

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Aslin - Semi			Issued on Date	15/12/2022
Assessment Reference	Aslin - Semi	Prop Type Ref			
Property	Plot, 4 Bed, K, WC, B, ES				
SAP Rating	86 B	DER	13.78	TER	17.39
Environmental	88 B	% DER<TER	20.75		
CO ₂ Emissions (t/year)	1.18	DFEE	41.81	TFEE	52.53
General Requirements Compliance	Pass	% DFEE<TFEE	20.41		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 103 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) 17.39 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)41.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.28 (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	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.80 (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 ESPl 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 South East: 5.48 m², No overhang

Windows facing South West: 0.66 m², No overhang

Windows facing North West: 6.63 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

External wall U-value	0.12 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	0.11 W/m ² K
Window U-value	1.00 W/m ² K
Thermal bridging y-value	0.90 W/m ² K
	0.032 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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												1 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
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													
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
(26)...(30) + (32) =							53.9057
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6980 (36)
Total fabric heat loss							(33) + (36) = 60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Heat transfer coeff	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
Average = Sum(39)m / 12 =												103.5114 (39)
HLP	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
HLP (average)												1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7677 (42)
Average daily hot water use (litres/day)												99.9335 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268 (44)
Energy content (annual)	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812 (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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355 (61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099 (62)
WWHRS	-52.2169	-45.9449	-46.8924	-38.5768	-35.8168	-29.5453	-25.0019	-30.2727	-31.1572	-38.5200	-44.6249	-50.4711 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-469.0410
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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388 (64)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271 (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	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3717	22.5349	18.3266	13.8744	10.3713	8.7559	9.4611	12.2978	16.5061	20.9583	24.4615	26.0769 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.4928	264.2063	257.3684	242.8114	224.4358	207.1653	195.6275	192.9140	199.7519	214.3089	232.6846	249.9551 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386 (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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090 (71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053 (72)
Total internal gains	431.9886	429.5527	413.7042	388.1640	362.0427	337.1855	321.2809	327.9065	341.2656	367.0343	396.5433	418.8531 (73)

6. Solar gains

[Jan]																		
			Area			Solar flux			g			FF			Access			Gains
			m2			Table 6a			Specific data			Specific data			factor			W
						W/m2			or Table 6b			or Table 6c			Table 6d			
Southeast			5.4800			36.7938			0.4600			0.0000			0.7700			71.4174 (77)
Southwest			0.6600			36.7938			0.4600			0.0000			0.7700			8.6014 (79)
Northwest			3.4800			11.2829			0.4600			0.0000			0.7700			13.9075 (81)
Northwest			3.1500			11.2829			0.4300			0.0000			0.7700			11.7677 (81)
Northwest			0.6400			16.8560			0.7100			0.7000			1.0000			4.8254 (82)
Solar gains	110.5194	198.5719	299.2354	417.1553	509.7530	524.8066	498.1677	426.1918	339.6000	226.8766	134.2522	93.3699	(83)					
Total gains	542.5081	628.1247	712.9396	805.3193	871.7957	861.9922	819.4486	754.0983	680.8656	593.9109	530.7955	512.2230	(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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093
util living area	0.9882	0.9795	0.9601	0.9122	0.8151	0.6669	0.5220	0.5784	0.7965	0.9403	0.9807	0.9903 (86)
MIT	19.2280	19.4379	19.7869	20.2305	20.6255	20.8698	20.9588	20.9406	20.7445	20.2302	19.6356	19.1698 (87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813 (88)
util rest of house	0.9859	0.9756	0.9523	0.8942	0.7763	0.5971	0.4256	0.4814	0.7399	0.9244	0.9764	0.9884 (89)
MIT 2	17.6903	17.9950	18.4993	19.1296	19.6662	19.9666	20.0561	20.0421	19.8302	19.1402	18.2849	17.6056 (90)
Living area fraction	17.9588	18.2469	18.7242	19.3219	19.8337	20.1244	20.2137	20.1990	19.9899	19.3306	18.5207	17.8787 (92)
Temperature adjustment	17.8088	18.0969	18.5742	19.1719	19.6837	19.9744	20.0637	20.0490	19.8399	19.1806	18.3707	-0.1500
adjusted MIT	17.8088	18.0969	18.5742	19.1719	19.6837	19.9744	20.0637	20.0490	19.8399	19.1806	18.3707	17.7287 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9776	0.9635	0.9349	0.8719	0.7570	0.5882	0.4237	0.4778	0.7225	0.9036	0.9646	0.9812	(94)
Useful gains	530.3660	605.2276	666.5361	702.1656	659.9310	507.0395	347.1733	360.2815	491.9330	536.6545	512.0122	502.5937	(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													
	1398.3136	1366.0320	1249.8128	1063.2552	826.4008	556.3067	358.5341	377.7120	594.1414	888.1857	1166.6498	1400.3727	(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													
	645.7530	511.2606	433.9579	259.9845	123.8536	0.0000	0.0000	0.0000	0.0000	261.5392	471.3391	667.9476	(98)
Space heating													3375.6354 (98)
Space heating per m2											(98) / (4) =	32.6906	(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	3729.9839	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	645.7530	511.2606	433.9579	259.9845	123.8536	0.0000	0.0000	0.0000	0.0000	261.5392	471.3391	667.9476	(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)	713.5392	564.9288	479.5115	287.2757	136.8548	0.0000	0.0000	0.0000	0.0000	288.9936	520.8167	738.0636	(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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Efficiency of water heater (217)m	89.9654	89.9190	89.8135	89.5664	89.0318	87.3000	87.3000	87.3000	87.3000	89.5362	89.8566	89.9922	(216)
Fuel for water heating, kWh/month	138.8858	121.6643	127.3126	115.3401	113.7727	103.3248	100.0943	110.7348	110.7742	121.4487	127.3338	135.0549	(219)
Water heating fuel used												1425.7410	(219)
Annual totals kWh/year													
Space heating fuel - main system												3729.9839	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)		
mechanical ventilation fans (SFP = 0.2294)		72.7890 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		147.7890 (231)
Electricity for lighting (calculated in Appendix L)		448.0723 (232)
Total delivered energy for all uses		5751.5862 (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	3729.9839	0.2160	805.6765	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1425.7410	0.2160	307.9601	(264)
Space and water heating			1113.6366	(265)
Pumps and fans	147.7890	0.5190	76.7025	(267)
Energy for lighting	448.0723	0.5190	232.5495	(268)
Total CO2, kg/year			1422.8886	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7800	(273)

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

DER		13.7800	ZC1
Total Floor Area	TFA	103.2600	
Assumed number of occupants	N	2.7677	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0063	ZC2
CO2 emissions from cooking, equation (L16)		1.7957	ZC3
Total CO2 emissions		30.5820	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		30.5820	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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) = 0.1538 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4038 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3735 (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	0.4763	0.4669	0.4576	0.4109	0.4015	0.3549	0.3549	0.3455	0.3735	0.4015	0.4202	0.4389 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5963 (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 Opening Type (Uw = 1.40)			12.7700	1.3258	16.9299		(27)
TER Room Window (Uw = 1.70)			0.6400	1.5918	1.0187		(27a)
FP McCann System			40.1800	0.1300	5.2234		(28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.1800	16.6608		(29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.1800	0.3888		(29a)
Wall to Void	18.8700		18.8700	0.1800	3.3966		(29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.1300	1.5275		(30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1300	1.4898		(30)
Dormer Flat Roof	1.9000		1.9000	0.1300	0.2470		(30)
Ceiling to Void	17.2800		17.2800	0.1300	2.2464		(30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.1090		(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)							10.7251 (36)
Total fabric heat loss						(33) + (36) =	61.8341 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.6399	52.2620	51.8916	50.1517	49.8261	48.3107	48.3107	48.0301	48.8944	49.8261	50.4847	51.1731 (38)
Heat transfer coeff	114.4740	114.0960	113.7256	111.9857	111.6602	110.1448	110.1448	109.8642	110.7285	111.6602	112.3187	113.0072 (39)
Average = Sum(39)m / 12 =												111.9841 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1086	1.1049	1.1014	1.0845	1.0813	1.0667	1.0667	1.0640	1.0723	1.0813	1.0877	1.0944 (40)
HLP (average)												1.0845 (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												2.7677 (42)
Average daily hot water use (litres/day)												99.9335 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268 (44)
Energy conte	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745 (45)

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Energy content (annual)												Total = Sum(45)m = 1572.3423 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812 (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	50.9589	46.0274	50.9589	48.2966	47.8695	44.3540	45.8325	47.8695	48.2966	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.9772	188.6042	198.0854	176.5651	170.9461	150.5598	144.2478	160.8024	162.5783	184.1432	194.6962	208.8334 (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	213.9772	188.6042	198.0854	176.5651	170.9461	150.5598	144.2478	160.8024	162.5783	184.1432	194.6962	208.8334 (64)
												Total per year (kWh/year) = Sum(64)m = 2154.0391 (64)
Heat gains from water heating, kWh/month	66.9433	58.9136	61.6593	54.7234	52.8904	46.4019	44.1812	49.5176	50.0728	57.0235	60.6680	65.2330 (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	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3717	22.5349	18.3266	13.8744	10.3713	8.7559	9.4611	12.2978	16.5061	20.9583	24.4615	26.0769	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.4928	264.2063	257.3684	242.8114	224.4358	207.1653	195.6275	192.9140	199.7519	214.3089	232.6846	249.9551	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	89.9776	87.6691	82.8754	76.0047	71.0892	64.4471	59.3833	66.5559	69.5456	76.6445	84.2611	87.6788	(72)
Total internal gains	444.3580	441.9262	426.0863	400.2064	373.4121	347.8841	331.9878	339.2836	353.3195	379.4276	408.9230	431.2266	(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			
Southeast				5.4800	36.7938	0.6300	0.7000	0.7700	61.6208 (77)			
Southwest				0.6600	36.7938	0.6300	0.7000	0.7700	7.4215 (79)			
Northwest				6.6300	11.2829	0.6300	0.7000	0.7700	22.8617 (81)			
Northwest				0.6400	16.8560	0.6300	0.7000	1.0000	4.2817 (82)			
Solar gains	96.1856	173.0202	261.2412	364.9692	446.6182	460.0640	436.6084	373.1195	296.7431	197.8201	116.8771	81.2366 (83)
Total gains	540.5436	614.9464	687.3276	765.1757	820.0304	807.9481	768.5961	712.4032	650.0626	577.2478	525.8001	512.4631 (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	62.6416	62.8491	63.0538	64.0335	64.2201	65.1037	65.1037	65.2700	64.7605	64.2201	63.8436	63.4547
alpha	5.1761	5.1899	5.2036	5.2689	5.2813	5.3402	5.3402	5.3513	5.3174	5.2813	5.2562	5.2303
util living area	0.9990	0.9977	0.9938	0.9780	0.9218	0.7797	0.6096	0.6724	0.9012	0.9873	0.9978	0.9992 (86)
MIT	19.7429	19.8781	20.1136	20.4415	20.7398	20.9308	20.9851	20.9756	20.8356	20.4554	20.0464	19.7261 (87)
Th 2	19.9938	19.9968	19.9997	20.0135	20.0161	20.0281	20.0281	20.0304	20.0235	20.0161	20.0109	20.0054 (88)
util rest of house	0.9986	0.9969	0.9915	0.9688	0.8881	0.6948	0.4856	0.5485	0.8454	0.9805	0.9969	0.9990 (89)
MIT 2	18.3070	18.5067	18.8522	19.3351	19.7459	19.9787	20.0222	20.0194	19.8799	19.3613	18.7632	18.2907 (90)
Living area fraction	18.5577	18.7461	19.0725	19.5283	19.9195	20.1449	20.1904	20.1864	20.0467	19.5523	18.9873	18.5413 (91)
MIT	18.5577	18.7461	19.0725	19.5283	19.9195	20.1449	20.1904	20.1864	20.0467	19.5523	18.9873	18.5413 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5577	18.7461	19.0725	19.5283	19.9195	20.1449	20.1904	20.1864	20.0467	19.5523	18.9873	18.5413 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9978	0.9954	0.9884	0.9628	0.8841	0.7061	0.5072	0.5698	0.8471	0.9760	0.9955	0.9983	(94)
Useful gains	539.3566	612.1324	679.3500	736.7459	725.0074	570.4599	389.8548	405.9336	550.6457	563.3870	523.4154	511.6128	(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	1632.1354	1579.7908	1429.8137	1190.2131	917.7866	610.7463	395.4598	415.9900	658.4728	999.6206	1335.1657	1620.6717	(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	813.0274	650.2664	558.3450	326.4963	143.4277	0.0000	0.0000	0.0000	0.0000	324.5578	584.4602	825.1398	(98)
Space heating												4225.7208	(98)
Space heating per m2												(98) / (4) = 40.9231	(99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4524.3264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	813.0274	650.2664	558.3450	326.4963	143.4277	0.0000	0.0000	0.0000	0.0000	324.5578	584.4602	825.1398 (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)	870.4790	696.2167	597.7998	349.5678	153.5629	0.0000	0.0000	0.0000	0.0000	347.4923	625.7604	883.4473 (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	213.9772	188.6042	198.0854	176.5651	170.9461	150.5598	144.2478	160.8024	162.5783	184.1432	194.6962	208.8334 (64)
Efficiency of water heater (217)m	88.0915	87.9139	87.5174	86.5779	84.6130	80.3000	80.3000	80.3000	80.3000	86.4633	87.6453	80.3000 (216)
Fuel for water heating, kWh/month	242.9034	214.5329	226.3383	203.9377	202.0330	187.4966	179.6361	200.2521	202.4637	212.9727	222.1409	236.8789 (219)
Water heating fuel used												2531.5863 (219)
Annual totals kWh/year												
Space heating fuel - main system												4524.3264 (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)												448.0723 (232)
Total delivered energy for all uses												7578.9849 (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	4524.3264	0.2160	977.2545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2531.5863	0.2160	546.8226 (264)
Space and water heating			1524.0771 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	448.0723	0.5190	232.5495 (268)
Total CO2, kg/m2/year			1795.5517 (272)
Emissions per m2 for space and water heating			14.7596 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2521 (272b)
Emissions per m2 for pumps and fans			0.3770 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7596 * 1.00) + 2.2521 + 0.3770, rounded to 2 d.p.			17.3900 (273)

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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	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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) =					Air changes per hour 40.0000 / (5) = 0.1538 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3543 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3277 (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	0.4179	0.4097	0.4015	0.3605	0.3523	0.3114	0.3114	0.3032	0.3277	0.3523	0.3687	0.3851 (22b)
Effective ac	0.5873	0.5839	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.9057		(33)
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14025.8160 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K 135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.6980 (36)
Total fabric heat loss (33) + (36) = 60.6037 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	50.4002	50.1092	49.8241	48.4846	48.2340	47.0673	47.0673	46.8513	47.5167	48.2340	48.7410	49.2710 (38)
Heat transfer coeff	111.0039	110.7129	110.4278	109.0883	108.8377	107.6710	107.6710	107.4550	108.1204	108.8377	109.3446	109.8747 (39)
Average = Sum(39)m / 12 =												109.0871 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0750	1.0722	1.0694	1.0564	1.0540	1.0427	1.0427	1.0406	1.0471	1.0540	1.0589	1.0641 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7677 (42)											
Average daily hot water use (litres/day)	99.9335 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268 (44)
Energy content	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745 (45)
Energy content (annual)	Total = Sum(45)m =											1572.3423 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.6414	30.2976	31.2644	27.2570	26.1538	22.5687	20.9132	23.9983	24.2849	28.3017	30.8935	33.5483 (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	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3717	22.5349	18.3266	13.8744	10.3713	8.7559	9.4611	12.2978	16.5061	20.9583	24.4615	26.0769 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.4928	264.2063	257.3684	242.8114	224.4358	207.1653	195.6275	192.9140	199.7519	214.3089	232.6846	249.9551 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386 (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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090 (71)
Water heating gains (Table 5)	46.5610	45.0857	42.0220	37.8570	35.1529	31.3455	28.1092	32.2557	33.7290	38.0399	42.9076	45.0918 (72)
Total internal gains	397.9414	396.3428	382.2329	359.0587	334.4759	311.7825	297.7136	301.9834	314.5029	337.8230	364.5695	385.6396 (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			
Southeast				5.4800	36.7938	0.4600	0.0000	0.7700	71.4174 (77)			
Southwest				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (79)			
Northwest				3.4800	11.2829	0.4600	0.0000	0.7700	13.9075 (81)			
Northwest				3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)			
Northwest				0.6400	16.8560	0.7100	0.7000	1.0000	4.8254 (82)			
Solar gains	110.5194	198.5719	299.2354	417.1553	509.7530	524.8066	498.1677	426.1918	339.6000	226.8766	134.2522	93.3699 (83)
Total gains	508.4608	594.9147	681.4684	776.2140	844.2289	836.5891	795.8813	728.1752	654.1029	564.6996	498.8217	479.0095 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0984	35.1906	35.2815	35.7147	35.7970	36.1849	36.1849	36.2576	36.0345	35.7970	35.6310	35.4591
alpha	3.3399	3.3460	3.3521	3.3810	3.3865	3.4123	3.4123	3.4172	3.4023	3.3865	3.3754	3.3639
util living area	0.9903	0.9829	0.9664	0.9242	0.8365	0.6934	0.5496	0.6080	0.8208	0.9501	0.9842	0.9921 (86)
MIT	19.0361	19.2565	19.6267	20.1187	20.5521	20.8400	20.9466	20.9242	20.6933	20.1287	19.4964	19.0000 (87)
Th 2	20.0213	20.0236	20.0259	20.0366	20.0386	20.0479	20.0479	20.0496	20.0443	20.0386	20.0345	20.0303 (88)
util rest of house	0.9884	0.9796	0.9595	0.9076	0.7991	0.6223	0.4473	0.5065	0.7660	0.9360	0.9806	0.9905 (89)
MIT 2	18.2140	18.4346	18.8025	19.2902	19.6977	19.9510	20.0256	20.0153	19.8366	19.3087	18.6825	18.1847 (90)
Living area fraction	18.3576	18.5781	18.9464	19.4349	19.8469	20.1062	20.1864	20.1740	19.9862	19.4519	18.8246	18.3270 (92)
MIT	18.3576	18.5781	18.9464	19.4349	19.8469	20.1062	20.1864	20.1740	19.9862	19.4519	18.8246	18.3270 (93)
Temperature adjustment	18.3576	18.5781	18.9464	19.4349	19.8469	20.1062	20.1864	20.1740	19.9862	19.4519	18.8246	18.3270 (93)
adjusted MIT	18.3576	18.5781	18.9464	19.4349	19.8469	20.1062	20.1864	20.1740	19.9862	19.4519	18.8246	18.3270 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	500.2973	578.7867	647.1341	694.7691	667.4351	524.5884	368.5767	379.2416	498.5164	522.3494	486.0216	472.6268 (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	1560.4456	1514.3404	1374.4274	1149.2322	886.6883	592.8625	386.1504	405.5364	636.4135	963.4209	1282.0268	1552.2016 (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	788.7503	628.6921	541.1062	327.2134	163.1243	0.0000	0.0000	0.0000	0.0000	328.1572	573.1237	803.2036 (98)
Space heating	788.7503	628.6921	541.1062	327.2134	163.1243	0.0000	0.0000	0.0000	0.0000	328.1572	573.1237	803.2036 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 40.2225 (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	1012.1074	796.7654	816.6576	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7970	0.8605	0.8293	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	806.6774	685.5969	677.2448	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1077.7677	1028.4638	953.0838	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	195.1850	255.0930	205.2242	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													655.5022 (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	48.7963	63.7732	51.3060	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													163.8756 (107)
Space cooling per m2													1.5870 (108)
Energy for space heating													40.2225 (99)
Energy for space cooling													1.5870 (108)
Total													41.8095 (109)
Dwelling Fabric Energy Efficiency (DFEE)													41.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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) = 0.1538 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4038 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3735 (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	0.4763	0.4669	0.4576	0.4109	0.4015	0.3549	0.3549	0.3455	0.3735	0.4015	0.4202	0.4389 (22b)
Effective ac	0.6134	0.6090	0.6047	0.5844	0.5806	0.5630	0.5630	0.5597	0.5698	0.5806	0.5883	0.5963 (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 Opening Type (Uw = 1.40)			12.7700	1.3258	16.9299		(27)
TER Room Window (Uw = 1.70)			0.6400	1.5918	1.0187		(27a)
FP McCann System			40.1800	0.1300	5.2234		(28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.1800	16.6608		(29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.1800	0.3888		(29a)
Wall to Void	18.8700		18.8700	0.1800	3.3966		(29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.1300	1.5275		(30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1300	1.4898		(30)
Dormer Flat Roof	1.9000		1.9000	0.1300	0.2470		(30)
Ceiling to Void	17.2800		17.2800	0.1300	2.2464		(30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.1090		(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)							10.7251 (36)
Total fabric heat loss						(33) + (36) =	61.8341 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.6399	52.2620	51.8916	50.1517	49.8261	48.3107	48.3107	48.0301	48.8944	49.8261	50.4847	51.1731 (38)
Heat transfer coeff	114.4740	114.0960	113.7256	111.9857	111.6602	110.1448	110.1448	109.8642	110.7285	111.6602	112.3187	113.0072 (39)
Average = Sum(39)m / 12 =												111.9841 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1086	1.1049	1.1014	1.0845	1.0813	1.0667	1.0667	1.0640	1.0723	1.0813	1.0877	1.0944 (40)
HLP (average)												1.0845 (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												2.7677 (42)
Average daily hot water use (litres/day)												99.9335 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268 (44)
Energy conte	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1572.3423 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.6414	30.2976	31.2644	27.2570	26.1538	22.5687	20.9132	23.9983	24.2849	28.3017	30.8935	33.5483 (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	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	138.3862	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3717	22.5349	18.3266	13.8744	10.3713	8.7559	9.4611	12.2978	16.5061	20.9583	24.4615	26.0769	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.4928	264.2063	257.3684	242.8114	224.4358	207.1653	195.6275	192.9140	199.7519	214.3089	232.6846	249.9551	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	36.8386	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	46.5610	45.0857	42.0220	37.8570	35.1529	31.3455	28.1092	32.2557	33.7290	38.0399	42.9076	45.0918	(72)
Total internal gains	397.9414	396.3428	382.2329	359.0587	334.4759	311.7825	297.7136	301.9834	314.5029	337.8230	364.5695	385.6396	(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			
Southeast				5.4800	36.7938	0.6300	0.7000	0.7700	61.6208 (77)			
Southwest				0.6600	36.7938	0.6300	0.7000	0.7700	7.4215 (79)			
Northwest				6.6300	11.2829	0.6300	0.7000	0.7700	22.8617 (81)			
Northwest				0.6400	16.8560	0.6300	0.7000	1.0000	4.2817 (82)			
Solar gains	96.1856	173.0202	261.2412	364.9692	446.6182	460.0640	436.6084	373.1195	296.7431	197.8201	116.8771	81.2366 (83)
Total gains	494.1270	569.3629	643.4742	724.0279	781.0941	771.8465	734.3220	675.1030	611.2460	535.6431	481.4466	466.8762 (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	62.6416	62.8491	63.0538	64.0335	64.2201	65.1037	65.1037	65.2700	64.7605	64.2201	63.8436	63.4547	
alpha	5.1761	5.1899	5.2036	5.2689	5.2813	5.3402	5.3402	5.3513	5.3174	5.2813	5.2562	5.2303	
util living area	0.9993	0.9984	0.9954	0.9825	0.9339	0.8017	0.6337	0.7011	0.9192	0.9909	0.9986	0.9995	(86)
MIT	19.7006	19.8368	20.0746	20.4075	20.7154	20.9205	20.9822	20.9704	20.8135	20.4193	20.0060	19.6844	(87)
Th 2	19.9938	19.9968	19.9997	20.0135	20.0161	20.0281	20.0281	20.0304	20.0235	20.0161	20.0109	20.0054	(88)
util rest of house	0.9991	0.9979	0.9937	0.9751	0.9038	0.7190	0.5069	0.5758	0.8698	0.9859	0.9980	0.9993	(89)
MIT 2	18.7999	18.9382	19.1777	19.5178	19.8111	19.9885	20.0232	20.0210	19.9089	19.5341	19.1188	18.7930	(90)
Living area fraction	18.9571	19.0951	19.3343	19.6731	19.9690	20.1512	20.1907	20.1868	20.0668	19.6887	19.2737	18.9486	(91)
MIT	18.9571	19.0951	19.3343	19.6731	19.9690	20.1512	20.1907	20.1868	20.0668	19.6887	19.2737	18.9486	(92)
Temperature adjustment	18.9571	19.0951	19.3343	19.6731	19.9690	20.1512	20.1907	20.1868	20.0668	19.6887	19.2737	18.9486	(93)
adjusted MIT	18.9571	19.0951	19.3343	19.6731	19.9690	20.1512	20.1907	20.1868	20.0668	19.6887	19.2737	18.9486	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.5041	567.7351	638.3709	703.5469	704.6185	563.9817	388.6573	403.4822	533.3354	526.8282	480.1528	466.4437	(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	1677.8594	1619.6066	1459.5841	1206.4351	923.3161	611.4359	395.4920	416.0320	660.6991	1014.8409	1367.3392	1666.7009	(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	881.1604	706.8577	610.9827	362.0795	162.7110	0.0000	0.0000	0.0000	0.0000	363.0814	638.7742	892.9914	(98)
Space heating												4618.6383	(98)
Space heating per m2												44.7282	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1035.3610	815.0714	834.9676	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8286	0.9016	0.8689	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	857.8920	734.8410	725.4836	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1002.9743	957.3319	891.6961	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	104.4593	165.5332	123.6621	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			393.6546 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	26.1148	41.3833	30.9155	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												98.4136 (107)
Energy for space heating												0.9531 (108)
Energy for space cooling												44.7282 (99)
Total												0.9531 (108)
Target Fabric Energy Efficiency (TFEE)												45.6813 (109)
												52.5 (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	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		4.0100
Infiltration rate													0.2005 (18)
Number of sides sheltered													1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1855 (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)	
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													
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				53.9057		(33)
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6980 (36)
Total fabric heat loss	(33) + (36) =						60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Heat transfer coeff	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
Average = Sum(39)m / 12 =												103.5114 (39)
HLP	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
HLP (average)												1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7677 (42)											
Average daily hot water use (litres/day)	99.9335 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268 (44)
Energy content (annual)	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812 (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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355 (61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099 (64)
RHI water heating demand	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271 (65)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271 (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	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4293	56.3373	45.8166	34.6861	25.9283	21.8897	23.6526	30.7446	41.2653	52.3958	61.1536	65.1922 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.2878	394.3378	384.1320	362.4051	334.9788	309.2019	291.9814	287.9314	298.1372	319.8641	347.2904	373.0673 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741 (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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090 (71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053 (72)
Total internal gains	644.0539	638.6993	613.1704	573.7820	533.3553	497.5687	477.0391	486.5833	509.6228	549.2396	593.0541	626.2933 (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	
Southeast												5.4800	40.4699		0.4600	0.0000		0.7700		78.5528 (77)	
Southwest												0.6600	40.4699		0.4600	0.0000		0.7700		9.4607 (79)	
Northwest												3.4800	12.9236		0.4600	0.0000		0.7700		15.9298 (81)	
Northwest												3.1500	12.9236		0.4300	0.0000		0.7700		13.4788 (81)	
Northwest												0.6400	19.3863		0.7100	0.7000		1.0000		5.5497 (82)	
Solar gains	122.9718	199.4381	298.4852	431.1499	514.6802	567.4302	532.6787	465.2106	368.0488	243.7620	153.1600			102.8113 (83)							
Total gains	767.0257	838.1373	911.6556	1004.9319	1048.0355	1064.9989	1009.7178	951.7939	877.6715	793.0015	746.2141			729.1046 (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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093
util living area	0.9622	0.9474	0.9107	0.8272	0.6793	0.4653	0.3139	0.3424	0.6145	0.8502	0.9395	0.9672 (86)
MIT	19.6511	19.8113	20.1419	20.5279	20.8273	20.9673	20.9941	20.9920	20.9093	20.5560	20.0422	19.6023 (87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813 (88)
util rest of house	0.9554	0.9382	0.8946	0.7964	0.6245	0.3872	0.2227	0.2467	0.5373	0.8160	0.9270	0.9612 (89)
MIT 2	18.3013	18.5304	18.9996	19.5294	19.9105	20.0593	20.0793	20.0784	20.0080	19.5790	18.8652	18.2316 (90)
Living area fraction	18.5370	18.7540	19.1990	19.7038	20.0706	20.2179	20.2390	20.2379	20.1654	19.7496	19.0707	0.1746 (91)
MIT	18.5370	18.7540	19.1990	19.7038	20.0706	20.2179	20.2390	20.2379	20.1654	19.7496	19.0707	18.4710 (92)
Temperature adjustment	18.3870	18.6040	19.0490	19.5538	19.9206	20.0679	20.0890	20.0879	20.0154	19.5996	18.9207	-0.1500
adjusted MIT	18.3870	18.6040	19.0490	19.5538	19.9206	20.0679	20.0890	20.0879	20.0154	19.5996	18.9207	18.3210 (93)

8. Space heating requirement

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	
Utilisation	0.9386	0.9189	0.8724	0.7760	0.6141	0.3860	0.2235	0.2474	0.5314	0.7947	0.9065	0.9455	(94)
Useful gains	719.9331	770.1241	795.3386	779.8595	643.6348	411.1113	225.6625	235.4742	466.3723	630.2377	676.4438	689.4004	(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													
Month fracti	1375.3515	1346.0649	1205.8070	999.2741	716.3586	421.0724	226.5916	236.8263	498.4481	828.0498	1130.4174	1368.5210	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
RHI space heating demand	487.6313	387.0322	305.3885	157.9785	54.1065	0.0000	0.0000	0.0000	0.0000	147.1722	326.8610	505.2657	(98)
												2371.4358	(98)
												2371	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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												1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (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													
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				53.9057		(33)
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6980 (36)
Total fabric heat loss	(33) + (36) =						60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Average = Sum(39)m / 12 =	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7677 (42)
Average daily hot water use (litres/day)													99.9335 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268	(44)
Energy content (annual)	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812	(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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355	(61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099	(62)
WWHRS	-52.2169	-45.9449	-46.8924	-38.5768	-35.8168	-29.5453	-25.0019	-30.2727	-31.1572	-38.5200	-44.6249	-50.4711	eq. (G10)
Total of WWHRS savings	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	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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271	(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	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4293	56.3373	45.8166	34.6861	25.9283	21.8897	23.6526	30.7446	41.2653	52.3958	61.1536	65.1922	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.2878	394.3378	384.1320	362.4051	334.9788	309.2019	291.9814	287.9314	298.1372	319.8641	347.2904	373.0673	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053	(72)
Total internal gains	644.0539	638.6993	613.1704	573.7820	533.3553	497.5687	477.0391	486.5833	509.6228	549.2396	593.0541	626.2933	(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			
Southeast				5.4800	36.7938	0.4600	0.0000	0.7700	71.4174 (77)			
Southwest				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (79)			
Northwest				3.4800	11.2829	0.4600	0.0000	0.7700	13.9075 (81)			
Northwest				3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)			
Northwest				0.6400	16.8560	0.7100	0.7000	1.0000	4.8254 (82)			

Solar gains	110.5194	198.5719	299.2354	417.1553	509.7530	524.8066	498.1677	426.1918	339.6000	226.8766	134.2522	93.3699 (83)
Total gains	754.5733	837.2712	912.4058	990.9373	1043.1084	1022.3753	975.2068	912.7751	849.2228	776.1162	727.3062	719.6632 (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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	
util living area	0.9685	0.9535	0.9235	0.8593	0.7460	0.5900	0.4492	0.4948	0.7067	0.8852	0.9527	0.9730	(86)
MIT	19.5174	19.7099	20.0219	20.4042	20.7259	20.9120	20.9742	20.9636	20.8304	20.4213	19.8917	19.4565	(87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	(88)
util rest of house	0.9631	0.9455	0.9102	0.8344	0.7018	0.5213	0.3624	0.4059	0.6433	0.8594	0.9432	0.9683	(89)
MIT 2	18.1078	18.3843	18.8292	19.3618	19.7864	20.0065	20.0661	20.0583	19.9227	19.3970	18.6499	18.0202	(90)
Living area fraction	18.3539	18.6158	19.0375	19.5438	19.9504	20.1646	20.2247	20.2164	20.0812	19.5759	18.8668	18.2710	(91)
MIT	18.3539	18.6158	19.0375	19.5438	19.9504	20.1646	20.2247	20.2164	20.0812	19.5759	18.8668	18.2710	(92)
Temperature adjustment	18.2039	18.4658	18.8875	19.3938	19.8004	20.0146	20.0747	20.0664	19.9312	19.4259	18.7168	18.1210	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9478	0.9272	0.8886	0.8125	0.6869	0.5160	0.3617	0.4044	0.6318	0.8369	0.9245	0.9542	(94)
Useful gains	715.1960	776.2774	810.7641	805.1448	716.4618	527.5646	352.7384	369.1220	536.5299	649.5550	672.3880	686.7134	(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													
	1439.2112	1404.2105	1282.2446	1086.2304	838.4879	560.4693	359.6684	379.5134	603.5968	913.5782	1202.4670	1440.9802	(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													
	538.6673	421.9710	350.7815	202.3817	90.7874	0.0000	0.0000	0.0000	0.0000	196.4333	381.6569	561.1745	(98)
Space heating													2743.8536 (98)
Space heating per m2											(98) / (4) =		26.5723 (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	3031.8824	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	538.6673	421.9710	350.7815	202.3817	90.7874	0.0000	0.0000	0.0000	0.0000	196.4333	381.6569	561.1745	(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)	595.2125	466.2663	387.6039	223.6261	100.3176	0.0000	0.0000	0.0000	0.0000	217.0534	421.7203	620.0823	(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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Efficiency of water heater	89.8797	89.8221	89.6918	89.3926	88.7838	87.3000	87.3000	87.3000	87.3000	89.3332	89.7413	89.9133	(216)
(217)m	89.8797	89.8221	89.6918	89.3926	88.7838	87.3000	87.3000	87.3000	87.3000	89.3332	89.7413	89.9133	(217)
Fuel for water heating, kWh/month	139.0182	121.7955	127.4853	115.5643	114.0905	103.3248	100.0943	110.7348	110.7742	121.7247	127.4975	135.1734	(219)
Water heating fuel used												1427.2774	(219)
Annual totals kWh/year													
Space heating fuel - main system												3031.8824	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)		
mechanical ventilation fans (SFP = 0.2294)		72.7890 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		147.7890 (231)
Electricity for lighting (calculated in Appendix L)		448.0723 (232)
Total delivered energy for all uses		5055.0212 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3031.8824	3.4800	105.5095	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1427.2774	3.4800	49.6693	(247)
Mechanical ventilation fans	72.7890	13.1900	9.6009	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	448.0723	13.1900	59.1007	(250)
Additional standing charges			120.0000	(251)
Total energy cost			353.7729	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		1.0022 (257)
SAP rating (Section 12)		86.0195
SAP band		86 (258)
		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	3031.8824	0.2160	654.8866	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1427.2774	0.2160	308.2919	(264)
Space and water heating			963.1785	(265)
Pumps and fans	147.7890	0.5190	76.7025	(267)

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Energy for lighting	448.0723	0.5190	232.5495 (268)
Total kg/year			1272.4306 (272)
CO2 emissions per m2			12.3200 (273)
EI value			88.4995
EI rating			88 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8881 = 3.918$, stars = 5
Water heating environmental impact	$0.216 / 0.8881 = 0.2432$, 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	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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					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					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1855 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.9057		(33)
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.6980 (36)
Total fabric heat loss (33) + (36) = 60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Heat transfer coeff	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
Average = Sum(39)m / 12 =												103.5114 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
HLP (average)												1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7677 (42)
Average daily hot water use (litres/day)													99.9335 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268	(44)
Energy content	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745	(45)
Energy content (annual)													Total = Sum(45)m = 1572.3423 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812	(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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355	(61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099	(62)
WWHRS	-52.2169	-45.9449	-46.8924	-38.5768	-35.8168	-29.5453	-25.0019	-30.2727	-31.1572	-38.5200	-44.6249	-50.4711	eq. (G10)
Total of WWHRS savings													-469.0410
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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Total per year (kWh/year) = Sum(64)m =													1268.9516 (64)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271	(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	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4293	56.3373	45.8166	34.6861	25.9283	21.8897	23.6526	30.7446	41.2653	52.3958	61.1536	65.1922	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.2878	394.3378	384.1320	362.4051	334.9788	309.2019	291.9814	287.9314	298.1372	319.8641	347.2904	373.0673	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053	(72)
Total internal gains	644.0539	638.6993	613.1704	573.7820	533.3553	497.5687	477.0391	486.5833	509.6228	549.2396	593.0541	626.2933	(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			
Southeast				5.4800	40.4699	0.4600	0.0000	0.7700	78.5528 (77)			
Southwest				0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (79)			
Northwest				3.4800	12.9236	0.4600	0.0000	0.7700	15.9298 (81)			
Northwest				3.1500	12.9236	0.4300	0.0000	0.7700	13.4788 (81)			
Northwest				0.6400	19.3863	0.7100	0.7000	1.0000	5.5497 (82)			
Solar gains	122.9718	199.4381	298.4852	431.1499	514.6802	567.4302	532.6787	465.2106	368.0488	243.7620	153.1600	102.8113 (83)
Total gains	767.0257	838.1373	911.6556	1004.9319	1048.0355	1064.9989	1009.7178	951.7939	877.6715	793.0015	746.2141	729.1046 (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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	
util living area	0.9622	0.9474	0.9107	0.8272	0.6793	0.4653	0.3139	0.3424	0.6145	0.8502	0.9395	0.9672	(86)
MIT	19.6511	19.8113	20.1419	20.5279	20.8273	20.9673	20.9941	20.9920	20.9093	20.5560	20.0422	19.6023	(87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	(88)
util rest of house	0.9554	0.9382	0.8946	0.7964	0.6245	0.3872	0.2227	0.2467	0.5373	0.8160	0.9270	0.9612	(89)
MIT 2	18.3013	18.5304	18.9996	19.5294	19.9105	20.0593	20.0793	20.0784	20.0080	19.5790	18.8652	18.2316	(90)
Living area fraction													fLA = Living area / (4) = 0.1746 (91)
MIT	18.5370	18.7540	19.1990	19.7038	20.0706	20.2179	20.2390	20.2379	20.1654	19.7496	19.0707	18.4710	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.3870	18.6040	19.0490	19.5538	19.9206	20.0679	20.0890	20.0879	20.0154	19.5996	18.9207	18.3210	(93)

8. Space heating requirement

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	
Utilisation	0.9386	0.9189	0.8724	0.7760	0.6141	0.3860	0.2235	0.2474	0.5314	0.7947	0.9065	0.9455	(94)
Useful gains	719.9331	770.1241	795.3386	779.8595	643.6348	411.1113	225.6625	235.4742	466.3723	630.2377	676.4438	689.4004	(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	1375.3515	1346.0649	1205.8070	999.2741	716.3586	421.0724	226.5916	236.8263	498.4481	828.0498	1130.4174	1368.5210	(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	487.6313	387.0322	305.3885	157.9785	54.1065	0.0000	0.0000	0.0000	0.0000	147.1722	326.8610	505.2657	(98)
Space heating												2371.4358	(98)
Space heating per m2										(98) / (4) =		22.9657	(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	2620.3711	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.6313	387.0322	305.3885	157.9785	54.1065	0.0000	0.0000	0.0000	0.0000	147.1722	326.8610	505.2657	(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)	538.8191	427.6599	337.4459	174.5619	59.7861	0.0000	0.0000	0.0000	0.0000	162.6212	361.1724	558.3047	(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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Efficiency of water heater (217)m	89.8284	89.7748	89.6052	89.2072	88.3882	87.3000	87.3000	87.3000	87.3000	89.1121	89.6480	89.8613	(216)
Fuel for water heating, kWh/month	139.0976	121.8597	127.6084	115.8046	114.6012	103.3248	100.0943	110.7348	110.7742	122.0268	127.6302	135.2516	(219)
Water heating fuel used												1428.8081	(219)
Annual totals kWh/year													
Space heating fuel - main system												2620.3711	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)		
mechanical ventilation fans (SFP = 0.2294)		72.7890 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		147.7890 (231)
Electricity for lighting (calculated in Appendix L)		448.0723 (232)
Total delivered energy for all uses		4645.0405 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2620.3711	3.9200	102.7185 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1428.8081	3.9200	56.0093 (247)
Mechanical ventilation fans	72.7890	16.9600	12.3450 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	448.0723	16.9600	75.9931 (250)
Additional standing charges			88.0000 (251)
Total energy cost			347.7859 (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	2620.3711	0.2160	566.0002 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1428.8081	0.2160	308.6226 (264)
Space and water heating			874.6227 (265)
Pumps and fans	147.7890	0.5190	76.7025 (267)
Energy for lighting	448.0723	0.5190	232.5495 (268)
Total kg/year			1183.8747 (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	2620.3711	1.2200	3196.8527 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1428.8081	1.2200	1743.1459 (264)
Space and water heating			4939.9986 (265)
Pumps and fans	147.7890	3.0700	453.7123 (267)
Energy for lighting	448.0723	3.0700	1375.5820 (268)
Primary energy kWh/year			6769.2929 (272)
Primary energy kWh/m2/year			65.5558 (273)

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	+ 9.0	-£ 309	-947 kg (80.0%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 22	-142 kg (12.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 9.17 kg/m ²	A 95	A 97
Total Savings	£309 9.17 kg/m ²		

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

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	£101	£101	£0
Mains gas	£247	£247	£0
Space heating	£216	£216	£0
Water heating	£56	£56	£0
Lighting	£76	£76	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£348	£39	£309
Total cost of uses	£348	£39	£309
Delivered energy	45 kWh/m ²	27 kWh/m ²	18 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.2 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	2 kg/m ²	9 kg/m ²
Primary energy	66 kWh/m ²	11 kWh/m ²	54 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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												1 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
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													
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
(26)...(30) + (32) =							53.9057
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6980 (36)
Total fabric heat loss							(33) + (36) = 60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Heat transfer coeff	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
Average = Sum(39)m / 12 =												103.5114 (39)
HLP	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
HLP (average)												1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7677 (42)
Average daily hot water use (litres/day)													99.9335 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268	(44)
Energy content	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745	(45)
Energy content (annual)													Total = Sum(45)m = 1572.3423 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812	(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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355	(61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099	(62)
WWHRS	-52.2169	-45.9449	-46.8924	-38.5768	-35.8168	-29.5453	-25.0019	-30.2727	-31.1572	-38.5200	-44.6249	-50.4711	eq. (G10)
Total of WWHRS savings													-469.0410
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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271	(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	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4293	56.3373	45.8166	34.6861	25.9283	21.8897	23.6526	30.7446	41.2653	52.3958	61.1536	65.1922	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.2878	394.3378	384.1320	362.4051	334.9788	309.2019	291.9814	287.9314	298.1372	319.8641	347.2904	373.0673	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053	(72)
Total internal gains	644.0539	638.6993	613.1704	573.7820	533.3553	497.5687	477.0391	486.5833	509.6228	549.2396	593.0541	626.2933	(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	
Southeast					5.4800	36.7938	0.4600	0.0000	0.7700		71.4174 (77)	
Southwest					0.6600	36.7938	0.4600	0.0000	0.7700		8.6014 (79)	
Northwest					3.4800	11.2829	0.4600	0.0000	0.7700		13.9075 (81)	
Northwest					3.1500	11.2829	0.4300	0.0000	0.7700		11.7677 (81)	
Northwest					0.6400	16.8560	0.7100	0.7000	1.0000		4.8254 (82)	
Solar gains	110.5194	198.5719	299.2354	417.1553	509.7530	524.8066	498.1677	426.1918	339.6000	226.8766	134.2522	93.3699 (83)
Total gains	754.5733	837.2712	912.4058	990.9373	1043.1084	1022.3753	975.2068	912.7751	849.2228	776.1162	727.3062	719.6632 (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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	
util living area	0.9685	0.9535	0.9235	0.8593	0.7460	0.5900	0.4492	0.4948	0.7067	0.8852	0.9527	0.9730	(86)
MIT	19.5174	19.7099	20.0219	20.4042	20.7259	20.9120	20.9742	20.9636	20.8304	20.4213	19.8917	19.4565	(87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	(88)
util rest of house	0.9631	0.9455	0.9102	0.8344	0.7018	0.5213	0.3624	0.4059	0.6433	0.8594	0.9432	0.9683	(89)
MIT 2	18.1078	18.3843	18.8292	19.3618	19.7864	20.0065	20.0661	20.0583	19.9227	19.3970	18.6499	18.0202	(90)
Living area fraction													fLA = Living area / (4) = 0.1746 (91)
MIT	18.3539	18.6158	19.0375	19.5438	19.9504	20.1646	20.2247	20.2164	20.0812	19.5759	18.8668	18.2710	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.2039	18.4658	18.8875	19.3938	19.8004	20.0146	20.0747	20.0664	19.9312	19.4259	18.7168	18.1210	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3031.8824	0.2160	654.8866 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1427.2774	0.2160	308.2919 (264)
Space and water heating			963.1785 (265)
Pumps and fans	147.7890	0.5190	76.7025 (267)
Energy for lighting	448.0723	0.5190	232.5495 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			375.9933 (272)
CO2 emissions per m2			3.6400 (273)
EI value			96.6017
EI rating			97 (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	40.1800 (1b)	x 2.3800 (2b)	= 95.6284 (1b) - (3b)
First floor	40.1800 (1c)	x 2.6900 (2c)	= 108.0842 (1c) - (3c)
Second floor	22.9000 (1d)	x 2.4600 (2d)	= 56.3340 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 260.0466 (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					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					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1855 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
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)
Window (Uw = 1.20)			9.6200	1.1450	11.0153		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Window (Uw = 1.80)			0.6400	1.6791	1.0746		(27a)
FP McCann System			40.1800	0.1100	4.4198	75.0000	3013.5000 (28a)
100mm Knauf Supafil 34	106.0500	13.4900	92.5600	0.2500	23.1400	52.8000	4887.1680 (29a)
Dormer Cheek	3.4200	1.2600	2.1600	0.2800	0.6048	9.0000	19.4400 (29a)
Wall to Void	18.8700		18.8700	0.1200	2.2644	9.0000	169.8300 (29a)
Plane Ceiling-500mm Loft Roll	11.7500		11.7500	0.0900	1.0575	9.0000	105.7500 (30)
Sloping Ceiling	12.1000	0.6400	11.4600	0.1600	1.8336	9.0000	103.1400 (30)
Dormer Flat Roof	1.9000		1.9000	0.1400	0.2660	9.0000	17.1000 (30)
Ceiling to Void	17.2800		17.2800	0.1200	2.0736	9.0000	155.5200 (30)
Total net area of external elements Aum(A, m ²)			211.5500				(31)
Fabric heat loss, W/K = Sum (A x U)							(32)
(26)...(30) + (32) =							53.9057
E-WM-30			55.5500	0.0000	0.0000	45.0000	2499.7500 (32)
Timber GF			67.4500			9.0000	607.0500 (32c)
Timber 1F			82.1300			9.0000	739.1700 (32c)
Timber 2F			38.4300			9.0000	345.8700 (32c)
Internal Floor			40.1800			12.6000	506.2680 (32d)
Internal Floor			22.9000			12.6000	288.5400 (32d)
Internal Ceiling			40.1800			9.0000	361.6200 (32e)
Internal Ceiling			22.9000			9.0000	206.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14025.8160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6980 (36)
Total fabric heat loss							(33) + (36) = 60.6037 (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	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077	42.9077 (38)
Heat transfer coeff	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114	103.5114 (39)
Average = Sum(39)m / 12 =												103.5114 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024	1.0024 (40)
HLP (average)												1.0024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7677 (42)
Average daily hot water use (litres/day)													99.9335 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.9268	105.9295	101.9321	97.9348	93.9374	89.9401	89.9401	93.9374	97.9348	101.9321	105.9295	109.9268	(44)
Energy content (annual)	163.0183	142.5768	147.1265	128.2685	123.0766	106.2058	98.4153	112.9330	114.2817	133.1843	145.3811	157.8745	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4527	21.3865	22.0690	19.2403	18.4615	15.9309	14.7623	16.9399	17.1423	19.9777	21.8072	23.6812	(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	14.1478	12.7675	14.1097	13.6143	14.0340	13.5421	13.9690	14.0112	13.5814	14.0762	13.6617	14.1355	(61)
Total heat required for water heating calculated for each month	177.1661	155.3443	161.2362	141.8827	137.1107	119.7478	112.3843	126.9441	127.8631	147.2605	159.0428	172.0099	(62)
WWHRS	-52.2169	-45.9449	-46.8924	-38.5768	-35.8168	-29.5453	-25.0019	-30.2727	-31.1572	-38.5200	-44.6249	-50.4711	eq. (G10)
Total of WWHRS savings	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	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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)
Heat gains from water heating, kWh/month	57.7405	50.5987	52.4470	46.0528	44.4315	38.6989	36.2153	41.0530	41.3940	47.8028	51.7547	56.0271	(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	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	166.0635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.4293	56.3373	45.8166	34.6861	25.9283	21.8897	23.6526	30.7446	41.2653	52.3958	61.1536	65.1922	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	390.2878	394.3378	384.1320	362.4051	334.9788	309.2019	291.9814	287.9314	298.1372	319.8641	347.2904	373.0673	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	54.3741	(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)	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	-110.7090	(71)
Water heating gains (Table 5)	77.6082	75.2956	70.4933	63.9623	59.7197	53.7485	48.6765	55.1788	57.4917	64.2511	71.8815	75.3053	(72)
Total internal gains	644.0539	638.6993	613.1704	573.7820	533.3553	497.5687	477.0391	486.5833	509.6228	549.2396	593.0541	626.2933	(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		
Southeast											5.4800	40.4699		0.4600		0.0000		0.7700		78.5528		(77)	
Southwest											0.6600	40.4699		0.4600		0.0000		0.7700		9.4607		(79)	
Northwest											3.4800	12.9236		0.4600		0.0000		0.7700		15.9298		(81)	
Northwest											3.1500	12.9236		0.4300		0.0000		0.7700		13.4788		(81)	
Northwest											0.6400	19.3863		0.7100		0.7000		1.0000		5.5497		(82)	
Solar gains	122.9718	199.4381	298.4852	431.1499	514.6802	567.4302	532.6787	465.2106	368.0488	243.7620	153.1600	102.8113	(83)										
Total gains	767.0257	838.1373	911.6556	1004.9319	1048.0355	1064.9989	1009.7178	951.7939	877.6715	793.0015	746.2141	729.1046	(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	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	37.6390	
alpha	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	3.5093	
util living area	0.9622	0.9474	0.9107	0.8272	0.6793	0.4653	0.3139	0.3424	0.6145	0.8502	0.9395	0.9672	(86)
MIT	19.6511	19.8113	20.1419	20.5279	20.8273	20.9673	20.9941	20.9920	20.9093	20.5560	20.0422	19.6023	(87)
Th 2	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	20.0813	(88)
util rest of house	0.9554	0.9382	0.8946	0.7964	0.6245	0.3872	0.2227	0.2467	0.5373	0.8160	0.9270	0.9612	(89)
MIT 2	18.3013	18.5304	18.9996	19.5294	19.9105	20.0593	20.0793	20.0784	20.0080	19.5790	18.8652	18.2316	(90)
Living area fraction	18.5370	18.7540	19.1990	19.7038	20.0706	20.2179	20.2390	20.2379	20.1654	19.7496	19.0707	18.4710	(91)
Temperature adjustment	18.3870	18.6040	19.0490	19.5538	19.9206	20.0679	20.0890	20.0879	20.0154	19.5996	18.9207	18.3210	(92)
adjusted MIT	18.3870	18.6040	19.0490	19.5538	19.9206	20.0679	20.0890	20.0879	20.0154	19.5996	18.9207	18.3210	(93)

8. Space heating requirement

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	
Utilisation	0.9386	0.9189	0.8724	0.7760	0.6141	0.3860	0.2235	0.2474	0.5314	0.7947	0.9065	0.9455	(94)
Useful gains	719.9331	770.1241	795.3386	779.8595	643.6348	411.1113	225.6625	235.4742	466.3723	630.2377	676.4438	689.4004	(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	1375.3515	1346.0649	1205.8070	999.2741	716.3586	421.0724	226.5916	236.8263	498.4481	828.0498	1130.4174	1368.5210	(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	487.6313	387.0322	305.3885	157.9785	54.1065	0.0000	0.0000	0.0000	0.0000	147.1722	326.8610	505.2657	(98)
Space heating per m2											(98) / (4) =	22.9657	(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													2620.3711	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	487.6313	387.0322	305.3885	157.9785	54.1065	0.0000	0.0000	0.0000	0.0000	147.1722	326.8610	505.2657	(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)	538.8191	427.6599	337.4459	174.5619	59.7861	0.0000	0.0000	0.0000	0.0000	162.6212	361.1724	558.3047	(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	124.9491	109.3994	114.3438	103.3060	101.2939	90.2025	87.3823	96.6715	96.7059	108.7406	114.4179	121.5388	(64)	
Efficiency of water heater	89.8284	89.7748	89.6052	89.2072	88.3882	87.3000	87.3000	87.3000	87.3000	89.1121	89.6480	89.8613	(217)	
Fuel for water heating, kWh/month	139.0976	121.8597	127.6084	115.8046	114.6012	103.3248	100.0943	110.7348	110.7742	122.0268	127.6302	135.2516	(219)	
Annual totals kWh/year												1428.8081	(219)	
Space heating fuel - main system												2620.3711	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)													72.7890	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													147.7890	(231)
Electricity for lighting (calculated in Appendix L)													448.0723	(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												2820.8809	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2620.3711	3.9200	102.7185	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1428.8081	3.9200	56.0093	(247)
Mechanical ventilation fans	72.7890	16.9600	12.3450	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	448.0723	16.9600	75.9931	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	16.9600	-309.3775	(252)
Total energy cost			38.4084	(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	2620.3711	0.2160	566.0002	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1428.8081	0.2160	308.6226	(264)
Space and water heating			874.6227	(265)
Pumps and fans	147.7890	0.5190	76.7025	(267)
Energy for lighting	448.0723	0.5190	232.5495	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			237.1359	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	2620.3711	1.2200	3196.8527 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1428.8081	1.2200	1743.1459 (264)
Space and water heating			4939.9986 (265)
Pumps and fans	147.7890	3.0700	453.7123 (267)
Energy for lighting	448.0723	3.0700	1375.5820 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1169.1228 (272)
Primary energy kWh/m2/year			11.3221 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	135.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	343.26 (P1)
Transmission heat loss coefficient	60.60 (37)
Summer heat loss coefficient	403.87 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
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				
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)
North West	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	5.4800	119.9223	0.4600	0.0000	0.9000	272.0702
South West	0.6600	119.9223	0.4600	0.0000	0.9000	32.7676
North West	3.4800	98.8453	0.4600	0.0000	0.9000	142.4084
North West	3.1500	98.8453	0.4300	0.0000	0.9000	120.4973
North West	0.6400	163.9792	0.7100	0.7000	1.0000	46.9426

total: 614.6861

	Jun	Jul	Aug	
Solar gains	655	615	537	(P3/P4)
Internal gains	495	474	484	
Total summer gains	1149	1089	1021	(P5)
Summer gain/loss ratio	2.85	2.70	2.53	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 135.8)	1.05	1.05	1.05	
Threshold temperature	19.89	21.64	21.38	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			