.7690		(26)
Half Glaze			2.1300	1.4000	2.9820		(26a)
Window (Uw = 1.30)			12.7000	1.2357	15.6939		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			50.3900	0.1300	6.5507	75.0000	3779.2500 (28a)
EW Brick AAC015	149.0500	20.2900	128.7600	0.2500	32.1900	52.3000	6734.1480 (29a)
Plane Ceiling	50.3900		50.3900	0.1600	8.0624	9.0000	453.5100 (30)
Total net area of external elements Aum(A, m ²)			249.8300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	72.3630	(33)
GF Timber			59.4900			9.0000	535.4100 (32c)
1F Timber			99.5900			9.0000	896.3100 (32c)
GF Masonry			30.2800			75.0000	2271.0000 (32c)
Internal Floor			50.3900			18.0000	907.0200 (32d)
Internal Ceiling			50.3900			9.0000	453.5100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16030.1580 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.0609 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1639 (36)
Total fabric heat loss							(33) + (36) = 79.5270 (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	52.2616	51.3992	51.3992	50.1844	50.1844	48.7120	49.0643	48.3701	48.7120	49.4271	49.4271	50.5788 (38)
Heat transfer coeff	131.7886	130.9261	130.9261	129.7114	129.7114	128.2389	128.5912	127.8971	128.2389	128.9541	128.9541	130.1058 (39)
Average = Sum(39)m / 12 =												129.5036 (39)
HLP	1.3077	1.2991	1.2991	1.2871	1.2871	1.2725	1.2760	1.2691	1.2725	1.2796	1.2796	1.2910 (40)
HLP (average)												1.2850 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466 (42)
Average daily hot water use (litres/day)												99.4325 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830 (45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1458	12.7657	14.1079	13.6113	14.0313	13.5398	13.9669	14.0086	13.5787	14.0746	13.6600	14.1336 (61)
Total heat required for water heating calculated for each month	176.3469	154.6278	160.4968	141.2367	136.4909	119.2131	111.8888	126.3754	127.2875	146.5913	158.3123	171.2166 (62)
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												1.2243 (H8)
Utilisation factor												0.5582 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.4325 (H14)
Volume ratio Veff/V												0.7543 (H15)
Solar storage volume factor												0.9436 (H16)
Solar input												-887.0104 (H17)
Solar input	-27.3017	-41.0345	-69.1072	-95.5273	-115.0470	-121.0820	-118.1746	-105.5306	-82.3670	-56.0328	-33.1860	-22.6197 (63)
Solar input (sum of months) = Sum (63)m =												-887.0104 (63)
Output from w/h	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969 (64)
Total per year (kWh/year) = Sum (64)m =												851.2283 (64)
Heat gains from water heating, kWh/month	57.4683	50.3606	52.2013	45.8383	44.2256	38.5213	36.0507	40.8641	41.2029	47.5804	51.5119	55.7635 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9638	53.2593	43.3134	32.7910	24.5117	20.6938	22.3604	29.0649	39.0108	49.5332	57.8125	61.6304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)	77.2423	74.9413	70.1630	63.6643	59.4431	53.5018	48.4553	54.9249	57.2262	63.9522	71.5443	74.9509	(72)
Total internal gains	633.8168	628.8007	604.0233	565.6002	526.0834	490.9329	470.5899	479.7746	502.0750	540.7254	583.6130	616.2290	(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				5.0200	11.9814	0.4600	0.0000		0.7700	21.3040 (74)		
South				7.6800	50.9848	0.4600	0.0000		0.7700	138.6918 (78)		
North				3.3300	11.9814	0.4600	0.0000		0.7700	14.1319 (74)		
Solar gains	174.1277	265.3246	360.3382	472.6284	533.1003	576.1644	545.3399	496.3794	426.3820	312.9927	213.1786	147.9724 (83)
Total gains	807.9445	894.1253	964.3615	1038.2286	1059.1838	1067.0973	1015.9298	976.1540	928.4570	853.7181	796.7916	764.2014 (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	33.7876	34.0102	34.0102	34.3287	34.3287	34.7229	34.6277	34.8157	34.7229	34.5303	34.5303	34.2246	
alpha	3.2525	3.2673	3.2673	3.2886	3.2886	3.3149	3.3085	3.3210	3.3149	3.3020	3.3020	3.2816	
util living area	0.9718	0.9597	0.9333	0.8738	0.7589	0.5510	0.3814	0.4054	0.6771	0.8807	0.9531	0.9756	(86)
MIT	19.3526	19.5407	19.8905	20.3269	20.7044	20.9325	20.9859	20.9828	20.8539	20.4172	19.8390	19.3296	(87)
Th 2	19.8348	19.8415	19.8415	19.8510	19.8510	19.8625	19.8597	19.8651	19.8625	19.8569	19.8569	19.8479	(88)
util rest of house	0.9655	0.9507	0.9176	0.8425	0.6956	0.4439	0.2462	0.2680	0.5813	0.8442	0.9407	0.9701	(89)
MIT 2	17.6952	17.9692	18.4685	19.0808	19.5699	19.8223	19.8562	19.8605	19.7543	19.2189	18.4116	17.6706	(90)
Living area fraction									fLA = Living area / (4) =			0.1739	(91)
MIT	17.9835	18.2426	18.7158	19.2976	19.7673	20.0154	20.0527	20.0557	19.9456	19.4273	18.6598	17.9592	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8335	18.0926	18.5658	19.1476	19.6173	19.8654	19.9027	19.9057	19.7956	19.2773	18.5098	17.8092	(93)

FULL SAP CALCULATION PRINTOUT

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9496	0.9318	0.8948	0.8189	0.6808	0.4442	0.2515	0.2731	0.5749	0.8209	0.9206	0.9557	(94)
Useful gains	767.2508	833.1460	862.8690	850.1573	721.1258	474.0014	255.4744	266.5914	533.8146	700.7828	733.5199	730.3111	(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	1678.1294	1635.6058	1461.9011	1199.5130	858.3334	495.6945	257.5305	269.3102	589.3351	990.0193	1355.2875	1653.5378	(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	677.6937	539.2530	445.6799	251.5361	102.0825	0.0000	0.0000	0.0000	0.0000	215.1920	447.6727	686.8807	(98)
Space heating												3365.9906	(98)
Space heating per m2											(98) / (4) =	33.3994	(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													3719.3266 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	677.6937	539.2530	445.6799	251.5361	102.0825	0.0000	0.0000	0.0000	0.0000	215.1920	447.6727	686.8807	(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)	748.8328	595.8597	492.4640	277.9404	112.7983	0.0000	0.0000	0.0000	0.0000	237.7812	494.6660	758.9842	(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	149.0451	113.5933	91.3896	45.7094	21.4439	0.0000	0.0000	20.8448	44.9205	90.5585	125.1263	148.5969	(64)
Efficiency of water heater	89.9059	89.9265	89.9390	89.9927	89.9278	87.3000	87.3000	87.3000	87.3000	89.5280	89.7811	87.3000	(216)
(217)m	89.9059	89.9265	89.9390	89.9927	89.9278	87.3000	87.3000	87.3000	87.3000	89.5280	89.7811	89.9138	(217)
Fuel for water heating, kWh/month	165.7791	126.3180	101.6129	50.7923	23.8457	0.0000	0.0000	23.8772	51.4554	101.1510	139.3682	165.2660	(219)
Water heating fuel used												949.4656	(219)
Annual totals kWh/year												3719.3266	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
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)												423.5919	(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												3393.2244	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3719.3266	9.7400	362.2624	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	949.4656	9.7400	92.4779	(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	423.5919	36.8500	156.0936	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028	(252)
Total energy cost			88.6936	(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	3719.3266	0.2160	803.3745	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	949.4656	0.2160	205.0846	(264)
Space and water heating			1008.4591	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	423.5919	0.5190	219.8442	(268)
Energy saving/generation technologies				

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PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			346.4394 (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	3719.3266	1.2200	4537.5785 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	949.4656	1.2200	1158.3480 (264)
Space and water heating			5695.9265 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	423.5919	3.0700	1300.4271 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1779.9335 (272)
Primary energy kWh/m2/year			17.6616 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	159.1 (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	343.88 (P1)
Transmission heat loss coefficient	79.53 (37)
Summer heat loss coefficient	423.41 (P2)

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Shading	Gains W
North	5.0200	81.1852	0.4600	0.0000	0.9000	168.7255
South	7.6800	112.2060	0.4600	0.0000	0.9000	356.7612
North	3.3300	81.1852	0.4600	0.0000	0.9000	111.9235
total:						637.4102

	Jun	Jul	Aug	
Solar gains	673	637	580	(P4)
Internal gains	488	468	477	
Total summer gains	1161	1105	1057	(P5)
Summer gain/loss ratio	2.74	2.61	2.50	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 159.1)	0.89	0.89	0.89	
Threshold temperature	19.63	21.40	21.18	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			