

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-P637-6633-625				Issued on Date	22/03/2023
Assessment Reference	Plot 625	Prop Type Ref	Dawlish-As-DET			
Property	Plot 625, 3 Bed, K, WC, Ut, B, En					
SAP Rating	83 B	DER	18.58	TER	19.35	
Environmental	84 B	% DER<TER	3.98			
CO ₂ Emissions (t/year)	1.49	DFEE	55.48	TFEE	62.88	
General Requirements Compliance	Pass	% DFEE<TFEE	11.77			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 97 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) 19.35 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)62.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.5 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: 1.03 m², No overhang

Windows facing North East: 6.71 m², No overhang

Windows facing South East: 5.95 m², No overhang

Windows facing South West: 1.31 m², No overhang

Windows facing West: 1.03 m², No overhang

Windows facing North West: 5.25 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 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283 (22b)
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	55.0546	54.5259	54.0076	51.5733	51.1179	48.9977	48.9977	48.6051	49.8144	51.1179	52.0393	53.0025 (38)
Average = Sum(39)m / 12 =	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
												136.9449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4424	1.4369	1.4316	1.4066	1.4019	1.3802	1.3802	1.3761	1.3885	1.4019	1.4114	1.4213 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
										Total per year (kWh/year) = Sum (64)m =		1717.7401 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4777	19.9645	16.2362	12.2919	9.1883	7.7572	8.3819	10.8951	14.6234	18.5677	21.6713	23.1024 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	417.8424	415.6611	400.6028	376.1820	351.1829	327.2146	311.7142	318.0311	330.6319	355.2780	383.6216	405.0753 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					1.0300	10.6334		0.4600	0.0000	0.7700		3.8793 (74)
Northeast					6.7100	11.2829		0.4600	0.0000	0.7700		26.8160 (75)
Southeast					2.6200	36.7938		0.4600	0.0000	0.7700		34.1448 (77)
Southwest					1.3100	36.7938		0.4600	0.0000	0.7700		17.0724 (79)
West					1.0300	19.6403		0.4600	0.0000	0.7700		7.1653 (80)
Northwest					5.2500	11.2829		0.4600	0.0000	0.7700		20.9812 (81)
Southeast					3.3300	36.7938		0.4600	0.0000	0.7700		43.3978 (77)

Solar gains	153.4568	279.8873	431.4836	615.0031	761.5153	787.7822	746.2971	632.2586	494.3554	322.4772	187.1881	129.1307 (83)
Total gains	571.2992	695.5484	832.0863	991.1851	1112.6982	1114.9968	1058.0113	950.2898	824.9873	677.7552	570.8097	534.2060 (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	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
alpha	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
util living area	0.9929	0.9858	0.9684	0.9201	0.8190	0.6644	0.5220	0.5875	0.8172	0.9549	0.9877	0.9943 (86)
MIT	18.9333	19.1766	19.5840	20.1270	20.5801	20.8596	20.9541	20.9316	20.6958	20.0942	19.4244	18.9054 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house	0.9910	0.9820	0.9597	0.8972	0.7668	0.5703	0.3925	0.4561	0.7433	0.9375	0.9838	0.9928 (89)
MIT 2	17.0055	17.3617	17.9528	18.7325	19.3373	19.6750	19.7582	19.7477	19.5075	18.7053	17.7364	16.9744 (90)
Living area fraction	17.3964	17.7297	18.2836	19.0153	19.5893	19.9152	20.0007	19.9878	19.7484	18.9869	18.0787	17.3659 (92)
MIT	17.3964	17.7297	18.2836	19.0153	19.5893	19.9152	20.0007	19.9878	19.7484	18.9869	18.0787	17.3659 (92)
Temperature adjustment	17.2464	17.5797	18.1336	18.8653	19.4393	19.7652	19.8507	19.8378	19.5984	18.8369	17.9287	-0.1500
adjusted MIT	17.2464	17.5797	18.1336	18.8653	19.4393	19.7652	19.8507	19.8378	19.5984	18.8369	17.9287	17.2159 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9849	0.9721	0.9437	0.8758	0.7507	0.5691	0.4007	0.4627	0.7305	0.9189	0.9748	0.9877 (94)
Ext temp.	562.6763	676.1617	785.2439	868.0620	835.2856	634.5647	423.9417	439.7022	602.6661	622.8098	556.4282	527.6613 (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	1818.0409	1773.8847	1621.5014	1364.7153	1056.3470	694.0522	436.7988	460.5869	743.3219	1124.2630	1488.0016	1801.0957 (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)
	933.9913	737.6698	622.1755	357.5904	164.4697	0.0000	0.0000	0.0000	0.0000	373.0812	670.7329	947.4352 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 4807.1459 (98)
 Space heating per m2 (98) / (4) = 49.3750 (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													5311.7635 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	933.9913	737.6698	622.1755	357.5904	164.4697	0.0000	0.0000	0.0000	0.0000	373.0812	670.7329	947.4352	(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)	1032.0346	815.1048	687.4868	395.1275	181.7344	0.0000	0.0000	0.0000	0.0000	412.2444	741.1413	1046.8897	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater	89.9794	89.9322	89.8287	89.5751	89.0258	87.3000	87.3000	87.3000	87.3000	89.5785	89.8746	89.9982	(216)
(217)m	89.9794	89.9322	89.8287	89.5751	89.0258	87.3000	87.3000	87.3000	87.3000	89.5785	89.8746	89.9982	(217)
Fuel for water heating, kWh/month	194.5648	170.6948	177.3853	156.5483	152.2295	135.5997	127.2799	143.7432	144.7757	162.4794	174.8792	188.8686	(219)
Water heating fuel used												1929.0483	(219)
Annual totals kWh/year													
Space heating fuel - main system												5311.7635	(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)												396.9635	(232)
Total delivered energy for all uses												7712.7753	(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	5311.7635	0.2160	1147.3409	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.0483	0.2160	416.6744	(264)
Space and water heating			1564.0153	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total CO2, kg/year			1808.9644	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.5800	(273)

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

DER	18.5800	ZC1
Total Floor Area	97.3600	TFA
Assumed number of occupants	2.7137	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.3372	ZC2
CO2 emissions from cooking, equation (L16)	1.8912	ZC3
Total CO2 emissions	35.8084	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	35.8084	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1195 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3695 (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) =	0.3695 (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	0.4711	0.4618	0.4526	0.4064	0.3972	0.3510	0.3510	0.3417	0.3695	0.3972	0.4156	0.4341 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5682	0.5789	0.5864	0.5942 (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 (U _w = 1.40)			20.0900	1.3258	26.6345		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051		(28a)
EW Brick AAC015	147.0400	24.3500	122.6900	0.1800	22.0842		(29a)
Plane Ceiling	48.0900		48.0900	0.1300	6.2517		(30)
Bay	1.1800		1.1800	0.1300	0.1534		(30)
Total net area of external elements A _{um} (A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2149		(33)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3682 (36)
Total fabric heat loss						(33) + (36) =	78.5831 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	50.6332	50.2762	49.9262	48.2824	47.9748	46.5431	46.5431	46.2779	47.0946	47.9748	48.5970	49.2475 (38)
Heat transfer coeff	129.2163	128.8592	128.5093	126.8654	126.5579	125.1262	125.1262	124.8610	125.6776	126.5579	127.1801	127.8305 (39)
Average = Sum(39)m / 12 =												126.8640 (39)
HLP	1.3272	1.3235	1.3199	1.3031	1.2999	1.2852	1.2852	1.2825	1.2909	1.2999	1.3063	1.3130 (40)
HLP (average)												1.3030 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Daily hot water use	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy conte	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1552.1566 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	50.9589	46.0274	50.9589	47.6766	47.2549	43.7846	45.2441	47.2549	47.6766	50.9589	49.3151	50.9589 (57)
Total heat required for water heating calculated for each month	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066 (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	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066 (64)
Heat gains from water heating, kWh/month	66.2474	58.3050	61.0313	54.0209	52.2113	45.8062	43.6140	48.8819	49.4300	56.4550	60.0474	64.5591 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5569	20.0348	16.2934	12.3351	9.2207	7.7845	8.4114	10.9335	14.6749	18.6331	21.7476	23.1838	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	89.0423	86.7634	82.0313	75.0290	70.1765	63.6197	58.6210	65.7014	68.6528	75.8804	83.3992	86.7730	(72)
Total internal gains	430.2925	428.1065	413.0436	388.0552	362.3805	337.7448	322.2546	329.2423	342.5243	367.7381	396.0791	417.5318	(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				0.9700	10.6334	0.6300	0.7000		0.7700	3.1522 (74)		
Northeast				6.3400	11.2829	0.6300	0.7000		0.7700	21.8617 (75)		
Southeast				5.6200	36.7938	0.6300	0.7000		0.7700	63.1951 (77)		
Southwest				1.2400	36.7938	0.6300	0.7000		0.7700	13.9434 (79)		
West				0.9700	19.6403	0.6300	0.7000		0.7700	5.8223 (80)		
Northwest				4.9500	11.2829	0.6300	0.7000		0.7700	17.0687 (81)		
Solar gains	125.0433	228.0527	351.5463	501.0281	620.3589	641.7457	607.9554	515.0744	402.7572	262.7476	152.5268	105.2227 (83)
Total gains	555.3358	656.1592	764.5898	889.0833	982.7395	979.4905	930.2100	844.3167	745.2816	630.4856	548.6059	522.7545 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3240	52.4690	52.6119	53.2936	53.4231	54.0344	54.0344	54.1491	53.7973	53.4231	53.1617	52.8912	
alpha	4.4883	4.4979	4.5075	4.5529	4.5615	4.6023	4.6023	4.6099	4.5865	4.5615	4.5441	4.5261	
util living area	0.9983	0.9961	0.9893	0.9632	0.8855	0.7303	0.5690	0.6387	0.8771	0.9815	0.9966	0.9987	(86)
MIT	19.5016	19.6713	19.9642	20.3631	20.7120	20.9195	20.9800	20.9669	20.7992	20.3452	19.8547	19.4772	(87)
Th 2	19.8196	19.8224	19.8252	19.8384	19.8409	19.8525	19.8525	19.8546	19.8480	19.8409	19.8359	19.8307	(88)
util rest of house	0.9977	0.9948	0.9852	0.9483	0.8390	0.6316	0.4320	0.4993	0.8080	0.9716	0.9952	0.9983	(89)
MIT 2	17.8332	18.0829	18.5108	19.0899	19.5579	19.7992	19.8454	19.8411	19.6824	19.0749	18.3608	17.8052	(90)
Living area fraction	18.1715	18.4049	18.8055	19.3480	19.7919	20.0264	20.0754	20.0694	19.9088	19.3325	18.6637	18.1442	(92)
MIT	18.1715	18.4049	18.8055	19.3480	19.7919	20.0264	20.0754	20.0694	19.9088	19.3325	18.6637	18.1442	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.1715	18.4049	18.8055	19.3480	19.7919	20.0264	20.0754	20.0694	19.9088	19.3325	18.6637	18.1442	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	553.3396	651.0520	749.3868	835.7637	822.2329	634.7270	427.7679	445.2287	605.4745	608.5905	544.6948	521.3194	(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	1792.4230	1740.2344	1581.3726	1325.4947	1024.0957	678.9819	434.8646	458.1619	730.0386	1105.1657	1470.6714	1782.4914	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	921.8781	731.9305	618.9974	352.6063	150.1860	0.0000	0.0000	0.0000	0.0000	369.4520	666.7032	938.3120	(98)
Space heating												4750.0655	(98)
Space heating per m2												48.7887	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5085.7232	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	921.8781	731.9305	618.9974	352.6063	150.1860	0.0000	0.0000	0.0000	0.0000	369.4520	666.7032	938.3120	(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)	987.0215	783.6516	662.7382	377.5228	160.7987	0.0000	0.0000	0.0000	0.0000	395.5588	713.8150	1004.6167	(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	211.8843	186.7738	196.1966	174.2983	168.7515	148.6269	142.3959	158.7381	160.4912	182.4334	192.8298	206.8066	(64)	
Efficiency of water heater (217)m	88.3238	88.1460	87.7438	86.7890	84.7593	80.3000	80.3000	80.3000	80.3000	86.7914	87.9191	88.3921	(216)	
Fuel for water heating, kWh/month	239.8948	211.8914	223.6015	200.8300	199.0951	185.0896	177.3299	197.6813	199.8645	210.1976	219.3263	233.9649	(219)	
Water heating fuel used												2498.7668	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5085.7232	(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)												398.3610	(232)	
Total delivered energy for all uses												8057.8510	(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	5085.7232	0.2160	1098.5162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2498.7668	0.2160	539.7336 (264)
Space and water heating			1638.2498 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.3610	0.5190	206.7494 (268)
Total CO2, kg/m2/year			1883.9242 (272)
Emissions per m2 for space and water heating			16.8267 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1236 (272b)
Emissions per m2 for pumps and fans			0.3998 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8267 * 1.00) + 2.1236 + 0.3998, rounded to 2 d.p.			19.3500 (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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1195 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.3700 (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) =					0.3700 (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	0.4717	0.4624	0.4532	0.4069	0.3977	0.3515	0.3515	0.3422	0.3700	0.3977	0.4162	0.4347 (22b)					
Effective ac	0.6112	0.6069	0.6027	0.5828	0.5791	0.5618	0.5618	0.5586	0.5684	0.5791	0.5866	0.5945 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(32)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (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	50.6581	50.3001	49.9492	48.3009	47.9925	46.5569	46.5569	46.2911	47.1099	47.9925	48.6164	49.2686 (38)
Heat transfer coeff	136.0318	135.6738	135.3229	133.6746	133.3662	131.9306	131.9306	131.6648	132.4836	133.3662	133.9901	134.6423 (39)
Average = Sum(39)m / 12 =												133.6731 (39)
HLP	1.3972	1.3935	1.3899	1.3730	1.3698	1.3551	1.3551	1.3523	1.3608	1.3698	1.3762	1.3829 (40)
HLP (average)												1.3730 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1552.1566 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1967	29.9086	30.8630	26.9071	25.8180	22.2790	20.6448	23.6902	23.9731	27.9383	30.4969	33.1176 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4777	19.9645	16.2362	12.2919	9.1883	7.7572	8.3819	10.8951	14.6234	18.5677	21.6713	23.1024	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	45.9632	44.5069	41.4825	37.3710	34.7016	30.9430	27.7483	31.8416	33.2960	37.5515	42.3568	44.5130	(72)
Total internal gains	384.1344	382.7796	369.4377	347.3539	323.8733	302.0408	288.3524	292.3441	304.1161	326.3439	351.9604	372.1904	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.0300	10.6334	0.4600	0.0000	0.7700	3.8793 (74)			
Northeast				6.7100	11.2829	0.4600	0.0000	0.7700	26.8160 (75)			
Southeast				2.6200	36.7938	0.4600	0.0000	0.7700	34.1448 (77)			
Southwest				1.3100	36.7938	0.4600	0.0000	0.7700	17.0724 (79)			
West				1.0300	19.6403	0.4600	0.0000	0.7700	7.1653 (80)			
Northwest				5.2500	11.2829	0.4600	0.0000	0.7700	20.9812 (81)			
Southeast				3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (77)			
Solar gains	153.4568	279.8873	431.4836	615.0031	761.5153	787.7822	746.2971	632.2586	494.3554	322.4772	187.1881	129.1307 (83)
Total gains	537.5912	662.6670	800.9212	962.3570	1085.3886	1089.8230	1034.6496	924.6027	798.4715	648.8211	539.1485	501.3211 (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	35.6561	35.7502	35.8429	36.2849	36.3688	36.7645	36.7645	36.8388	36.6111	36.3688	36.1994	36.0241	
alpha	3.3771	3.3833	3.3895	3.4190	3.4246	3.4510	3.4510	3.4559	3.4407	3.4246	3.4133	3.4016	
util living area	0.9941	0.9876	0.9710	0.9237	0.8226	0.6682	0.5248	0.5933	0.8241	0.9591	0.9896	0.9954	(86)
MIT	18.9603	19.2024	19.6071	20.1400	20.5896	20.8624	20.9555	20.9323	20.6968	20.0967	19.4325	18.9236	(87)
Th 2	19.7655	19.7683	19.7711	19.7841	19.7865	19.7979	19.7979	19.8001	19.7935	19.7865	19.7816	19.7764	(88)
util rest of house	0.9926	0.9943	0.9631	0.9018	0.7715	0.5752	0.3966	0.4630	0.7523	0.9433	0.9863	0.9941	(89)
MIT 2	17.9220	18.1645	18.5662	19.0911	19.5018	19.7281	19.7843	19.7768	19.6117	19.0622	18.4046	17.8933	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	18.1325	18.3749	18.7773	19.3038	19.7223	19.9581	20.0218	20.0111	19.8317	19.2720	18.6130	18.1022	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1325	18.3749	18.7773	19.3038	19.7223	19.9581	20.0218	20.0111	19.8317	19.2720	18.6130	18.1022	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	531.9844	648.8702	764.4634	857.5913	834.0108	641.6329	436.5217	450.9998	602.8235	606.1713	529.3576	497.1541	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1881.6576	1828.1905	1661.3970	1390.7214	1069.9067	706.8987	451.4346	475.4529	759.3589	1156.5496	1542.6259	1871.8246	(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	1004.1568	792.5032	667.3186	383.8537	175.5065	0.0000	0.0000	0.0000	0.0000	409.4814	729.5532	1022.7548	(98)
Space heating												5185.1283	(98)
Space heating per m2												(98) / (4) =	53.2573 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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	1240.1479	976.2866	1000.6523	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8141	0.8736	0.8358	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1009.6619	852.8818	836.3634	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1377.3531	1310.6366	1183.8184	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	264.7377	340.5695	258.5065	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												863.8137	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	66.1844	85.1424	64.6266	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												215.9534	(107)
Energy for space heating												2.2181	(108)
Energy for space cooling												53.2573	(99)
Total												2.2181	(108)
Dwelling Fabric Energy Efficiency (DFEE)												55.4754	(109)
												55.5	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1195 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3695 (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) =	0.3695 (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	0.4711	0.4618	0.4526	0.4064	0.3972	0.3510	0.3510	0.3417	0.3695	0.3972	0.4156	0.4341 (22b)
Effective ac	0.6109	0.6066	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5682	0.5789	0.5864	0.5942 (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)			20.0900	1.3258	26.6345		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051		(28a)
EW Brick AAC015	147.0400	24.3500	122.6900	0.1800	22.0842		(29a)
Plane Ceiling	48.0900		48.0900	0.1300	6.2517		(30)
Bay	1.1800		1.1800	0.1300	0.1534		(30)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2149		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3682 (36)
Total fabric heat loss						(33) + (36) =	78.5831 (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	50.6332	50.2762	49.9262	48.2824	47.9748	46.5431	46.5431	46.2779	47.0946	47.9748	48.5970	49.2475 (38)
Heat transfer coeff	129.2163	128.8592	128.5093	126.8654	126.5579	125.1262	125.1262	124.8610	125.6776	126.5579	127.1801	127.8305 (39)
Average = Sum(39)m / 12 =												126.8640 (39)
HLP	1.3272	1.3235	1.3199	1.3031	1.2999	1.2852	1.2852	1.2825	1.2909	1.2999	1.3063	1.3130 (40)
HLP (average)												1.3030 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy conte	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Energy content (annual)										Total = Sum(45)m =		1552.1566 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.1967	29.9086	30.8630	26.9071	25.8180	22.2790	20.6448	23.6902	23.9731	27.9383	30.4969	33.1176 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	135.6853	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5569	20.0348	16.2934	12.3351	9.2207	7.7845	8.4114	10.9335	14.6749	18.6331	21.7476	23.1838	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.9878	254.6027	248.0133	233.9854	216.2777	199.6350	188.5166	185.9018	192.4911	206.5190	224.2267	240.8694	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	36.5685	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	(71)
Water heating gains (Table 5)	45.9632	44.5069	41.4825	37.3710	34.7016	30.9430	27.7483	31.8416	33.2960	37.5515	42.3568	44.5130	(72)
Total internal gains	384.2135	382.8499	369.4949	347.3972	323.9056	302.0681	288.3820	292.3825	304.1675	326.4092	352.0367	372.2718	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.9700	10.6334	0.6300	0.7000	0.7700	3.1522 (74)
Northeast	6.3400	11.2829	0.6300	0.7000	0.7700	21.8617 (75)
Southeast	5.6200	36.7938	0.6300	0.7000	0.7700	63.1951 (77)
Southwest	1.2400	36.7938	0.6300	0.7000	0.7700	13.9434 (79)
West	0.9700	19.6403	0.6300	0.7000	0.7700	5.8223 (80)
Northwest	4.9500	11.2829	0.6300	0.7000	0.7700	17.0687 (81)

Solar gains	125.0433	228.0527	351.5463	501.0281	620.3589	641.7457	607.9554	515.0744	402.7572	262.7476	152.5268	105.2227	(83)
Total gains	509.2568	610.9027	721.0411	848.4253	944.2646	943.8138	896.3374	807.4569	706.9248	589.1568	504.5635	477.4944	(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	52.3240	52.4690	52.6119	53.2936	53.4231	54.0344	54.0344	54.1491	53.7973	53.4231	53.1617	52.8912	
alpha	4.4883	4.4979	4.5075	4.5529	4.5615	4.6023	4.6023	4.6099	4.5865	4.5615	4.5441	4.5261	
util living area	0.9988	0.9971	0.9915	0.9688	0.8975	0.7482	0.5873	0.6612	0.8936	0.9857	0.9976	0.9991	(86)
MIT	19.4588	19.6297	19.9254	20.3307	20.6906	20.9109	20.9773	20.9619	20.7786	20.3094	19.8140	19.4351	(87)
Th 2	19.8196	19.8224	19.8252	19.8384	19.8409	19.8525	19.8525	19.8546	19.8480	19.8409	19.8359	19.8307	(88)
util rest of house	0.9984	0.9961	0.9882	0.9558	0.8540	0.6503	0.4474	0.5200	0.8298	0.9778	0.9966	0.9988	(89)
MIT 2	18.4208	18.5934	18.8897	19.2971	19.6307	19.8115	19.8469	19.8438	19.7203	19.2837	18.7883	18.4057	(90)
Living area fraction										fLA = Living area / (4) =		0.2028	(91)
MIT	18.6312	18.8035	19.0997	19.5067	19.8456	20.0344	20.0761	20.0705	19.9348	19.4916	18.9963	18.6144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6312	18.8035	19.0997	19.5067	19.8456	20.0344	20.0761	20.0705	19.9348	19.4916	18.9963	18.6144	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9948	0.9854	0.9510	0.8542	0.6675	0.4761	0.5488	0.8357	0.9744	0.9955	0.9984	(94)
Ext temp.	508.1316	607.7089	710.4861	806.8219	806.6082	629.9844	426.7732	443.1047	590.7782	574.0798	502.2697	476.7100	(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	1851.8277	1791.5941	1619.1735	1345.6215	1030.8886	679.9899	434.9460	458.2973	733.3094	1125.3069	1512.9700	1842.5966	(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	999.7099	795.5709	676.0634	387.9357	166.8647	0.0000	0.0000	0.0000	0.0000	410.1130	727.7042	1016.2197	(98)
Space heating per m2												5180.1815	(98)
										(98) / (4) =		53.2065	(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	1176.1858	925.9335	948.9437	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8319	0.8975	0.8596	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	978.4305	831.0504	815.7189	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.7294	1149.0123	1046.9457	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	164.3752	236.5637	172.0328	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												572.9716 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.0938	59.1409	43.0082	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.2429 (107)
Space cooling per m2												1.4713 (108)
Energy for space heating												53.2065 (99)
Energy for space cooling												1.4713 (108)
Total												54.6777 (109)
Target Fabric Energy Efficiency (TFEE)												62.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
												133.7720 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
												1718 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North												1.0300	11.9814	0.4600	0.0000	0.7700	4.3711 (74)
Northeast												6.7100	12.9236	0.4600	0.0000	0.7700	30.7152 (75)
Southeast												2.6200	40.4699	0.4600	0.0000	0.7700	37.5562 (77)
Southwest												1.3100	40.4699	0.4600	0.0000	0.7700	18.7781 (79)
West												1.0300	22.3313	0.4600	0.0000	0.7700	8.1470 (80)
Northwest												5.2500	12.9236	0.4600	0.0000	0.7700	24.0320 (81)
Southeast												3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (77)
Solar gains	171.3334	282.1937	432.0801	637.6303	770.6034	853.3161	799.5989	692.0506	537.7384	347.8515	214.3165	142.6535 (83)					
Total gains	791.5703	897.7673	1023.7575	1192.0612	1286.6581	1335.0586	1261.3019	1162.5524	1029.6789	877.2638	785.4495	745.5841 (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	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
alpha	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
util living area	0.9785	0.9664	0.9341	0.8504	0.6983	0.4728	0.3218	0.3566	0.6512	0.8885	0.9625	0.9818 (86)
MIT	19.3697	19.5716	19.9622	20.4415	20.7956	20.9629	20.9929	20.9901	20.8840	20.4413	19.8468	19.3448 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9729	0.9579	0.9170	0.8122	0.6255	0.3683	0.1985	0.2259	0.5473	0.8501	0.9512	0.9771 (89)
MIT 2	17.6589	17.9528	18.5079	19.1670	19.6024	19.7742	19.7892	19.7939	19.7150	19.1905	18.3628	17.6315 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	18.0058	18.2810	18.8028	19.4254	19.8443	20.0152	20.0332	20.0364	19.9520	19.4441	18.6637	17.9788 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8558	18.1310	18.6528	19.2754	19.6943	19.8652	19.8832	19.8864	19.8020	19.2941	18.5137	17.8288 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9603	0.9419	0.8965	0.7932	0.6197	0.3748	0.2081	0.2359	0.5481	0.8302	0.9344	0.9658 (94)
Useful gains	760.1635	845.5863	917.7732	945.5660	797.3889	500.3293	262.5343	274.2885	564.3703	728.3196	733.9570	720.0679 (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	1735.3793	1694.0448	1521.2408	1256.1078	896.8985	512.1902	263.4988	275.7679	609.8301	1025.0426	1400.6914	1710.3931 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	725.5605	570.1641	448.9799	223.5901	74.0351	0.0000	0.0000	0.0000	0.0000	220.7619	480.0488	736.8019 (98)
Space heating												3479.9425 (98)
RHI space heating demand												3480 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1991 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.4496 (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) =					0.4496	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283	(22b)				
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395	(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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.0546	Feb 54.5259	Mar 54.0076	Apr 51.5733	May 51.1179	Jun 48.9977	Jul 48.9977	Aug 48.6051	Sep 49.8144	Oct 51.1179	Nov 52.0393	Dec 53.0025 (38)
Heat transfer coeff	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
Average = Sum(39)m / 12 =												136.9449 (39)
HLP	Jan 1.4424	Feb 1.4369	Mar 1.4316	Apr 1.4066	May 1.4019	Jun 1.3802	Jul 1.3802	Aug 1.3761	Sep 1.3885	Oct 1.4019	Nov 1.4114	Dec 1.4213 (40)
HLP (average)												1.4066 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
								Total per year (kWh/year) =	Sum (64)m =			1717.7401 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)												
	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0300	10.6334	0.4600	0.0000	0.7700	3.8793 (74)
Northeast	6.7100	11.2829	0.4600	0.0000	0.7700	26.8160 (75)
Southeast	2.6200	36.7938	0.4600	0.0000	0.7700	34.1448 (77)
Southwest	1.3100	36.7938	0.4600	0.0000	0.7700	17.0724 (79)
West	1.0300	19.6403	0.4600	0.0000	0.7700	7.1653 (80)
Northwest	5.2500	11.2829	0.4600	0.0000	0.7700	20.9812 (81)
Southeast	3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (77)

Solar gains	153.4568	279.8873	431.4836	615.0031	761.5153	787.7822	746.2971	632.2586	494.3554	322.4772	187.1881	129.1307 (83)
Total gains	773.6936	895.4610	1023.1609	1169.4340	1277.5700	1269.5247	1208.0001	1102.7604	986.2959	851.8896	758.3211	732.0614 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
alpha	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
util living area	0.9827	0.9711	0.9456	0.8833	0.7686	0.6067	0.4665	0.5222	0.7503	0.9198	0.9723	0.9854 (86)
MIT	19.1577	19.3906	19.7725	20.2688	20.6629	20.8942	20.9674	20.9523	20.7732	20.2541	19.6274	19.1276 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house	0.9783	0.9639	0.9318	0.8533	0.7106	0.5137	0.3469	0.3990	0.6673	0.8924	0.9641	0.9817 (89)
MIT 2	17.3304	17.6687	18.2170	18.9189	19.4310	19.7033	19.7646	19.7591	19.5850	18.9197	18.0271	17.2966 (90)
Living area fraction												0.2028 (91)
MIT	17.7009	18.0178	18.5324	19.1926	19.6808	19.9447	20.0085	20.0010	19.8259	19.1902	18.3516	17.6678 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5509	17.8678	18.3824	19.0426	19.5308	19.7947	19.8585	19.8510	19.6759	19.0402	18.2016	17.5178 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9670	0.9487	0.9117	0.8320	0.6982	0.5151	0.3551	0.4065	0.6598	0.8713	0.9493	0.9718 (94)
Useful gains	748.1978	849.5021	932.8457	973.0173	891.9667	653.9025	428.9480	448.2454	650.7685	742.2886	719.8905	711.4167 (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	1860.7956	1814.1898	1656.1832	1389.0015	1068.8371	698.0237	437.8495	462.3657	753.7986	1152.0230	1525.4988	1842.8694 (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	827.7728	648.2702	538.1631	299.5086	131.5916	0.0000	0.0000	0.0000	0.0000	304.8424	580.0380	841.8008 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 4171.9875 (98)
 Space heating per m2 (98) / (4) = 42.8511 (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													4609.9309 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	827.7728	648.2702	538.1631	299.5086	131.5916	0.0000	0.0000	0.0000	0.0000	304.8424	580.0380	841.8008	(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)	914.6661	716.3206	594.6554	330.9487	145.4051	0.0000	0.0000	0.0000	0.0000	336.8425	640.9259	930.1667	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater	89.9246	89.8693	89.7485	89.4544	88.8477	87.3000	87.3000	87.3000	87.3000	89.4405	89.7982	89.9461	(216)
Fuel for water heating, kWh/month	194.6834	170.8142	177.5438	156.7596	152.5347	135.5997	127.2799	143.7432	144.7757	162.7300	175.0279	188.9779	(217)
Water heating fuel used												1930.4700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4609.9309	(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)												396.9635	(232)
Total delivered energy for all uses												7012.3644	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4609.9309	3.4800	160.4256 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1930.4700	3.4800	67.1804 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	396.9635	13.1900	52.3595 (250)
Additional standing charges			120.0000 (251)
Total energy cost			409.8579 (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] =	1.2092 (257)
SAP value	83.1318	
SAP rating (Section 12)	83	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4609.9309	0.2160	995.7451 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1930.4700	0.2160	416.9815 (264)
Space and water heating			1412.7266 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.9635	0.5190	206.0241 (268)
Total kg/year			1657.6757 (272)
CO2 emissions per m2			17.0300 (273)
EI value			84.3967
EI rating			84
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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8885 = 3.917$, stars = 4
 $0.216 / 0.8885 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
Effective ac	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
	133.7720 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)
								Total per year (kWh/year) =	Sum (64)m =			1717.7401 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)												
	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North	1.0300	11.9814	0.4600	0.0000	0.7700	4.3711 (74)
Northeast	6.7100	12.9236	0.4600	0.0000	0.7700	30.7152 (75)
Southeast	2.6200	40.4699	0.4600	0.0000	0.7700	37.5562 (77)
Southwest	1.3100	40.4699	0.4600	0.0000	0.7700	18.7781 (79)
West	1.0300	22.3313	0.4600	0.0000	0.7700	8.1470 (80)
Northwest	5.2500	12.9236	0.4600	0.0000	0.7700	24.0320 (81)
Southeast	3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (77)

Solar gains	171.3334	282.1937	432.0801	637.6303	770.6034	853.3161	799.5989	692.0506	537.7384	347.8515	214.3165	142.6535 (83)
Total gains	791.5703	897.7673	1023.7575	1192.0612	1286.6581	1335.0586	1261.3019	1162.5524	1029.6789	877.2638	785.4495	745.5841 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
util living area	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
	0.9785	0.9664	0.9341	0.8504	0.6983	0.4728	0.3218	0.3566	0.6512	0.8885	0.9625	0.9818 (86)
MIT	19.3697	19.5716	19.9622	20.4415	20.7956	20.9629	20.9929	20.9901	20.8840	20.4413	19.8468	19.3448 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9729	0.9579	0.9170	0.8122	0.6255	0.3683	0.1985	0.2259	0.5473	0.8501	0.9512	0.9771 (89)
MIT 2	17.6589	17.9528	18.5079	19.1670	19.6024	19.7742	19.7892	19.7939	19.7150	19.1905	18.3628	17.6315 (90)
Living area fraction	18.0058	18.2810	18.8028	19.4254	19.8443	20.0152	20.0332	20.0364	19.9520	19.4441	18.6637	17.9788 (91)
MIT												0.2028 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.8558	18.1310	18.6528	19.2754	19.6943	19.8652	19.8832	19.8864	19.8020	19.2941	18.5137	17.8288 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9603	0.9419	0.8965	0.7932	0.6197	0.3748	0.2081	0.2359	0.5481	0.8302	0.9344	0.9658 (94)
Ext temp.	760.1635	845.5863	917.7732	945.5660	797.3889	500.3293	262.5343	274.2885	564.3703	728.3196	733.9570	720.0679 (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	1735.3793	1694.0448	1521.2408	1256.1078	896.8985	512.1902	263.4988	275.7679	609.8301	1025.0426	1400.6914	1710.3931 (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)
	725.5605	570.1641	448.9799	223.5901	74.0351	0.0000	0.0000	0.0000	0.0000	220.7619	480.0488	736.8019 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Space heating 3479.9425 (98)
 Space heating per m2 (98) / (4) = 35.7430 (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													3845.2403 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	725.5605	570.1641	448.9799	223.5901	74.0351	0.0000	0.0000	0.0000	0.0000	220.7619	480.0488	736.8019	(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)	801.7243	630.0156	496.1104	247.0609	81.8068	0.0000	0.0000	0.0000	0.0000	243.9358	530.4407	814.1458	(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	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783	(64)
Efficiency of water heater (217)m	89.8597	89.8017	89.6393	89.2392	88.4044	87.3000	87.3000	87.3000	87.3000	89.2008	89.6891	89.8824	(216)
Fuel for water heating, kWh/month	194.8239	170.9427	177.7599	157.1376	153.2996	135.5997	127.2799	143.7432	144.7757	163.1673	175.2408	189.1119	(217)
Water heating fuel used												1932.8821	(219)
Annual totals kWh/year													
Space heating fuel - main system												3845.2403	(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)												396.9635	(232)
Total delivered energy for all uses												6250.0859	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3845.2403	9.7400	374.5264	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1932.8821	9.7400	188.2627	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	396.9635	36.8500	146.2811	(250)
Additional standing charges			104.0000	(251)
Total energy cost			840.7077	(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	3845.2403	0.2160	830.5719	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1932.8821	0.2160	417.5025	(264)
Space and water heating			1248.0744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.9635	0.5190	206.0241	(268)
Total kg/year			1493.0235	(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	3845.2403	1.2200	4691.1931	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1932.8821	1.2200	2358.1162	(264)
Space and water heating			7049.3093	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.9635	3.0700	1218.6781	(268)
Primary energy kWh/year			8498.2374	(272)
Primary energy kWh/m2/year			87.2867	(273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 78	-189 kg (12.6%)
U Solar photovoltaic panels	+ 9.4	-£ 672	-947 kg (72.6%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£78	1.94 kg/m²	B 84 B 86
Solar photovoltaic panels	£672	9.72 kg/m²	A 94 A 95
Total Savings	£751	11.66 kg/m²	

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

Fuel prices for cost data on this page from database revision number 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	£174	£192	-£18
Mains gas	£667	£570	£97
Space heating	£506	£506	£0
Water heating	£188	£110	£78
Lighting	£146	£146	£0
Generated (PV)	-£0	-£672	£672
Total cost of fuels	£841	£90	£751
Total cost of uses	£840	£90	£750
Delivered energy	64 kWh/m²	36 kWh/m²	28 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	4 kg/m²	12 kg/m²
Primary energy	87 kWh/m²	19 kWh/m²	68 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1991 (8)
Pressure test										Yes							
Measured/design AP50										5.0100							
Infiltration rate										0.4496 (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) =					0.4496	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.5732	0.5620	0.5507	0.4945	0.4833	0.4271	0.4271	0.4159	0.4496	0.4833	0.5058	0.5283	(22b)				
Effective ac	0.6643	0.6579	0.6517	0.6223	0.6168	0.5912	0.5912	0.5865	0.6011	0.6168	0.6279	0.6395	(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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.0546	Feb 54.5259	Mar 54.0076	Apr 51.5733	May 51.1179	Jun 48.9977	Jul 48.9977	Aug 48.6051	Sep 49.8144	Oct 51.1179	Nov 52.0393	Dec 53.0025 (38)
Heat transfer coeff	140.4283	139.8996	139.3813	136.9471	136.4916	134.3714	134.3714	133.9788	135.1881	136.4916	137.4130	138.3762 (39)
Average = Sum(39)m / 12 =												136.9449 (39)
HLP	Jan 1.4424	Feb 1.4369	Mar 1.4316	Apr 1.4066	May 1.4019	Jun 1.3802	Jul 1.3802	Aug 1.3761	Sep 1.3885	Oct 1.4019	Nov 1.4114	Dec 1.4213 (40)
HLP (average)												1.4066 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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												1.1684 (H8)
Utilisation factor												0.5751 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6505 (H14)
Volume ratio Veff/V												0.7603 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-866.7922 (H17)
Solar input	-25.1352	-41.9435	-71.4346	-95.7364	-118.2743	-116.2825	-114.7457	-100.2539	-78.5189	-53.6192	-29.8140	-21.0339 (63)
								Solar input (sum of months) =	Sum (63)m =			-866.7922 (63)
Output from w/h	149.9330	111.5660	87.9082	44.4919	17.2493	2.0961	0.0000	25.2339	47.8702	91.9274	127.3579	148.9444 (64)
								Total per year (kWh/year) =	Sum (64)m =			854.5783 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0300	10.6334	0.4600	0.0000	0.7700	3.8793 (74)
Northeast	6.7100	11.2829	0.4600	0.0000	0.7700	26.8160 (75)
Southeast	2.6200	36.7938	0.4600	0.0000	0.7700	34.1448 (77)
Southwest	1.3100	36.7938	0.4600	0.0000	0.7700	17.0724 (79)
West	1.0300	19.6403	0.4600	0.0000	0.7700	7.1653 (80)
Northwest	5.2500	11.2829	0.4600	0.0000	0.7700	20.9812 (81)
Southeast	3.3300	36.7938	0.4600	0.0000	0.7700	43.3978 (77)

Solar gains	153.4568	279.8873	431.4836	615.0031	761.5153	787.7822	746.2971	632.2586	494.3554	322.4772	187.1881	129.1307 (83)
Total gains	773.6936	895.4610	1023.1609	1169.4340	1277.5700	1269.5247	1208.0001	1102.7604	986.2959	851.8896	758.3211	732.0614 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.5398	34.6703	34.7993	35.4178	35.5360	36.0967	36.0967	36.2025	35.8787	35.5360	35.2977	35.0520
alpha	3.3027	3.3114	3.3200	3.3612	3.3691	3.4064	3.4064	3.4135	3.3919	3.3691	3.3532	3.3368
util living area	0.9827	0.9711	0.9456	0.8833	0.7686	0.6067	0.4665	0.5222	0.7503	0.9198	0.9723	0.9854 (86)
MIT	19.1577	19.3906	19.7725	20.2688	20.6629	20.8942	20.9674	20.9523	20.7732	20.2541	19.6274	19.1276 (87)
Th 2	19.7310	19.7351	19.7392	19.7583	19.7619	19.7786	19.7786	19.7817	19.7721	19.7619	19.7546	19.7471 (88)
util rest of house	0.9783	0.9639	0.9318	0.8533	0.7106	0.5137	0.3469	0.3990	0.6673	0.8924	0.9641	0.9817 (89)
MIT 2	17.3304	17.6687	18.2170	18.9189	19.4310	19.7033	19.7646	19.7591	19.5850	18.9197	18.0271	17.2966 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)

MIT	17.7009	18.0178	18.5324	19.1926	19.6808	19.9447	20.0085	20.0010	19.8259	19.1902	18.3516	17.6678 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5509	17.8678	18.3824	19.0426	19.5308	19.7947	19.8585	19.8510	19.6759	19.0402	18.2016	17.5178 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4609.9309	0.2160	995.7451 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	952.4382	0.2160	205.7267 (264)
Space and water heating			1201.4717 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.9635	0.5190	206.0241 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			575.9336 (272)
CO2 emissions per m2			5.9200 (273)
EI value			94.5789
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	49.2700 (1b)	x 2.5400 (2b)	= 125.1458 (1b) - (3b)
First floor	48.0900 (1c)	x 2.6200 (2c)	= 125.9958 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 251.1416 (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) = 0.1991 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4496 (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) =	0.4496 (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	0.4721	0.4496	0.4496	0.4159	0.4159	0.3709	0.3822	0.3597	0.3709	0.3934	0.3934	0.4271 (22b)
Effective ac	0.6114	0.6011	0.6011	0.5865	0.5865	0.5688	0.5730	0.5647	0.5688	0.5774	0.5774	0.5912 (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)			17.9500	1.2357	22.1816		(27)
French Door (Uw = 1.30)			3.3300	1.2357	4.1150		(27)
GF B&B J150 P/A=0.60			49.2700	0.1300	6.4051	75.0000	3695.2500 (28a)
EW Brick AAC015	147.0400	25.5400	121.5000	0.2500	30.3750	52.3000	6354.4500 (29a)
Plane Ceiling	48.0900		48.0900	0.1600	7.6944	9.0000	432.8100 (30)
Bay	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (31)
Total net area of external elements Aum(A, m ²)			245.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6873		(33)
GF Timber			28.5500			9.0000	256.9500 (32c)
1F Timber			114.5900			9.0000	1031.3100 (32c)
GF Masonry			58.4200			75.0000	4381.5000 (32c)
Internal Floor			48.0900			18.0000	865.6200 (32d)
Internal Ceiling			48.0900			9.0000	432.8100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17461.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.3480 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6864 (36)
Total fabric heat loss						(33) + (36) =	85.3737 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.6729	49.8144	49.8144	48.6051	48.6051	47.1393	47.4900	46.7990	47.1393	47.8513	47.8513	48.9977 (38)
Average = Sum(39)m / 12 =	136.0466	135.1881	135.1881	133.9788	133.9788	132.5130	132.8638	132.1727	132.5130	133.2250	133.2250	134.3714 (39)
	133.7720 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3974	1.3885	1.3885	1.3761	1.3761	1.3611	1.3647	1.3576	1.3611	1.3684	1.3684	1.3802 (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												2.7137 (42)
Average daily hot water use (litres/day)												98.6505 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	108.5156	104.5695	100.6235	96.6775	92.7315	88.7855	88.7855	92.7315	96.6775	100.6235	104.5695	108.5156 (44)
Energy content (annual)	160.9254	140.7464	145.2377	126.6217	121.4966	104.8423	97.1518	111.4831	112.8146	131.4745	143.5147	155.8477 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1552.1566 (45)
	24.1388	21.1120	21.7857	18.9933	18.2245	15.7263	14.5728	16.7225	16.9222	19.7212	21.5272	23.3772 (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	14.1428	12.7631	14.1051	13.6066	14.0270	13.5362	13.9636	14.0047	13.5746	14.0721	13.6572	14.1306 (61)
Total heat required for water heating calculated for each month	175.0682	153.5095	159.3428	140.2283	135.5235	118.3785	111.1154	125.4878	126.3891	145.5466	157.1720	169.9783 (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												1.2340 (H8)
Utilisation factor												0.5553 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6505 (H14)
Volume ratio Veff/V												0.7603 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-883.9623 (H17)
Solar input	-27.2079	-40.8934	-68.8697	-95.1991	-114.6517	-120.6659	-117.7685	-105.1680	-82.0840	-55.8402	-33.0719	-22.5419 (63)
								Solar input (sum of months) =	Sum (63)m =			-883.9623 (63)
Output from w/h	147.8603	112.6160	90.4731	45.0293	20.8719	0.0000	0.0000	20.3198	44.3052	89.7064	124.1000	147.4364 (64)
								Total per year (kWh/year) =	Sum (64)m =			842.7184 (64)
Heat gains from water heating, kWh/month	57.0434	49.9890	51.8178	45.5034	43.9044	38.2441	35.7939	40.5693	40.9045	47.2333	51.1330	55.3520 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223	162.8223 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.1943	49.9113	40.5906	30.7297	22.9708	19.3929	20.9547	27.2377	36.5584	46.4193	54.1782	57.7561 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	376.1012	380.0040	370.1692	349.2320	322.8026	297.9627	281.3681	277.4654	287.3002	308.2373	334.6667	359.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959	53.9959 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482	-108.5482 (71)
Water heating gains (Table 5)	76.6712	74.3883	69.6476	63.1991	59.0112	53.1168	48.1100	54.5286	56.8118	63.4856	71.0180	74.3979 (72)
Total internal gains	620.2368	615.5736	591.6774	554.4309	516.0547	481.7425	461.7029	470.5018	491.9405	529.4124	571.1330	602.9307 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0300	11.9814	0.4600	0.0000	0.7700	4.3711 (74)
Northeast	6.7100	12.9236	0.4600	0.0000	0.7700	30.7152 (75)
Southeast	2.6200	40.4699	0.4600	0.0000	0.7700	37.5562 (77)
Southwest	1.3100	40.4699	0.4600	0.0000	0.7700	18.7781 (79)
West	1.0300	22.3313	0.4600	0.0000	0.7700	8.1470 (80)
Northwest	5.2500	12.9236	0.4600	0.0000	0.7700	24.0320 (81)
Southeast	3.3300	40.4699	0.4600	0.0000	0.7700	47.7337 (77)

Solar gains	171.3334	282.1937	432.0801	637.6303	770.6034	853.3161	799.5989	692.0506	537.7384	347.8515	214.3165	142.6535 (83)
Total gains	791.5703	897.7673	1023.7575	1192.0612	1286.6581	1335.0586	1261.3019	1162.5524	1029.6789	877.2638	785.4495	745.5841 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6522	35.8787	35.8787	36.2025	36.2025	36.6029	36.5063	36.6972	36.6029	36.4073	36.4073	36.0967
alpha	3.3768	3.3919	3.3919	3.4135	3.4135	3.4402	3.4338	3.4465	3.4402	3.4272	3.4272	3.4064
util living area	0.9785	0.9664	0.9341	0.8504	0.6983	0.4728	0.3218	0.3566	0.6512	0.8885	0.9625	0.9818 (86)
MIT	19.3697	19.5716	19.9622	20.4415	20.7956	20.9629	20.9929	20.9901	20.8840	20.4413	19.8468	19.3448 (87)
Th 2	19.7654	19.7721	19.7721	19.7817	19.7817	19.7933	19.7905	19.7960	19.7933	19.7877	19.7877	19.7786 (88)
util rest of house	0.9729	0.9579	0.9170	0.8122	0.6255	0.3683	0.1985	0.2259	0.5473	0.8501	0.9512	0.9771 (89)
MIT 2	17.6589	17.9528	18.5079	19.1670	19.6024	19.7742	19.7892	19.7939	19.7150	19.1905	18.3628	17.6315 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT	18.0058	18.2810	18.8028	19.4254	19.8443	20.0152	20.0332	20.0364	19.9520	19.4441	18.6637	17.9788 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8558	18.1310	18.6528	19.2754	19.6943	19.8652	19.8832	19.8864	19.8020	19.2941	18.5137	17.8288 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9419	0.8965	0.7932	0.6197	0.3748	0.2081	0.2359	0.5481	0.8302	0.9344	0.9658 (94)	
Useful gains	760.1635	845.5863	917.7732	945.5660	797.3889	500.3293	262.5343	274.2885	564.3703	728.3196	733.9570	720.0679 (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	1735.3793	1694.0448	1521.2408	1256.1078	896.8985	512.1902	263.4988	275.7679	609.8301	1025.0426	1400.6914	1710.3931 (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	725.5605	570.1641	448.9799	223.5901	74.0351	0.0000	0.0000	0.0000	0.0000	220.7619	480.0488	736.8019 (98)	
Space heating												3479.9425 (98)	
Space heating per m2												(98) / (4) = 35.7430 (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													3845.2403 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	725.5605	570.1641	448.9799	223.5901	74.0351	0.0000	0.0000	0.0000	0.0000	220.7619	480.0488	736.8019 (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)	801.7243	630.0156	496.1104	247.0609	81.8068	0.0000	0.0000	0.0000	0.0000	243.9358	530.4407	814.1458 (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	147.8603	112.6160	90.4731	45.0293	20.8719	0.0000	0.0000	20.3198	44.3052	89.7064	124.1000	147.4364 (64)	
Efficiency of water heater (217)m	89.9419	89.9561	89.9470	89.9473	89.7763	87.3000	87.3000	87.3000	87.3000	89.5515	89.8237	89.9502 (217)	
Fuel for water heating, kWh/month	164.3954	125.1899	100.5848	50.0618	23.2487	0.0000	0.0000	23.2759	50.7505	100.1729	138.1596	163.9088 (219)	
Water heating fuel used												939.7484 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3845.2403 (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)													396.9635 (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												3482.7926 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3845.2403	9.7400	374.5264 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	939.7484	9.7400	91.5315 (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	396.9635	36.8500	146.2811 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1824.1596	36.8500	-672.2028 (252)	
Total energy cost			90.1986 (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	3845.2403	0.2160	830.5719 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	939.7484	0.2160	202.9857 (264)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			1033.5576 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.9635	0.5190	206.0241 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			357.7178 (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	3845.2403	1.2200	4691.1931 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.7484	1.2200	1146.4931 (264)
Space and water heating			5837.6862 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	396.9635	3.0700	1218.6781 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1839.9442 (272)
Primary energy kWh/m2/year			18.8984 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	179.3 (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	331.51 (P1)
Transmission heat loss coefficient	85.37 (37)
Summer heat loss coefficient	416.88 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0300	81.1852	0.4600	0.0000	0.9000	34.6190
North East	6.7100	98.8453	0.4600	0.0000	0.9000	274.5862
South East	2.6200	119.9223	0.4600	0.0000	0.9000	130.0774
South West	1.3100	119.9223	0.4600	0.0000	0.9000	65.0387
West	1.0300	117.5071	0.4600	0.0000	0.9000	50.1074
North West	5.2500	98.8453	0.4600	0.0000	0.9000	214.8402
South East	3.3300	119.9223	0.4600	0.0000	0.9000	165.3273
total:						934.5962

Solar gains	Jun 997	Jul 935	Aug 809	(P4)
Internal gains	479	459	468	
Total summer gains	1476	1393	1276	(P5)
Summer gain/loss ratio	3.54	3.34	3.06	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 179.3)	0.74	0.74	0.74	
Threshold temperature	20.29	21.99	21.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Assessment of likelihood of high internal temperature:

Slight