

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Pembroke - Det				Issued on Date	15/12/2022
Assessment Reference	Pembroke - Det	Prop Type Ref				
Property	Plot, 4 Bed, K, U, WC, B, ES					
SAP Rating	86 B	DER	13.66	TER	17.09	
Environmental	88 B	% DER<TER	20.08			
CO ₂ Emissions (t/year)	1.43	DFEE	44.45	TFEE	56.66	
General Requirements Compliance	Pass	% DFEE<TFEE	21.55			
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 126 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.09 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.66 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)44.4 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	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.22 (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:	4.01 (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

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 8.11 m², No overhang

Windows facing South East: 0.69 m², No overhang

Windows facing South West: 8.21 m², No overhang

Windows facing North West: 0.69 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Window U-value 0.90 W/m²K

Thermal bridging y-value 0.022 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	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(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) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27a)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 52.3702	Feb 51.8511	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	131.5816	131.0625	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												131.0518 (39)
HLP	Jan 1.0455	Feb 1.0414	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0413 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)										Total =	Sum (45)m =	1615.5518	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(62)
WWHRS	-52.7868	-46.4472	-47.4046	-38.9925	-36.1998	-29.8592	-25.2638	-30.5909	-31.4865	-38.9311	-45.1069	-51.0232	eq. (G10)
Total of WWHRS savings												-474.0925	
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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357	(64)
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(65)
Total per year (kWh/year) = Sum (64)m =												1307.2505	(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	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9614	24.8351	20.1973	15.2906	11.4299	9.6496	10.4268	13.5531	18.1909	23.0976	26.9583	28.7386	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6458	295.6826	288.0301	271.7388	251.1740	231.8460	218.9336	215.8969	223.5494	239.8407	260.4055	279.7335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	469.4716	467.0058	449.7811	421.8750	393.0908	365.8467	348.4999	355.2709	369.9373	398.0784	430.3439	454.9702	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					8.1100	11.2829	0.4600	0.0000			0.7700			32.4109 (75)
Southeast					0.6900	36.7938	0.4600	0.0000			0.7700			8.9923 (77)
Southwest					5.0600	36.7938	0.4600	0.0000			0.7700			65.9438 (79)
Northwest					0.6900	11.2829	0.4600	0.0000			0.7700			2.7575 (81)
Southwest					3.1500	36.7938	0.4300	0.0000			0.7700			38.3747 (79)
Solar gains	148.4793	264.5967	393.0611	539.0299	651.2290	667.4004	634.7556	547.8577	443.1076	300.8018	179.9713	125.6908	(83)	
Total gains	617.9509	731.6026	842.8422	960.9049	1044.3198	1033.2471	983.2555	903.1286	813.0449	698.8802	610.3152	580.6610	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.1858	37.3331	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516
alpha	3.4791	3.4889	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901
util living area	0.9913	0.9836	0.9665	0.9232	0.8330	0.6902	0.5448	0.6026	0.8165	0.9501	0.9852	0.9929 (86)
MIT	19.1317	19.3589	19.7194	20.1761	20.5888	20.8522	20.9520	20.9311	20.7167	20.1756	19.5604	19.0827 (87)
Th 2	20.0456	20.0490	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494 (88)
util rest of house	0.9895	0.9804	0.9595	0.9064	0.7949	0.6183	0.4426	0.5006	0.7606	0.9359	0.9817	0.9915 (89)
MIT 2	17.5241	17.8566	18.3789	19.0300	19.5936	19.9198	20.0205	20.0046	19.7711	19.0401	18.1525	17.4552 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	17.7554	18.0728	18.5718	19.1949	19.7368	20.0540	20.1546	20.1379	19.9071	19.2035	18.3551	17.6894 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6054	17.9228	18.4218	19.0449	19.5868	19.9040	20.0046	19.9879	19.7571	19.0535	18.2051	17.5394 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9826	0.9696	0.9429	0.8835	0.7731	0.6062	0.4374	0.4934	0.7400	0.9153	0.9714	0.9856	(94)
Useful gains	607.1733	709.3490	794.7509	848.9978	807.3556	626.3042	430.0957	445.6411	601.6327	639.6650	592.8717	572.3113	(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	1750.7497	1706.8034	1561.7286	1328.9623	1033.1554	694.8072	445.9887	470.0070	741.0713	1107.3845	1454.7396	1747.4270	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	850.8208	670.2894	570.6314	345.5744	167.9951	0.0000	0.0000	0.0000	0.0000	347.9833	620.5449	874.2861 (98)
Space heating												4448.1254 (98)
Space heating per m2										(98) / (4) =		35.3447 (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												4915.0557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	850.8208	670.2894	570.6314	345.5744	167.9951	0.0000	0.0000	0.0000	0.0000	347.9833	620.5449	874.2861 (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)	940.1335	740.6512	630.5319	381.8502	185.6299	0.0000	0.0000	0.0000	0.0000	384.5120	685.6850	966.0620 (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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357 (64)
Efficiency of water heater	90.0657	90.0246	89.9356	89.7256	89.2469	87.3000	87.3000	87.3000	87.3000	89.6994	89.9733	87.3000 (216)
Fuel for water heating, kWh/month	143.0842	125.3264	131.0766	118.6173	116.8765	106.3231	102.9059	113.9414	114.0096	124.8595	131.0842	139.1290 (219)
Water heating fuel used												1467.2337 (219)
Annual totals kWh/year												
Space heating fuel - main system												4915.0557 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												88.1618 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												163.1618 (231)
Electricity for lighting (calculated in Appendix L)												493.8077 (232)
Total delivered energy for all uses												7039.2589 (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	4915.0557	0.2160	1061.6520 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1467.2337	0.2160	316.9225 (264)
Space and water heating			1378.5745 (265)
Pumps and fans	163.1618	0.5190	84.6810 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)
Total CO2, kg/year			1719.5417 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6600 (273)

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

DER		13.6600 ZC1
Total Floor Area	TFA	125.8500
Assumed number of occupants	N	2.8834
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		13.7796 ZC2
CO2 emissions from cooking, equation (L16)		1.4954 ZC3
Total CO2 emissions		28.9350 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		28.9350 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1274 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3774 (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) =	0.3774 (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	0.4812	0.4718	0.4624	0.4152	0.4058	0.3586	0.3586	0.3491	0.3774	0.4058	0.4246	0.4435 (22b)
Effective ac	0.6158	0.6113	0.6069	0.5862	0.5823	0.5643	0.5643	0.5609	0.5712	0.5823	0.5902	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			17.7000	1.3258	23.4659		(27)
FP McCann System			63.5300	0.1300	8.2589		(28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.1800	25.0326		(29a)
Plane Ceiling-500mm Loft Roll			62.3200	0.1300	8.1016		(30)
Bay Flat Roof	1.2100		1.2100	0.1300	0.1573		(30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.3723		(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)							12.5503 (36)
Total fabric heat loss						(33) + (36) =	81.9226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.7799	63.3141	62.8576	60.7135	60.3123	58.4448	58.4448	58.0990	59.1641	60.3123	61.1239	61.9723 (38)
Average = Sum(39)m / 12 =	145.7025	145.2368	144.7803	142.6361	142.2349	140.3674	140.3674	140.0216	141.0867	142.2349	143.0465	143.8949 (39)
												142.6342 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1577	1.1540	1.1504	1.1334	1.1302	1.1154	1.1154	1.1126	1.1211	1.1302	1.1366	1.1434 (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												2.8834 (42)
Average daily hot water use (litres/day)												102.6797 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477 (44)
Energy content (annual)	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1615.5518 (45)
Water storage loss:	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320 (46)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.1850	45.5729	47.0920	49.1850	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.4571	192.5224	202.1286	181.1085	175.6439	154.6973	148.2118	165.2214	166.7374	187.8033	198.6914	213.1719 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	218.4571	192.5224	202.1286	181.1085	175.6439	154.6973	148.2118	165.2214	166.7374	187.8033	198.6914	213.1719 (64)
	68.4329	60.2164	63.0036	56.1501	54.3438	47.6771	45.3953	50.8784	51.3717	58.2405	61.9964	66.6756 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9614	24.8351	20.1973	15.2906	11.4299	9.6496	10.4268	13.5531	18.1909	23.0976	26.9583	28.7386	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6458	295.6826	288.0301	271.7388	251.1740	231.8460	218.9336	215.8969	223.5494	239.8407	260.4055	279.7335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	91.9797	89.6078	84.6823	77.9862	73.0428	66.2182	61.0152	68.3849	71.3496	78.2802	86.1061	89.6177	(72)
Total internal gains	481.8373	479.3758	462.1600	434.2660	404.8970	376.9641	359.6260	367.0852	382.3402	410.4688	442.7202	467.3401	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				8.1100	11.2829	0.6300		0.7000	0.7700		27.9650 (75)	
Southeast				0.6900	36.7938	0.6300		0.7000	0.7700		7.7588 (77)	
Southwest				8.2100	36.7938	0.6300		0.7000	0.7700		92.3188 (79)	
Northwest				0.6900	11.2829	0.6300		0.7000	0.7700		2.3793 (81)	
Solar gains	130.4219	232.2358	344.5272	471.7599	569.3693	583.2684	554.8353	479.2599	388.1544	263.8885	158.0508	110.4262 (83)
Total gains	612.2592	711.6116	806.6872	906.0259	974.2663	960.2325	914.4613	846.3452	770.4946	674.3573	600.7711	577.7664 (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	59.9824	60.1747	60.3645	61.2719	61.4447	62.2622	62.2622	62.4160	61.9448	61.4447	61.0961	60.7359	
alpha	4.9988	5.0116	5.0243	5.0848	5.0963	5.1508	5.1508	5.1611	5.1297	5.0963	5.0731	5.0491	
util living area	0.9992	0.9982	0.9949	0.9817	0.9344	0.8083	0.6435	0.7065	0.9175	0.9900	0.9984	0.9994	(86)
MIT	19.6427	19.7860	20.0324	20.3739	20.6911	20.9082	20.9781	20.9653	20.8000	20.3921	19.9613	19.6252	(87)
Th 2	19.9540	19.9569	19.9599	19.9737	19.9763	19.9883	19.9883	19.9906	19.9837	19.9763	19.9710	19.9656	(88)
util rest of house	0.9990	0.9976	0.9930	0.9739	0.9040	0.7241	0.5113	0.5769	0.8664	0.9845	0.9977	0.9993	(89)
MIT 2	18.1321	18.3438	18.7055	19.2093	19.6510	19.9212	19.9795	19.9746	19.8050	19.2416	18.6105	18.1148	(90)
Living area fraction	18.3495	18.5514	18.8965	19.3769	19.8007	20.0632	20.1232	20.1172	19.9482	19.4071	18.8048	18.3322	(92)
Temperature adjustment	18.3495	18.5514	18.8965	19.3769	19.8007	20.0632	20.1232	20.1172	19.9482	19.4071	18.8048	18.3322	(93)
adjusted MIT	18.3495	18.5514	18.8965	19.3769	19.8007	20.0632	20.1232	20.1172	19.9482	19.4071	18.8048	18.3322	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	611.2298	708.9211	798.6323	876.6181	874.3307	702.1297	484.7439	503.3280	665.7919	660.7855	598.6412	577.0461	(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	2047.0436	1982.6802	1794.7657	1494.3879	1152.2034	766.8584	494.5422	520.4866	825.1053	1252.6807	1674.3371	2033.5451	(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	1068.2454	855.9661	741.1232	444.7943	206.7373	0.0000	0.0000	0.0000	0.0000	440.3700	774.5011	1083.6352	(98)
Space heating												5615.3728	(98)
Space heating per m2												44.6196	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6012.1764 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1068.2454	855.9661	741.1232	444.7943	206.7373	0.0000	0.0000	0.0000	0.0000	440.3700	774.5011	1083.6352	(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)	1143.7317	916.4520	793.4938	476.2251	221.3462	0.0000	0.0000	0.0000	0.0000	471.4883	829.2303	1160.2090	(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	218.4571	192.5224	202.1286	181.1085	175.6439	154.6973	148.2118	165.2214	166.7374	187.8033	198.6914	213.1719	(64)
Efficiency of water heater (217)m	88.5099	88.3593	88.0274	87.2255	85.4624	80.3000	80.3000	80.3000	80.3000	87.1238	88.1367	88.5688	(216)
Fuel for water heating, kWh/month	246.8165	217.8857	229.6201	207.6326	205.5219	192.6492	184.5726	205.7552	207.6431	215.5590	225.4355	240.6852	(219)
Water heating fuel used												2579.7766	(219)
Annual totals kWh/year													
Space heating fuel - main system												6012.1764	(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)												493.8077	(232)
Total delivered energy for all uses												9160.7608	(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	6012.1764	0.2160	1298.6301 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2579.7766	0.2160	557.2318 (264)
Space and water heating			1855.8619 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)
Total CO2, kg/m2/year			2151.0731 (272)
Emissions per m2 for space and water heating			14.7466 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0364 (272b)
Emissions per m2 for pumps and fans			0.3093 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7466 * 1.00) + 2.0364 + 0.3093, rounded to 2 d.p.			17.0900 (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	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.8566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1274 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3279 (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) =	0.3279 (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	0.4181	0.4099	0.4017	0.3607	0.3525	0.3115	0.3115	0.3034	0.3279	0.3525	0.3689	0.3853 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5621	0.5485	0.5485	0.5460	0.5538	0.5621	0.5681	0.5742 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss							(33) + (36) = 79.2114 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	60.8404	60.4888	60.1442	58.5255	58.2227	56.8129	56.8129	56.5518	57.3559	58.2227	58.8353	59.4758 (38)
Average = Sum(39)m / 12 =	140.0518	139.7002	139.3556	137.7369	137.4341	136.0243	136.0243	135.7632	136.5673	137.4341	138.0467	138.6872 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1128	1.1101	1.1073	1.0945	1.0920	1.0808	1.0808	1.0788	1.0852	1.0920	1.0969	1.1020 (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												2.8834 (42)
Average daily hot water use (litres/day)												102.6797 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477 (44)
Energy content (annual)	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1615.5518 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5934	31.1302	32.1236	28.0061	26.8725	23.1889	21.4880	24.6577	24.9522	29.0794	31.7425	34.4703 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9614	24.8351	20.1973	15.2906	11.4299	9.6496	10.4268	13.5531	18.1909	23.0976	26.9583	28.7386	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6458	295.6826	288.0301	271.7388	251.1740	231.8460	218.9336	215.8969	223.5494	239.8407	260.4055	279.7335	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	47.8405	46.3247	43.1768	38.8974	36.1190	32.2069	28.8817	33.1421	34.6559	39.0853	44.0868	46.3310	(72)
Total internal gains	434.6982	433.0927	417.6545	392.1771	364.9732	339.9528	324.4924	328.8425	342.6466	368.2739	397.7009	421.0535	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					8.1100	11.2829	0.4600	0.0000			0.7700			32.4109 (75)
Southeast					0.6900	36.7938	0.4600	0.0000			0.7700			8.9923 (77)
Southwest					5.0600	36.7938	0.4600	0.0000			0.7700			65.9438 (79)
Northwest					0.6900	11.2829	0.4600	0.0000			0.7700			2.7575 (81)
Southwest					3.1500	36.7938	0.4300	0.0000			0.7700			38.3747 (79)
Solar gains	148.4793	264.5967	393.0611	539.0299	651.2290	667.4004	634.7556	547.8577	443.1076	300.8018	179.9713	125.6908	(83)	
Total gains	583.1775	697.6894	810.7156	931.2070	1016.2022	1007.3532	959.2480	876.7002	785.7542	669.0757	577.6722	546.7443	(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	34.9369	35.0248	35.1114	35.5240	35.6023	35.9713	35.9713	36.0405	35.8283	35.6023	35.4443	35.2806	
alpha	3.3291	3.3350	3.3408	3.3683	3.3735	3.3981	3.3981	3.4027	3.3886	3.3735	3.3630	3.3520	
util living area	0.9926	0.9860	0.9711	0.9326	0.8507	0.7133	0.5699	0.6290	0.8366	0.9574	0.9876	0.9941	(86)
MIT	18.9646	19.1930	19.5714	20.0721	20.5188	20.8226	20.9395	20.9147	20.6679	20.0824	19.4336	18.9277	(87)
Th 2	19.9904	19.9926	19.9949	20.0054	20.0073	20.0165	20.0165	20.0182	20.0130	20.0073	20.0034	19.9992	(88)
util rest of house	0.9911	0.9831	0.9649	0.9170	0.8140	0.6406	0.4623	0.5231	0.7826	0.9446	0.9846	0.9928	(89)
MIT 2	18.1175	18.3462	18.7227	19.2198	19.6415	19.9098	19.9917	19.9801	19.7885	19.2385	18.5948	18.0871	(90)
Living area fraction									fLA = Living area / (4) =			0.1439	(91)
MIT	18.2394	18.4681	18.8448	19.3425	19.7677	20.0411	20.1281	20.1146	19.9150	19.3600	18.7155	18.2081	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2394	18.4681	18.8448	19.3425	19.7677	20.0411	20.1281	20.1146	19.9150	19.3600	18.7155	18.2081	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9874	0.9772	0.9555	0.9041	0.8037	0.6426	0.4753	0.5344	0.7762	0.9337	0.9791	0.9897	(94)
Useful gains	575.8133	681.7490	774.6203	841.9242	816.7719	647.3282	455.9706	468.5371	609.9149	624.7083	565.6027	541.1174	(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	1952.2365	1895.4641	1720.3187	1438.3148	1108.7825	740.1243	479.9013	504.3047	794.1414	1203.9196	1603.4830	1942.7412	(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	1024.0588	815.6166	703.5996	429.4012	217.2559	0.0000	0.0000	0.0000	0.0000	430.9332	747.2738	1042.8081	(98)
Space heating												5410.9472	(98)
Space heating per m2												(98) / (4) =	42.9952 (99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1278.6283	1006.5797	1031.8004	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7776	0.8448	0.8105	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	994.2695	850.3221	836.2984	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1295.2987	1236.4880	1142.4629	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	216.7410	287.3074	227.7864	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													731.8348 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	54.1853	71.8269	56.9466	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													182.9587 (107)
Energy for space heating													1.4538 (108)
Energy for space cooling													42.9952 (99)
Total													1.4538 (108)
Dwelling Fabric Energy Efficiency (DFEE)													44.4490 (109)
													44.4 (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	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1274 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3774 (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) =	0.3774 (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	0.4812	0.4718	0.4624	0.4152	0.4058	0.3586	0.3586	0.3491	0.3774	0.4058	0.4246	0.4435 (22b)
Effective ac	0.6158	0.6113	0.6069	0.5862	0.5823	0.5643	0.5643	0.5609	0.5712	0.5823	0.5902	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			17.7000	1.3258	23.4659		(27)
FP McCann System			63.5300	0.1300	8.2589		(28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.1800	25.0326		(29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.1300	8.1016		(30)
Bay Flat Roof	1.2100		1.2100	0.1300	0.1573		(30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.3723		(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)							12.5503 (36)
Total fabric heat loss						(33) + (36) =	81.9226 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	63.7799	63.3141	62.8576	60.7135	60.3123	58.4448	58.4448	58.0990	59.1641	60.3123	61.1239	61.9723 (38)
Heat transfer coeff	145.7025	145.2368	144.7803	142.6361	142.2349	140.3674	140.3674	140.0216	141.0867	142.2349	143.0465	143.8949 (39)
Average = Sum(39)m / 12 =												142.6342 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1577	1.1540	1.1504	1.1334	1.1302	1.1154	1.1154	1.1126	1.1211	1.1302	1.1366	1.1434 (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												2.8834 (42)
Average daily hot water use (litres/day)												102.6797 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477 (44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130 (45)
Energy content (annual)												Total = Sum(45)m = 1615.5518 (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)
	35.5934	31.1302	32.1236	28.0061	26.8725	23.1889	21.4880	24.6577	24.9522	29.0794	31.7425	34.4703 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678	144.1678 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.9614	24.8351	20.1973	15.2906	11.4299	9.6496	10.4268	13.5531	18.1909	23.0976	26.9583	28.7386 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6458	295.6826	288.0301	271.7388	251.1740	231.8460	218.9336	215.8969	223.5494	239.8407	260.4055	279.7335 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168	37.4168 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343 (71)
Water heating gains (Table 5)	47.8405	46.3247	43.1768	38.8974	36.1190	32.2069	28.8817	33.1421	34.6559	39.0853	44.0868	46.3310 (72)
Total internal gains	434.6982	433.0927	417.6545	392.1771	364.9732	339.9528	324.4924	328.8425	342.6466	368.2739	397.7009	421.0535 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	8.1100	11.2829	0.6300	0.7000	0.7700		27.9650 (75)
Southeast	0.6900	36.7938	0.6300	0.7000	0.7700		7.7588 (77)
Southwest	8.2100	36.7938	0.6300	0.7000	0.7700		92.3188 (79)
Northwest	0.6900	11.2829	0.6300	0.7000	0.7700		2.3793 (81)

Solar gains	130.4219	232.2358	344.5272	471.7599	569.3693	583.2684	554.8353	479.2599	388.1544	263.8885	158.0508	110.4262 (83)
Total gains	565.1200	665.3285	762.1817	863.9370	934.3425	923.2211	879.3277	808.1024	730.8009	632.1624	555.7517	531.4797 (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	59.9824	60.1747	60.3645	61.2719	61.4447	62.2622	62.2622	62.4160	61.9448	61.4447	61.0961	60.7359
alpha	4.9988	5.0116	5.0243	5.0848	5.0963	5.1508	5.1508	5.1611	5.1297	5.0963	5.0731	5.0491
util living area	0.9995	0.9987	0.9961	0.9850	0.9433	0.8258	0.6641	0.7304	0.9308	0.9924	0.9989	0.9996 (86)
MIT	19.6077	19.7518	20.0000	20.3451	20.6694	20.8979	20.9748	20.9595	20.7800	20.3620	19.9278	19.5908 (87)
Th 2	19.9540	19.9569	19.9599	19.9737	19.9763	19.9883	19.9883	19.9906	19.9837	19.9763	19.9710	19.9656 (88)
util rest of house	0.9993	0.9982	0.9945	0.9784	0.9159	0.7442	0.5302	0.6007	0.8852	0.9882	0.9984	0.9995 (89)
MIT 2	18.6751	18.8215	19.0714	19.4241	19.7355	19.9363	19.9812	19.9775	19.8462	19.4453	19.0088	18.6675 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	18.8093	18.9553	19.2050	19.5566	19.8699	20.0747	20.1242	20.1188	19.9806	19.5772	19.1410	18.8003 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8093	18.9553	19.2050	19.5566	19.8699	20.0747	20.1242	20.1188	19.9806	19.5772	19.1410	18.8003 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9990	0.9976	0.9930	0.9748	0.9123	0.7522	0.5495	0.6190	0.8850	0.9858	0.9978	0.9993 (94)
Useful gains	564.5538	663.6986	756.8185	842.1529	852.4176	694.4555	483.1684	500.1818	646.7739	623.1660	554.5385	531.0951 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2114.0420	2041.3524	1839.4330	1520.0160	1162.0446	768.4634	494.6830	520.7176	829.6736	1276.8704	1722.4274	2100.9142 (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	1152.8192	925.7834	805.4652	488.0615	230.3625	0.0000	0.0000	0.0000	0.0000	486.3561	840.8800	1167.9454 (98)
Space heating												6097.6732 (98)
Space heating per m2										(98) / (4) =		48.4519 (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	1319.4536	1038.7188	1064.1640	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7941	0.8747	0.8369	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1047.7292	908.5825	890.6507	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1196.9625	1143.0746	1062.2836	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	107.4480	174.4621	127.6949	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												409.6050 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.8620	43.6155	31.9237	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												102.4012 (107)
Space cooling per m2												0.8137 (108)
Energy for space heating												48.4519 (99)
Energy for space cooling												0.8137 (108)
Total												49.2656 (109)
Target Fabric Energy Efficiency (TFEE)												56.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (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																0 * 10 =	0.0000 (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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 51.7863	Feb 51.7863	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												130.9978 (39)
HLP	Jan 1.0409	Feb 1.0409	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0409 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)	Total = Sum (45)m =												1615.5518 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(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	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(65)
Total per year (kWh/year) = Sum (64)m =													1781.3430 (64)
													1781 (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	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.9036	62.0878	50.4932	38.2266	28.5748	24.1241	26.0669	33.8827	45.4773	57.7439	67.3957	71.8464	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7848	441.3173	429.8956	405.5803	374.8865	346.0387	326.7666	322.2342	333.6558	357.9712	388.6649	417.5127	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	702.1530	696.4935	668.5429	625.2527	580.5485	541.1142	518.5733	528.5380	553.9304	597.4555	645.6410	682.4575	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					8.1100	12.9236		0.4600	0.0000	0.7700		37.1237 (75)				
Southeast					0.6900	40.4699		0.4600	0.0000	0.7700		9.8908 (77)				
Southwest					5.0600	40.4699		0.4600	0.0000	0.7700		72.5323 (79)				
Northwest					0.6900	12.9236		0.4600	0.0000	0.7700		3.1585 (81)				
Southwest					3.1500	40.4699		0.4300	0.0000	0.7700		42.2087 (79)				
Solar gains					164.9140	265.1500	391.0229	555.6845	656.1446	720.2969	677.4114	596.5851	478.9243	322.3918	204.9222	138.1736 (83)
Total gains					867.0670	961.6434	1059.5657	1180.9373	1236.6931	1261.4111	1195.9847	1125.1231	1032.8547	919.8473	850.5633	820.6311 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516
alpha	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901
util living area	0.9720	0.9591	0.9268	0.8503	0.7091	0.4925	0.3343	0.3650	0.6466	0.8748	0.9536	0.9762 (86)
MIT	19.5362	19.7074	20.0562	20.4689	20.7981	20.9602	20.9926	20.9900	20.8915	20.4963	19.9472	19.4869 (87)
Th 2	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494 (88)
util rest of house	0.9667	0.9514	0.9125	0.8209	0.6533	0.4084	0.2343	0.2601	0.5661	0.8431	0.9432	0.9715 (89)
MIT 2	18.1127	18.3586	18.8562	19.4268	19.8497	20.0230	20.0470	20.0459	19.9620	19.4765	18.7074	18.0420 (90)
Living area fraction	18.3176	18.5527	19.0289	19.5768	19.9861	20.1579	20.1831	20.1817	20.0958	19.6233	18.8858	18.2499 (91)
MIT	18.3176	18.5527	19.0289	19.5768	19.9861	20.1579	20.1831	20.1817	20.0958	19.6233	18.8858	18.2499 (92)
Temperature adjustment	18.1676	18.4027	18.8789	19.4268	19.8361	20.0079	20.0331	20.0317	19.9458	19.4733	18.7358	-0.1500
adjusted MIT	18.1676	18.4027	18.8789	19.4268	19.8361	20.0079	20.0331	20.0317	19.9458	19.4733	18.7358	18.0999 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	825.2544	897.4768	943.1653	942.6710	790.8784	510.3517	278.0865	290.3864	574.8047	753.8143	785.6566	786.0604	(94)
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	1711.8240	1677.1232	1503.7049	1247.9855	895.5187	525.0199	279.4277	292.3521	621.6841	1031.3796	1406.3623	1702.9571	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(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) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 52.3702	Feb 51.8511	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	131.5816	131.0625	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												131.0518 (39)
HLP	Jan 1.0455	Feb 1.0414	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0413 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)										Total =	Sum (45)m =	1615.5518	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(62)
WVHRS	-52.7868	-46.4472	-47.4046	-38.9925	-36.1998	-29.8592	-25.2638	-30.5909	-31.4865	-38.9311	-45.1069	-51.0232	eq. (G10)
Total of WVHRS savings												-474.0925	
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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357	(64)
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(65)
Total per year (kWh/year) =										Sum (64)m =		1307.2505	(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	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.9036	62.0878	50.4932	38.2266	28.5748	24.1241	26.0669	33.8827	45.4773	57.7439	67.3957	71.8464	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7848	441.3173	429.8956	405.5803	374.8865	346.0387	326.7666	322.2342	333.6558	357.9712	388.6649	417.5127	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	702.1530	696.4935	668.5429	625.2527	580.5485	541.1142	518.5733	528.5380	553.9304	597.4555	645.6410	682.4575	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					8.1100	11.2829	0.4600	0.0000			0.7700			32.4109 (75)
Southeast					0.6900	36.7938	0.4600	0.0000			0.7700			8.9923 (77)
Southwest					5.0600	36.7938	0.4600	0.0000			0.7700			65.9438 (79)
Northwest					0.6900	11.2829	0.4600	0.0000			0.7700			2.7575 (81)
Southwest					3.1500	36.7938	0.4300	0.0000			0.7700			38.3747 (79)
Solar gains	148.4793	264.5967	393.0611	539.0299	651.2290	667.4004	634.7556	547.8577	443.1076	300.8018	179.9713	125.6908	(83)	
Total gains	850.6323	961.0902	1061.6040	1164.2826	1231.7775	1208.5146	1153.3289	1076.3958	997.0380	898.2573	825.6124	808.1483	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.1858	37.3331	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516
alpha	3.4791	3.4889	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901
util living area	0.9771	0.9639	0.9375	0.8794	0.7730	0.6202	0.4765	0.5247	0.7377	0.9059	0.9644	0.9806 (86)
MIT	19.3894	19.6029	19.9326	20.3375	20.6858	20.8951	20.9684	20.9554	20.8013	20.3523	19.7905	19.3376 (87)
Th 2	20.0456	20.0490	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494 (88)
util rest of house	0.9729	0.9573	0.9258	0.8560	0.7290	0.5482	0.3826	0.4292	0.6737	0.8826	0.9567	0.9770 (89)
MIT 2	17.8972	18.2072	18.6798	19.2474	19.7109	19.9606	20.0311	20.0216	19.8633	19.2799	18.4822	17.8248 (90)
Living area fraction									fLA = Living area / (4) =			0.1439 (91)
MIT	18.1119	18.4081	18.8601	19.4042	19.8512	20.0951	20.1659	20.1560	19.9983	19.4342	18.6704	18.0425 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9619	18.2581	18.7101	19.2542	19.7012	19.9451	20.0159	20.0060	19.8483	19.2842	18.5204	17.8925 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9596	0.9403	0.9044	0.8325	0.7109	0.5397	0.3791	0.4246	0.6584	0.8589	0.9395	0.9650	(94)
Useful gains	816.2517	903.7137	960.1128	969.2935	875.6310	652.2197	437.2778	457.0333	656.4373	771.5075	775.6846	779.8846	(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	1797.6552	1750.7435	1599.4994	1356.3819	1048.1437	700.1926	447.4803	472.3762	753.0092	1137.6171	1496.0520	1793.6868	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fraction	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	730.1642	569.2040	475.7036	278.7037	128.3494	0.0000	0.0000	0.0000	0.0000	272.3856	518.6645	754.2688 (98)
Space heating												3727.4439 (98)
Space heating per m2										(98) / (4) =		29.6181 (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												4118.7226 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	730.1642	569.2040	475.7036	278.7037	128.3494	0.0000	0.0000	0.0000	0.0000	272.3856	518.6645	754.2688 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	806.8113	628.9547	525.6394	307.9599	141.8226	0.0000	0.0000	0.0000	0.0000	300.9785	573.1100	833.4462 (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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357 (64)
Efficiency of water heater	90.0051	89.9545	89.8460	89.5925	89.0368	87.3000	87.3000	87.3000	87.3000	89.5437	89.8896	87.3000 (216)
Fuel for water heating, kWh/month	143.1807	125.4240	131.2073	118.7935	117.1523	106.3231	102.9059	113.9414	114.0096	125.0767	131.2063	139.2158 (219)
Water heating fuel used												1468.4367 (219)
Annual totals kWh/year												
Space heating fuel - main system												4118.7226 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												88.1618 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												163.1618 (231)
Electricity for lighting (calculated in Appendix L)												493.8077 (232)
Total delivered energy for all uses												6244.1287 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4118.7226	3.4800	143.3315 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1468.4367	3.4800	51.1016 (247)
Mechanical ventilation fans	88.1618	13.1900	11.6285 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	493.8077	13.1900	65.1332 (250)
Additional standing charges			120.0000 (251)
Total energy cost			401.0874 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9860 (257)
SAP value		86.2454
SAP rating (Section 12)		86 (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	4118.7226	0.2160	889.6441 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1468.4367	0.2160	317.1823 (264)
Space and water heating			1206.8264 (265)
Pumps and fans	163.1618	0.5190	84.6810 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)
Total kg/year			1547.7936 (272)
CO2 emissions per m2			12.3000 (273)
EI value			87.8604
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8892 = 3.913$, stars = 5
Water heating environmental impact	$0.216 / 0.8892 = 0.2429$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(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) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 51.7863	Feb 51.7863	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												130.9978 (39)
HLP	Jan 1.0409	Feb 1.0409	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0409 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)										Total =	Sum (45)m =	1615.5518	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(62)
WWHRS	-52.7868	-46.4472	-47.4046	-38.9925	-36.1998	-29.8592	-25.2638	-30.5909	-31.4865	-38.9311	-45.1069	-51.0232	eq. (G10)
Total of WWHRS savings												-474.0925	
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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357	(64)
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(65)
Total per year (kWh/year) =										Sum (64)m =		1307.2505	(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	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.9036	62.0878	50.4932	38.2266	28.5748	24.1241	26.0669	33.8827	45.4773	57.7439	67.3957	71.8464	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7848	441.3173	429.8956	405.5803	374.8865	346.0387	326.7666	322.2342	333.6558	357.9712	388.6649	417.5127	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	702.1530	696.4935	668.5429	625.2527	580.5485	541.1142	518.5733	528.5380	553.9304	597.4555	645.6410	682.4575	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				8.1100	12.9236		0.4600		0.0000		0.7700		37.1237 (75)
Southeast				0.6900	40.4699		0.4600		0.0000		0.7700		9.8908 (77)
Southwest				5.0600	40.4699		0.4600		0.0000		0.7700		72.5323 (79)
Northwest				0.6900	12.9236		0.4600		0.0000		0.7700		3.1585 (81)
Southwest				3.1500	40.4699		0.4300		0.0000		0.7700		42.2087 (79)
Solar gains	164.9140	265.1500	391.0229	555.6845	656.1446	720.2969	677.4114	596.5851	478.9243	322.3918	204.9222	138.1736	(83)
Total gains	867.0670	961.6434	1059.5657	1180.9373	1236.6931	1261.4111	1195.9847	1125.1231	1032.8547	919.8473	850.5633	820.6311	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516		
alpha	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901		
util living area	0.9720	0.9591	0.9268	0.8503	0.7091	0.4925	0.3343	0.3650	0.6466	0.8748	0.9536	0.9762	(86)	
MIT	19.5362	19.7074	20.0562	20.4689	20.7981	20.9602	20.9926	20.9900	20.8915	20.4963	19.9472	19.4869	(87)	
Th 2	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	(88)	
util rest of house	0.9667	0.9514	0.9125	0.8209	0.6533	0.4084	0.2343	0.2601	0.5661	0.8431	0.9432	0.9715	(89)	
MIT 2	18.1127	18.3586	18.8562	19.4268	19.8497	20.0230	20.0470	20.0459	19.9620	19.4765	18.7074	18.0420	(90)	
Living area fraction									fLA = Living area / (4) =				0.1439	(91)
MIT	18.3176	18.5527	19.0289	19.5768	19.9861	20.1579	20.1831	20.1817	20.0958	19.6233	18.8858	18.2499	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.1676	18.4027	18.8789	19.4268	19.8361	20.0079	20.0331	20.0317	19.9458	19.4733	18.7358	18.0999	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9518	0.9333	0.8901	0.7982	0.6395	0.4046	0.2325	0.2581	0.5565	0.8195	0.9237	0.9579	(94)
Useful gains	825.2544	897.4768	943.1653	942.6710	790.8784	510.3517	278.0865	290.3864	574.8047	753.8143	785.6566	786.0604	(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	1711.8240	1677.1232	1503.7049	1247.9855	895.5187	525.0199	279.4277	292.3521	621.6841	1031.3796	1406.3623	1702.9571	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	659.6078	523.9224	417.0415	219.8264	77.8524	0.0000	0.0000	0.0000	0.0000	206.5086	446.9081	682.1711 (98)
Space heating												3233.8383 (98)
Space heating per m2											(98) / (4) =	25.6960 (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												3573.3020 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	659.6078	523.9224	417.0415	219.8264	77.8524	0.0000	0.0000	0.0000	0.0000	206.5086	446.9081	682.1711 (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)	728.8484	578.9197	460.8193	242.9021	86.0247	0.0000	0.0000	0.0000	0.0000	228.1863	493.8211	753.7803 (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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357 (64)
Efficiency of water heater (217)m	89.9610	89.9610	89.7748	89.4306	88.6395	87.3000	87.3000	87.3000	87.3000	89.3484	89.8126	87.3000 (216)
Fuel for water heating, kWh/month	143.2507	125.4778	131.3113	119.0085	117.6773	106.3231	102.9059	113.9414	114.0096	125.3501	131.3187	139.2804 (219)
Water heating fuel used												1469.8549 (219)
Annual totals kWh/year												
Space heating fuel - main system												3573.3020 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												88.1618 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												163.1618 (231)
Electricity for lighting (calculated in Appendix L)												493.8077 (232)
Total delivered energy for all uses												5700.1264 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3573.3020	3.9200	140.0734 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1469.8549	3.9200	57.6183 (247)
Mechanical ventilation fans	88.1618	16.9600	14.9522 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	493.8077	16.9600	83.7498 (250)
Additional standing charges			88.0000 (251)
Total energy cost			397.1138 (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	3573.3020	0.2160	771.8332 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.8549	0.2160	317.4887 (264)
Space and water heating			1089.3219 (265)
Pumps and fans	163.1618	0.5190	84.6810 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)
Total kg/year			1430.2891 (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	3573.3020	1.2200	4359.4284 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.8549	1.2200	1793.2230 (264)
Space and water heating			6152.6514 (265)
Pumps and fans	163.1618	3.0700	500.9066 (267)
Energy for lighting	493.8077	3.0700	1515.9897 (268)
Primary energy kWh/year			8169.5477 (272)
Primary energy kWh/m2/year			64.9150 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(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	SAP increase too small
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
U Solar photovoltaic panels	+ 7.8	-£ 309	-947 kg (66.2%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.7	-£ 23	-145 kg (10.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 7.52 kg/m²	A 94	A 95
Total Savings	£309 7.52 kg/m²		
Potential energy efficiency rating:		A 94	
Potential environmental impact rating:			A 95

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£111	£111	£0
Mains gas	£286	£286	£0
Space heating	£256	£256	£0
Water heating	£58	£58	£0
Lighting	£84	£84	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£397	£88	£309
Total cost of uses	£398	£89	£309
Delivered energy	45 kWh/m²	31 kWh/m²	14 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.5 tonnes	0.9 tonnes
CO2 emissions per m²	11 kg/m²	4 kg/m²	8 kg/m²
Primary energy	65 kWh/m²	20 kWh/m²	44 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(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) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27a)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 52.3702	Feb 51.8511	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	131.5816	131.0625	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												131.0518 (39)
HLP	Jan 1.0455	Feb 1.0414	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0413 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)										Total =	Sum (45)m =	1615.5518	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(62)
WWHRS	-52.7868	-46.4472	-47.4046	-38.9925	-36.1998	-29.8592	-25.2638	-30.5909	-31.4865	-38.9311	-45.1069	-51.0232	eq. (G10)
Total of WWHRS savings												-474.0925	
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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357	(64)
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(65)
Total per year (kWh/year) =										Sum (64)m =		1307.2505	(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	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.9036	62.0878	50.4932	38.2266	28.5748	24.1241	26.0669	33.8827	45.4773	57.7439	67.3957	71.8464	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7848	441.3173	429.8956	405.5803	374.8865	346.0387	326.7666	322.2342	333.6558	357.9712	388.6649	417.5127	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	702.1530	696.4935	668.5429	625.2527	580.5485	541.1142	518.5733	528.5380	553.9304	597.4555	645.6410	682.4575	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				8.1100	11.2829	0.4600	0.0000		0.7700	32.4109 (75)		
Southeast				0.6900	36.7938	0.4600	0.0000		0.7700	8.9923 (77)		
Southwest				5.0600	36.7938	0.4600	0.0000		0.7700	65.9438 (79)		
Northwest				0.6900	11.2829	0.4600	0.0000		0.7700	2.7575 (81)		
Southwest				3.1500	36.7938	0.4300	0.0000		0.7700	38.3747 (79)		
Solar gains	148.4793	264.5967	393.0611	539.0299	651.2290	667.4004	634.7556	547.8577	443.1076	300.8018	179.9713	125.6908 (83)
Total gains	850.6323	961.0902	1061.6040	1164.2826	1231.7775	1208.5146	1153.3289	1076.3958	997.0380	898.2573	825.6124	808.1483 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	37.1858	37.3331	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	
alpha	3.4791	3.4889	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	
util living area	0.9771	0.9639	0.9375	0.8794	0.7730	0.6202	0.4765	0.5247	0.7377	0.9059	0.9644	0.9806	(86)
MIT	19.3894	19.6029	19.9326	20.3375	20.6858	20.8951	20.9684	20.9554	20.8013	20.3523	19.7905	19.3376	(87)
Th 2	20.0456	20.0490	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	(88)
util rest of house	0.9729	0.9573	0.9258	0.8560	0.7290	0.5482	0.3826	0.4292	0.6737	0.8826	0.9567	0.9770	(89)
MIT 2	17.8972	18.2072	18.6798	19.2474	19.7109	19.9606	20.0311	20.0216	19.8633	19.2799	18.4822	17.8248	(90)
Living area fraction									fLA =	Living area / (4) =		0.1439	(91)
MIT	18.1119	18.4081	18.8601	19.4042	19.8512	20.0951	20.1659	20.1560	19.9983	19.4342	18.6704	18.0425	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9619	18.2581	18.7101	19.2542	19.7012	19.9451	20.0159	20.0060	19.8483	19.2842	18.5204	17.8925	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9596	0.9403	0.9044	0.8325	0.7109	0.5397	0.3791	0.4246	0.6584	0.8589	0.9395	0.9650	(94)
Useful gains	816.2517	903.7137	960.1128	969.2935	875.6310	652.2197	437.2778	457.0333	656.4373	771.5075	775.6846	779.8846	(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	1797.6552	1750.7435	1599.4994	1356.3819	1048.1437	700.1926	447.4803	472.3762	753.0092	1137.6171	1496.0520	1793.6868	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Month fraction	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	730.1642	569.2040	475.7036	278.7037	128.3494	0.0000	0.0000	0.0000	0.0000	272.3856	518.6645	754.2688 (98)
Space heating												3727.4439 (98)
Space heating per m2										(98) / (4) =		29.6181 (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												4118.7226 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	730.1642	569.2040	475.7036	278.7037	128.3494	0.0000	0.0000	0.0000	0.0000	272.3856	518.6645	754.2688 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	806.8113	628.9547	525.6394	307.9599	141.8226	0.0000	0.0000	0.0000	0.0000	300.9785	573.1100	833.4462 (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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357 (64)
Efficiency of water heater (217)m	90.0051	89.9545	89.8460	89.5925	89.0368	87.3000	87.3000	87.3000	87.3000	89.5437	89.8896	87.3000 (216)
Fuel for water heating, kWh/month	143.1807	125.4240	131.2073	118.7935	117.1523	106.3231	102.9059	113.9414	114.0096	125.0767	131.2063	139.2158 (219)
Water heating fuel used												1468.4367 (219)
Annual totals kWh/year												
Space heating fuel - main system												4118.7226 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												88.1618 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												163.1618 (231)
Electricity for lighting (calculated in Appendix L)												493.8077 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394 (233)
Total delivered energy for all uses												4516.8893 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4118.7226	3.4800	143.3315 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1468.4367	3.4800	51.1016 (247)
Mechanical ventilation fans	88.1618	13.1900	11.6285 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	493.8077	13.1900	65.1332 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			173.2645 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4259 (257)
SAP value		94.0582
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4118.7226	0.2160	889.6441 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1468.4367	0.2160	317.1823 (264)
Space and water heating			1206.8264 (265)
Pumps and fans	163.1618	0.5190	84.6810 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			651.3563 (272)
CO2 emissions per m2			5.1800 (273)
EI value			94.8913
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5300 (1b)	x 2.3800 (2b)	= 151.2014 (1b) - (3b)
First floor	62.3200 (1c)	x 2.6100 (2c)	= 162.6552 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.8566 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (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) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (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) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			14.5500	1.1450	16.6603		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			63.5300	0.1100	6.9883	75.0000	4764.7500 (28a)
100mm Knauf Supafil 34	160.7300	21.6600	139.0700	0.2500	34.7675	52.8000	7342.8960 (29a)
Plane Ceiling-500mm Loft Roll	62.3200		62.3200	0.0900	5.6088	9.0000	560.8800 (30)
Bay Flat Roof	1.2100		1.2100	0.1400	0.1694	9.0000	10.8900 (30)
Total net area of external elements Aum(A, m ²)			287.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.9244		(33)
Timber GF			77.3000			9.0000	695.7000 (32c)
Timber 1F			134.3500			9.0000	1209.1500 (32c)
Masonry GF			41.2700			39.0000	1609.5300 (32c)
Internal Floor			62.3200			13.8000	860.0160 (32d)
Internal Ceiling			62.3200			9.0000	560.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17614.6920 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							139.9658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2870 (36)
Total fabric heat loss						(33) + (36) =	79.2114 (37)

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

(38)m	Jan 51.7863	Feb 51.7863	Mar 51.7863	Apr 51.7863	May 51.7863	Jun 51.7863	Jul 51.7863	Aug 51.7863	Sep 51.7863	Oct 51.7863	Nov 51.7863	Dec 51.7863 (38)
Heat transfer coeff	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978	130.9978 (39)
Average = Sum(39)m / 12 =												130.9978 (39)
HLP	Jan 1.0409	Feb 1.0409	Mar 1.0409	Apr 1.0409	May 1.0409	Jun 1.0409	Jul 1.0409	Aug 1.0409	Sep 1.0409	Oct 1.0409	Nov 1.0409	Dec 1.0409 (40)
HLP (average)												1.0409 (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	2.8834 (42)
Average daily hot water use (litres/day)	102.6797 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9477	108.8405	104.7333	100.6261	96.5189	92.4117	92.4117	96.5189	100.6261	104.7333	108.8405	112.9477	(44)
Energy conte	167.4982	146.4950	151.1697	131.7934	126.4589	109.1244	101.1198	116.0365	117.4223	136.8444	149.3763	162.2130	(45)
Energy content (annual)	Total = Sum (45)m =												1615.5518 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1247	21.9742	22.6755	19.7690	18.9688	16.3687	15.1680	17.4055	17.6133	20.5267	22.4064	24.3320	(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	14.1586	12.7769	14.1194	13.6291	14.0495	13.5548	13.9808	14.0254	13.5946	14.0850	13.6713	14.1459	(61)
Total heat required for water heating calculated for each month	181.6567	159.2718	165.2890	145.4225	140.5084	122.6792	115.1006	130.0618	131.0169	150.9294	163.0476	176.3589	(62)
WWHRS	-52.7868	-46.4472	-47.4046	-38.9925	-36.1998	-29.8592	-25.2638	-30.5909	-31.4865	-38.9311	-45.1069	-51.0232	eq. (G10)
Total of WWHRS savings	-474.0925												
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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357	(64)
Total per year (kWh/year) = Sum (64)m =	1307.2505 (64)												
Heat gains from water heating, kWh/month	59.2328	51.9038	53.7938	47.2286	45.5600	39.6726	37.1175	42.0885	42.4416	49.0220	53.0855	57.4723	(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	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	173.0014	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.9036	62.0878	50.4932	38.2266	28.5748	24.1241	26.0669	33.8827	45.4773	57.7439	67.3957	71.8464	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7848	441.3173	429.8956	405.5803	374.8865	346.0387	326.7666	322.2342	333.6558	357.9712	388.6649	417.5127	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	55.1835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	-115.3343	(71)
Water heating gains (Table 5)	79.6139	77.2378	72.3034	65.5952	61.2365	55.1008	49.8892	56.5705	58.9466	65.8898	73.7298	77.2477	(72)
Total internal gains	702.1530	696.4935	668.5429	625.2527	580.5485	541.1142	518.5733	528.5380	553.9304	597.4555	645.6410	682.4575	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				8.1100	12.9236		0.4600		0.0000		0.7700		37.1237 (75)
Southeast				0.6900	40.4699		0.4600		0.0000		0.7700		9.8908 (77)
Southwest				5.0600	40.4699		0.4600		0.0000		0.7700		72.5323 (79)
Northwest				0.6900	12.9236		0.4600		0.0000		0.7700		3.1585 (81)
Southwest				3.1500	40.4699		0.4300		0.0000		0.7700		42.2087 (79)
Solar gains	164.9140	265.1500	391.0229	555.6845	656.1446	720.2969	677.4114	596.5851	478.9243	322.3918	204.9222	138.1736	(83)
Total gains	867.0670	961.6434	1059.5657	1180.9373	1236.6931	1261.4111	1195.9847	1125.1231	1032.8547	919.8473	850.5633	820.6311	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	37.3516	
alpha	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	3.4901	
util living area	0.9720	0.9591	0.9268	0.8503	0.7091	0.4925	0.3343	0.3650	0.6466	0.8748	0.9536	0.9762	(86)
MIT	19.5362	19.7074	20.0562	20.4689	20.7981	20.9602	20.9926	20.9900	20.8915	20.4963	19.9472	19.4869	(87)
Th 2	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	20.0494	(88)
util rest of house	0.9667	0.9514	0.9125	0.8209	0.6533	0.4084	0.2343	0.2601	0.5661	0.8431	0.9432	0.9715	(89)
MIT 2	18.1127	18.3586	18.8562	19.4268	19.8497	20.0230	20.0470	20.0459	19.9620	19.4765	18.7074	18.0420	(90)
Living area fraction	fLA = Living area / (4) =												0.1439 (91)
MIT	18.3176	18.5527	19.0289	19.5768	19.9861	20.1579	20.1831	20.1817	20.0958	19.6233	18.8858	18.2499	(92)
Temperature adjustment	-0.1500												
adjusted MIT	18.1676	18.4027	18.8789	19.4268	19.8361	20.0079	20.0331	20.0317	19.9458	19.4733	18.7358	18.0999	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9518	0.9333	0.8901	0.7982	0.6395	0.4046	0.2325	0.2581	0.5565	0.8195	0.9237	0.9579	(94)
Useful gains	825.2544	897.4768	943.1653	942.6710	790.8784	510.3517	278.0865	290.3864	574.8047	753.8143	785.6566	786.0604	(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	1711.8240	1677.1232	1503.7049	1247.9855	895.5187	525.0199	279.4277	292.3521	621.6841	1031.3796	1406.3623	1702.9571	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Month fraction	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	659.6078	523.9224	417.0415	219.8264	77.8524	0.0000	0.0000	0.0000	0.0000	206.5086	446.9081	682.1711 (98)
Space heating												3233.8383 (98)
Space heating per m2											(98) / (4) =	25.6960 (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												3573.3020 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	659.6078	523.9224	417.0415	219.8264	77.8524	0.0000	0.0000	0.0000	0.0000	206.5086	446.9081	682.1711 (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)	728.8484	578.9197	460.8193	242.9021	86.0247	0.0000	0.0000	0.0000	0.0000	228.1863	493.8211	753.7803 (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	128.8699	112.8246	117.8845	106.4300	104.3086	92.8201	89.8369	99.4709	99.5304	111.9982	117.9408	125.3357 (64)
Efficiency of water heater (217)m	89.9610	89.9160	89.7748	89.4306	88.6395	87.3000	87.3000	87.3000	87.3000	89.3484	89.8126	87.3000 (216)
Fuel for water heating, kWh/month	143.2507	125.4778	131.3113	119.0085	117.6773	106.3231	102.9059	113.9414	114.0096	125.3501	131.3187	139.2804 (219)
Water heating fuel used												1469.8549 (219)
Annual totals kWh/year												
Space heating fuel - main system												3573.3020 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												88.1618 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												163.1618 (231)
Electricity for lighting (calculated in Appendix L)												493.8077 (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												3875.9667 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3573.3020	3.9200	140.0734 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1469.8549	3.9200	57.6183 (247)
Mechanical ventilation fans	88.1618	16.9600	14.9522 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	493.8077	16.9600	83.7498 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			87.7363 (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	3573.3020	0.2160	771.8332 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.8549	0.2160	317.4887 (264)
Space and water heating			1089.3219 (265)
Pumps and fans	163.1618	0.5190	84.6810 (267)
Energy for lighting	493.8077	0.5190	256.2862 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			483.5502 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
--	-----------------	----------------------------------	-------------------------

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	3573.3020	1.2200	4359.4284 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1469.8549	1.2200	1793.2230 (264)
Space and water heating			6152.6514 (265)
Pumps and fans	163.1618	3.0700	500.9066 (267)
Energy for lighting	493.8077	3.0700	1515.9897 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2569.3776 (272)
Primary energy kWh/m2/year			20.4162 (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	140.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	414.29 (P1)
Transmission heat loss coefficient	79.21 (37)
Summer heat loss coefficient	493.50 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.1100	98.8453	0.4600	0.0000	0.9000	331.8769
South East	0.6900	119.9223	0.4600	0.0000	0.9000	34.2570
South West	5.0600	119.9223	0.4600	0.0000	0.9000	251.2181
North West	0.6900	98.8453	0.4600	0.0000	0.9000	28.2361
South West	3.1500	119.9223	0.4300	0.0000	0.9000	146.1913

total: 791.7796

Solar gains	Jun 842	Jul 792	Aug 697	(P3/P4)
Internal gains	538	516	526	
Total summer gains	1380	1307	1223	(P5)
Summer gain/loss ratio	2.80	2.65	2.48	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 140.0)	1.02	1.02	1.02	
Threshold temperature	19.82	21.57	21.30	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			