

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X518 Det			Issued on Date	15/12/2022
Assessment Reference	X518 Det	Prop Type Ref	Birch		
Property	5 Bed, K, WC, U, B, 2En				
SAP Rating	87 B	DER	13.04	TER	15.22
Environmental	87 B	% DER<TER	14.34		
CO ₂ Emissions (t/year)	1.86	DFEE	43.16	TFEE	56.05
General Requirements Compliance	Pass	% DFEE<TFEE	23.00		
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

Detached House, total floor area 168 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) 15.22 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.04 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC HEAT H15

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.69 kWh/day	
Permitted by DBSCG 2.86	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

Boiler interlock	Yes	OK
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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):	Medium	OK
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Based on:

Overshading:	Average	
Windows facing North East:	12.35 m ² , No overhang	
Windows facing South East:	5.90 m ² , No overhang	
Windows facing South West:	16.58 m ² , No overhang	
Windows facing North West:	2.83 m ² , No overhang	
Air change rate:	4.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.020 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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			30.3100	1.1450	34.7061			(27)					
French Door (Uw = 1.40)			7.3500	1.3258	9.7443			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			84.4100	0.1100	9.2851		6330.7500	(28a)					
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560	(29a)					
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900	(30)					
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200	(30)					
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800	(30)					
Total net area of external elements Aum(A, m2)			368.1500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488			(33)					
1F Timber			224.2900			9.0000	2018.6100	(32c)					
GF Masonry			93.7300			39.0000	3655.4700	(32c)					
GF Timber			81.2800			9.0000	731.5200	(32c)					
Internal Floor			83.2300			13.8000	1148.5740	(32d)					
Internal Ceiling			83.2300			9.0000	749.0700	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.0684	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261	(36)					
Total fabric heat loss						(33) + (36) =	110.8749	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0222	Feb 71.3083	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192	(38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	(39)
Average = Sum(39)m / 12 =												182.1685	(39)
HLP	Jan 1.0910	Feb 1.0868	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862	(40)
HLP (average)												1.0867	(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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9126 (55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings													-323.2853
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	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	571.3628	569.0884	550.1939	519.1960	486.7664	456.2143	436.7964	443.4410	459.7336	490.9702	526.9394	554.8360	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829	0.4600	0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938	0.4600	0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938	0.4600	0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829	0.4600	0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938	0.4300	0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains	918.7492	1180.9665	1440.9161	1712.5580	1905.3182	1900.5271	1814.2785	1647.4147	1454.3944	1181.6573	946.6979	849.7518 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9883	0.9729	0.9386	0.8600	0.7263	0.5629	0.4262	0.4825	0.7143	0.9145	0.9781	0.9910	(86)
MIT	19.1443	19.4556	19.8850	20.3676	20.7319	20.9173	20.9757	20.9629	20.8116	20.2960	19.6103	19.0805	(87)
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9860	0.9677	0.9267	0.8336	0.6781	0.4906	0.3367	0.3887	0.6468	0.8922	0.9730	0.9891	(89)
MIT 2	17.5172	17.9700	18.5854	19.2566	19.7310	19.9448	19.9987	19.9901	19.8399	19.1757	18.1987	17.4269	(90)
Living area fraction									fLA = Living area / (4) =			0.0997	(91)
MIT	17.6795	18.1182	18.7150	19.3674	19.8308	20.0418	20.0962	20.0871	19.9368	19.2874	18.3394	17.5918	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5295	17.9682	18.5650	19.2174	19.6808	19.8918	19.9462	19.9371	19.7868	19.1374	18.1894	17.4418	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9769	0.9520	0.9039	0.8083	0.6601	0.4813	0.3305	0.3812	0.6295	0.8665	0.9588	0.9816	(94)

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Useful gains	897.5063	1124.3355	1302.3778	1384.2148	1257.7680	914.6983	599.5705	628.0633	915.5469	1023.8651	907.6923	834.0878	(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	2419.6307	2380.8069	2196.9647	1878.7323	1453.2632	963.6101	609.3214	644.0864	1035.5330	1554.6110	2019.3234	2411.2510	(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	1132.4606	844.3488	665.5726	356.0527	145.4485	0.0000	0.0000	0.0000	0.0000	394.8750	800.3744	1173.4094	(98)
Space heating												5512.5419	(98)
Space heating per m2											(98) / (4) =	32.8832	(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 %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6097.9446	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1132.4606	844.3488	665.5726	356.0527	145.4485	0.0000	0.0000	0.0000	0.0000	394.8750	800.3744	1173.4094	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	1252.7219	934.0141	736.2529	393.8636	160.8943	0.0000	0.0000	0.0000	0.0000	436.8086	885.3699	1298.0193	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)	
Efficiency of water heater	88.7197	88.4687	87.9631	86.8264	84.5350	79.7000	79.7000	79.7000	79.7000	86.9699	88.3115	79.7000	(216)	
(217)m	209.6475	185.3312	196.7339	181.2955	184.0098	176.3797	172.1796	186.6671	185.5829	188.8684	193.7853	204.7541	(219)	
Fuel for water heating, kWh/month												2265.2351	(219)	
Water heating fuel used														
Annual totals kWh/year														
Space heating fuel - main system													6097.9446	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													121.5431	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													196.5431	(231)
Electricity for lighting (calculated in Appendix L)													533.8788	(232)
Total delivered energy for all uses													9093.6016	(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	6097.9446	0.2160	1317.1560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2265.2351	0.2160	489.2908 (264)
Space and water heating			1806.4468 (265)
Pumps and fans	196.5431	0.5190	102.0059 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Total CO2, kg/year			2185.5358 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0400 (273)

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

DER			13.0400	ZC1
Total Floor Area		TFA	167.6400	
Assumed number of occupants		N	2.9594	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			11.9878	ZC2
CO2 emissions from cooking, equation (L16)			1.1335	ZC3
Total CO2 emissions			26.1614	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			26.1614	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (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) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3427 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (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	0.4369	0.4283	0.4198	0.3769	0.3684	0.3255	0.3255	0.3170	0.3427	0.3684	0.3855	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			37.6600	1.3258	49.9280		(27)
FP McCann System			84.4100	0.1300	10.9733		(28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.1800	28.7136		(29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.1300	10.5833		(30)
Bay Plane	1.1800		1.1800	0.1300	0.1534		(30)
Sloping Ceiling	1.8200		1.8200	0.1300	0.2366		(30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.7382		(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)							15.7905 (36)
Total fabric heat loss						(33) + (36) =	118.5287 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	84.8141	84.2862	83.7687	81.3383	80.8835	78.7667	78.7667	78.3747	79.5821	80.8835	81.8034	82.7652 (38)
Heat transfer coeff	203.3428	202.8149	202.2974	199.8670	199.4123	197.2954	197.2954	196.9034	198.1108	199.4123	200.3322	201.2939 (39)
Average = Sum(39)m / 12 =												199.8648 (39)
HLP	1.2130	1.2098	1.2067	1.1922	1.1895	1.1769	1.1769	1.1746	1.1818	1.1895	1.1950	1.2008 (40)
HLP (average)												1.1922 (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												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Energy content (annual)											Total = Sum(45)m =	1643.9683 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599 (46)
Water storage loss:												
Store volume												300.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):	2.1127 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	1.1409 (55)
Total storage loss	
35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (56)	
If cylinder contains dedicated solar storage	
35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (57)	
Primary loss	23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month	
229.0732 202.0268 212.4575 190.8491 187.3120 167.7814 161.5273 176.7063 176.2252 197.8802 208.7413 223.6951 (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	
229.0732 202.0268 212.4575 190.8491 187.3120 167.7814 161.5273 176.7063 176.2252 197.8802 208.7413 223.6951 (64)	
Heat gains from water heating, kWh/month	
103.5758 91.9304 98.0511 89.9821 89.6902 82.3121 81.1168 86.1638 85.1197 93.2041 95.9313 101.7876 (65)	
Total per year (kWh/year) = Sum(64)m =	2334.2753 (64)

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

Metabolic gains (Table 5), Watts	
(66)m	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	30.2304 26.8504 21.8362 16.5314 12.3574 10.4327 11.2729 14.6529 19.6671 24.9719 29.1459 31.0706 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	339.1350 342.6542 333.7860 314.9067 291.0750 268.6766 253.7130 250.1939 259.0620 277.9413 301.7730 324.1715 (68)
Pumps, fans	37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 (71)
Total internal gains	139.2148 136.8012 131.7891 124.9752 120.5514 114.3224 109.0279 115.8116 118.2218 125.2744 133.2379 136.8113 (72)
578.9712 576.6968 557.8023 526.8044 494.3748 463.8227 444.4048 451.0494 467.3420 498.5786 534.5478 562.4444 (73)	

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			12.3500		11.2829		0.6300		0.7000		0.7700		42.5854 (75)
Southeast			5.9000		36.7938		0.6300		0.7000		0.7700		66.3436 (77)
Southwest			16.5800		36.7938		0.6300		0.7000		0.7700		186.4367 (79)
Northwest			2.8300		11.2829		0.6300		0.7000		0.7700		9.7584 (81)
Solar gains	305.1241	537.1258	781.1007	1045.2292	1241.3979	1263.4992	1205.2146	1054.1126	871.8217	606.0902	368.6346	259.0739	83)
Total gains	884.0954	1113.8226	1338.9030	1572.0336	1735.7728	1727.3218	1649.6195	1505.1620	1339.1636	1104.6688	903.1825	821.5183	84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	
tau	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
alpha	57.2514 57.4005 57.5473 58.2471 58.3799 59.0063 59.0063 59.1237 58.7634 58.3799 58.1118 57.8342
util living area	4.8168 4.8267 4.8365 4.8831 4.8920 4.9338 4.9338 4.9416 4.9176 4.8920 4.8741 4.8556
0.9989 0.9963 0.9876 0.9536 0.8565 0.6814 0.5155 0.5813 0.8394 0.9780 0.9972 0.9992 (86)	
MIT	19.6083 19.8054 20.1067 20.4889 20.7954 20.9522 20.9901 20.9828 20.8647 20.4474 19.9531 19.5785 (87)
Th 2	19.9096 19.9121 19.9146 19.9262 19.9284 19.9385 19.9385 19.9404 19.9346 19.9284 19.9240 19.9194 (88)
util rest of house	0.9985 0.9950 0.9831 0.9362 0.8061 0.5879 0.3967 0.4576 0.7646 0.9667 0.9960 0.9989 (89)
MIT 2	18.0508 18.3404 18.7797 19.3301 19.7315 19.9077 19.9350 19.9335 19.8270 19.2829 18.5653 18.0140 (90)
Living area fraction	18.2062 18.4865 18.9120 19.4457 19.8377 20.0118 20.0403 20.0382 19.9305 19.3991 18.7037 18.1701 (92)
MIT	18.2062 18.4865 18.9120 19.4457 19.8377 20.0118 20.0403 20.0382 19.9305 19.3991 18.7037 18.1701 (93)
Temperature adjustment	
adjusted MIT	

8. Space heating requirement

Utilisation	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Useful gains	0.9975 0.9924 0.9771 0.9261 0.8012 0.5948 0.4084 0.4695 0.7643 0.9588 0.9939 0.9982 (94)
Ext temp.	881.8462 1105.4019 1308.2629 1455.9201 1390.6344 1027.4202 673.7249 706.6763 1023.5010 1059.1427 897.6533 820.0392 (95)
Heat loss rate W	4.3000 4.9000 6.5000 8.9000 11.7000 14.6000 16.6000 16.4000 14.1000 10.6000 7.1000 4.2000 (96)
2827.7170 2755.5492 2510.9232 2107.7337 1622.7488 1067.7295 678.7472 716.3686 1155.0814 1754.6444 2324.5946 2812.0903 (97)	
Month fracti	1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 (97a)
Space heating kWh	1447.7278 1108.8990 894.7793 469.3058 172.6931 0.0000 0.0000 0.0000 0.0000 517.4533 1027.3977 1482.0860 (98)
Space heating	
Space heating per m2	(98) / (4) = 42.4740 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7615.3391	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1447.7278	1108.8990	894.7793	469.3058	172.6931	0.0000	0.0000	0.0000	0.0000	517.4533	1027.3977	1482.0860	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1548.3720	1185.9882	956.9832	501.9314	184.6985	0.0000	0.0000	0.0000	0.0000	553.4259	1098.8211	1585.1188	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	229.0732	202.0268	212.4575	190.8491	187.3120	167.7814	161.5273	176.7063	176.2252	197.8802	208.7413	223.6951	(64)	
Efficiency of water heater (217)m	88.8721	88.6678	88.2300	87.1228	84.5980	79.8000	79.8000	79.8000	79.8000	87.2633	88.4962	88.9362	(216)	
Fuel for water heating, kWh/month	257.7561	227.8469	240.7996	219.0576	221.4142	210.2524	202.4151	221.4364	220.8336	226.7623	235.8759	251.5232	(219)	
Water heating fuel used												2735.9734	(219)	
Annual totals kWh/year														
Space heating fuel - main system												7615.3391	(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)													533.8788	(232)
Total delivered energy for all uses													10960.1913	(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	7615.3391	0.2160	1644.9132 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2735.9734	0.2160	590.9703 (264)
Space and water heating			2235.8835 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Total CO2, kg/m2/year			2551.8916 (272)
Emissions per m2 for space and water heating			13.3374 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6528 (272b)
Emissions per m2 for pumps and fans			0.2322 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3374 * 1.00) + 1.6528 + 0.2322, rounded to 2 d.p.			15.2200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2932 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2932 (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	0.3738	0.3665	0.3591	0.3225	0.3152	0.2785	0.2785	0.2712	0.2932	0.3152	0.3298	0.3445 (22b)
Effective ac	0.5699	0.5671	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5593 (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
Window (Uw = 1.20)			30.3100	1.1450	34.7061		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			84.4100	0.1100	9.2851	75.0000	6330.7500 (28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560 (29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900 (30)
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800 (30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			83.2300			13.8000	1148.5740 (32d)
Internal Ceiling			83.2300			9.0000	749.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.0684 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261 (36)
Total fabric heat loss						(33) + (36) =	110.8749 (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	81.1701	80.7837	80.4050	78.6260	78.2931	76.7437	76.7437	76.4567	77.3405	78.2931	78.9665	79.6704 (38)
Average = Sum(39)m / 12 =	192.0450	191.6586	191.2799	189.5009	189.1680	187.6186	187.6186	187.3317	188.2154	189.1680	189.8414	190.5453 (39)
	189.4993 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1456	1.1433	1.1410	1.1304	1.1284	1.1192	1.1192	1.1175	1.1227	1.1284	1.1324	1.1366 (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												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy content (annual)	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1643.9683 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.2194	31.6777	32.6886	28.4987	27.3452	23.5968	21.8659	25.0915	25.3911	29.5909	32.3008	35.0766 (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	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	48.6820	47.1395	43.9363	39.5815	36.7543	32.7734	29.3897	33.7251	35.2655	39.7727	44.8622	47.1459	(72)
Total internal gains	485.4385	484.0351	466.9495	438.4107	407.5777	379.2736	361.7666	365.9629	381.3856	410.0770	443.1721	469.7791	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829		0.4600		0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938		0.4600		0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938		0.4600		0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829		0.4600		0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938		0.4300		0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158	(83)	
Total gains	832.8249	1095.9133	1357.6717	1631.7727	1826.1295	1823.5864	1739.2487	1569.9366	1376.0465	1100.7641	862.9306	764.6949	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.4484	34.5179	34.5862	34.9109	34.9723	35.2612	35.2612	35.3152	35.1494	34.9723	34.8483	34.7196	
alpha	3.2966	3.3012	3.3057	3.3274	3.3315	3.3507	3.3507	3.3543	3.3433	3.3315	3.3232	3.3146	
util living area	0.9913	0.9786	0.9495	0.8793	0.7546	0.5923	0.4533	0.5132	0.7470	0.9308	0.9835	0.9934	(86)
MIT	18.9720	19.2846	19.7344	20.2662	20.6738	20.8964	20.9681	20.9519	20.7680	20.1933	19.4701	18.9158	(87)
Th 2	19.9638	19.9656	19.9675	19.9761	19.9777	19.9852	19.9852	19.9866	19.9823	19.9777	19.9744	19.9710	(88)
util rest of house	0.9895	0.9743	0.9392	0.8549	0.7069	0.5171	0.3571	0.4134	0.6802	0.9114	0.9794	0.9920	(89)
MIT 2	18.1039	18.4151	18.8583	19.3741	19.7424	19.9273	19.9732	19.9670	19.8356	19.3182	18.6079	18.0533	(90)
Living area fraction									fLA = Living area / (4) =			0.0997	(91)
MIT	18.1905	18.5018	18.9457	19.4631	19.8353	20.0240	20.0725	20.0652	19.9286	19.4055	18.6939	18.1393	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1905	18.5018	18.9457	19.4631	19.8353	20.0240	20.0725	20.0652	19.9286	19.4055	18.6939	18.1393	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9660	0.9263	0.8405	0.6995	0.5201	0.3657	0.4216	0.6762	0.8977	0.9724	0.9885	(94)
Useful gains	820.3994	1058.6663	1257.6181	1371.4627	1277.4595	948.4770	636.1062	661.8238	930.5307	988.1217	839.1560	755.8711	(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	2667.6061	2606.9009	2380.6093	2001.7126	1538.9386	1017.6412	651.4969	686.6080	1097.0384	1665.7237	2201.0044	2656.0693	(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	1374.3217	1040.4136	835.5054	453.7799	194.5405	0.0000	0.0000	0.0000	0.0000	504.1359	980.5308	1413.7474	(98)
Space heating												6796.9754	(98)
Space heating per m2											(98) / (4) =	40.5451	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1763.6148	1388.3776	1423.7206	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8554	0.9050	0.8762	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1508.6415	1256.4370	1247.4480	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2262.9265	2161.1958	1965.9269	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	543.0852	673.1406	534.5483	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1750.7740 (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	135.7713	168.2851	133.6371	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													437.6935 (107)
Energy for space heating													2.6109 (108)
Energy for space cooling													40.5451 (99)
Total													2.6109 (108)
Dwelling Fabric Energy Efficiency (DFEE)													43.1560 (109)
													43.2 (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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3427 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3427 (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	0.4369	0.4283	0.4198	0.3769	0.3684	0.3255	0.3255	0.3170	0.3427	0.3684	0.3855	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			37.6600	1.3258	49.9280		(27)
FP McCann System			84.4100	0.1300	10.9733		(28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.1800	28.7136		(29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.1300	10.5833		(30)
Bay Plane	1.1800		1.1800	0.1300	0.1534		(30)
Sloping Ceiling	1.8200		1.8200	0.1300	0.2366		(30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.7382		(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)							15.7905 (36)
Total fabric heat loss						(33) + (36) =	118.5287 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	84.8141	84.2862	83.7687	81.3383	80.8835	78.7667	78.7667	78.3747	79.5821	80.8835	81.8034	82.7652 (38)
Heat transfer coeff	203.3428	202.8149	202.2974	199.8670	199.4123	197.2954	197.2954	196.9034	198.1108	199.4123	200.3322	201.2939 (39)
Average = Sum(39)m / 12 =												199.8648 (39)
HLP	1.2130	1.2098	1.2067	1.1922	1.1895	1.1769	1.1769	1.1746	1.1818	1.1895	1.1950	1.2008 (40)
HLP (average)												1.1922 (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												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Energy content (annual)										Total = Sum(45)m =		1643.9683 (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												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	36.2194	31.6777	32.6886	28.4987	27.3452	23.5968	21.8659	25.0915	25.3911	29.5909	32.3008	35.0766 (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	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970 (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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761 (71)
Water heating gains (Table 5)	48.6820	47.1395	43.9363	39.5815	36.7543	32.7734	29.3897	33.7251	35.2655	39.7727	44.8622	47.1459 (72)
Total internal gains	485.4385	484.0351	466.9495	438.4107	407.5777	379.2736	361.7666	365.9629	381.3856	410.0770	443.1721	469.7791 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.3500	11.2829	0.6300	0.7000	0.7700	42.5854 (75)
Southeast	5.9000	36.7938	0.6300	0.7000	0.7700	66.3436 (77)
Southwest	16.5800	36.7938	0.6300	0.7000	0.7700	186.4367 (79)
Northwest	2.8300	11.2829	0.6300	0.7000	0.7700	9.7584 (81)

Solar gains	305.1241	537.1258	781.1007	1045.2292	1241.3979	1263.4992	1205.2146	1054.1126	871.8217	606.0902	368.6346	259.0739 (83)
Total gains	790.5626	1021.1609	1248.0502	1483.6399	1648.9757	1642.7728	1566.9812	1420.0755	1253.2073	1016.1672	811.8068	728.8529 (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	57.2514	57.4005	57.5473	58.2471	58.3799	59.0063	59.0063	59.1237	58.7634	58.3799	58.1118	57.8342
alpha	4.8168	4.8267	4.8365	4.8831	4.8920	4.9338	4.9338	4.9416	4.9176	4.8920	4.8741	4.8556
util living area	0.9993	0.9975	0.9907	0.9623	0.8751	0.7072	0.5402	0.6109	0.8650	0.9842	0.9983	0.9995 (86)
MIT	19.5567	19.7549	20.0591	20.4492	20.7711	20.9437	20.9879	20.9787	20.8424	20.4027	19.9030	19.5272 (87)
Th 2	19.9096	19.9121	19.9146	19.9262	19.9284	19.9385	19.9385	19.9404	19.9346	19.9284	19.9240	19.9194 (88)
util rest of house	0.9991	0.9966	0.9872	0.9476	0.8282	0.6135	0.4169	0.4834	0.7958	0.9758	0.9975	0.9994 (89)
MIT 2	18.5891	18.7888	19.0931	19.4826	19.7754	19.9132	19.9355	19.9344	19.8462	19.4452	18.9464	18.5673 (90)
Living area fraction									fLA = Living area / (4) =			0.0997 (91)
MIT	18.6856	18.8852	19.1894	19.5790	19.8747	20.0160	20.0405	20.0386	19.9456	19.5407	19.0418	18.6630 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6856	18.8852	19.1894	19.5790	19.8747	20.0160	20.0405	20.0386	19.9456	19.5407	19.0418	18.6630 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9987	0.9954	0.9841	0.9415	0.8255	0.6209	0.4292	0.4959	0.7966	0.9715	0.9966	0.9991 (94)
Ext temp.	789.5050	1016.4303	1228.1547	1396.8256	1361.1813	1020.0211	672.5499	704.1628	998.3176	987.1825	809.0371	728.1965 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2925.2009	2836.3992	2567.0374	2134.3815	1630.1293	1068.5488	678.7969	716.4504	1158.0760	1782.8889	2392.3312	2911.3207 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1588.9577	1223.0191	996.1287	531.0403	200.0973	0.0000	0.0000	0.0000	0.0000	592.0056	1139.9718	1624.2444 (98)
Space heating per m2										(98) / (4) =		47.0977 (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	1854.5769	1459.9861	1496.4659	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8705	0.9277	0.8968	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1614.4363	1354.4878	1342.0484	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2051.5859	1959.8443	1790.7646	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	314.7477	450.3852	333.8448	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1098.9777 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	78.6869	112.5963	83.4612	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												274.7444 (107)
Space cooling per m2												1.6389 (108)
Energy for space heating												47.0977 (99)
Energy for space cooling												1.6389 (108)
Total												48.7366 (109)
Target Fabric Energy Efficiency (TFEE)												56.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (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							
Infiltration rate																		4.0100					
Number of sides sheltered																		0.2005 (18)					
																		0 (19)					
Shelter factor																(20) = 1 - [0.075 x (19)] =		1.0000 (20)					
Infiltration rate adjusted to include shelter factor																(21) = (18) x (20) =		0.2005 (21)					
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec											
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)										
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)										
Adj infilt rate																							
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905	(22b)										
Mechanical extract ventilation - decentralised																							
If mechanical ventilation:																							
													0.5000 (23a)										
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)										

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			30.3100	1.1450	34.7061		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			84.4100	0.1100	9.2851	75.0000	6330.7500 (28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560 (29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900 (30)
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800 (30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			83.2300			13.8000	1148.5740 (32d)
Internal Ceiling			83.2300			9.0000	749.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.0684 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261 (36)
Total fabric heat loss						(33) + (36) =	110.8749 (37)

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

(38)m	Jan 71.2192	Feb 71.2192	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192 (38)
Heat transfer coeff	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.0942 (39)
HLP	Jan 1.0862	Feb 1.0862	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862 (40)
HLP (average)												1.0862 (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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)	Total = Sum (45)m =												1643.9683 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9126 (55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(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	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	831.2580	825.6468	794.8631	746.6092	696.1807	651.7093	626.1817	636.1629	664.3447	712.8373	766.8055	808.6213	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					12.3500	12.9236	0.4600	0.0000			0.7700			56.5324 (75)
Southeast					5.9000	40.4699	0.4600	0.0000			0.7700			84.5732 (77)
Southwest					9.2300	40.4699	0.4600	0.0000			0.7700			132.3069 (79)
Northwest					2.8300	12.9236	0.4600	0.0000			0.7700			12.9544 (81)
Southwest					7.3500	40.4699	0.4300	0.0000			0.7700			98.4870 (79)
Solar gains	384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418	(83)	
Total gains	1216.1119	1436.8421	1677.5997	1972.3515	2121.1615	2206.4643	2092.1592	1942.7483	1735.2674	1450.5175	1243.4468	1132.0631	(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	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9695	0.9478	0.8964	0.7832	0.6134	0.4007	0.2676	0.2965	0.5596	0.8332	0.9443	0.9751	(86)
MIT	19.5142	19.7512	20.1579	20.5875	20.8652	20.9772	20.9960	20.9942	20.9264	20.5644	19.9672	19.4491	(87)
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9636	0.9381	0.8774	0.7466	0.5548	0.3260	0.1834	0.2066	0.4796	0.7945	0.9319	0.9702	(89)
MIT 2	18.0548	18.3935	18.9664	19.5444	19.8852	19.9979	20.0109	20.0102	19.9563	19.5310	18.7079	17.9615	(90)
Living area fraction	18.2004	18.5289	19.0853	19.6484	19.9829	20.0956	20.1091	20.1084	20.0531	19.6341	18.8335	18.1099	(91)
MIT	18.2004	18.5289	19.0853	19.6484	19.9829	20.0956	20.1091	20.1084	20.0531	19.6341	18.8335	18.1099	(92)
Temperature adjustment	18.0504	18.3789	18.9353	19.4984	19.8329	19.9456	19.9591	19.9584	19.9031	19.4841	18.6835	-0.1500	
adjusted MIT	18.0504	18.3789	18.9353	19.4984	19.8329	19.9456	19.9591	19.9584	19.9031	19.4841	18.6835	17.9599	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9469	0.9166	0.8519	0.7250	0.5434	0.3209	0.1788	0.2016	0.4702	0.7699	0.9095	0.9553	(94)
Useful gains	1151.5825	1317.0620	1429.1828	1430.0048	1152.6939	707.9718	374.0992	391.7055	815.9151	1116.6912	1130.9033	1081.4115	(95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	2358.1898	2326.9655	2100.5054	1747.8158	1244.2362	718.4628	374.9572	393.0291	856.3986	1435.6457	1945.4021	2341.7134 (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	897.7159	678.6551	499.4640	228.8239	68.1075	0.0000	0.0000	0.0000	0.0000	237.3022	586.4392	937.6646 (98)
Space heating												4134.1723 (98)
RHI space heating demand												4134 (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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			30.3100	1.1450	34.7061			(27)					
French Door (Uw = 1.40)			7.3500	1.3258	9.7443			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			84.4100	0.1100	9.2851		6330.7500	(28a)					
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560	(29a)					
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900	(30)					
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200	(30)					
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800	(30)					
Total net area of external elements Aum(A, m2)			368.1500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488			(33)					
1F Timber			224.2900			9.0000	2018.6100	(32c)					
GF Masonry			93.7300			39.0000	3655.4700	(32c)					
GF Timber			81.2800			9.0000	731.5200	(32c)					
Internal Floor			83.2300			13.8000	1148.5740	(32d)					
Internal Ceiling			83.2300			9.0000	749.0700	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.0684	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261	(36)					
Total fabric heat loss						(33) + (36) =	110.8749	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0222	Feb 71.3083	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192	(38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	(39)
Average = Sum(39)m / 12 =												182.1685	(39)
HLP	Jan 1.0910	Feb 1.0868	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862	(40)
HLP (average)												1.0867	(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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9126	(55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings												-323.2853	
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	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	831.2580	825.6468	794.8631	746.6092	696.1807	651.7093	626.1817	636.1629	664.3447	712.8373	766.8055	808.6213	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829	0.4600	0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938	0.4600	0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938	0.4600	0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829	0.4600	0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938	0.4300	0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains	1178.6443	1437.5249	1685.5853	1939.9712	2114.7325	2096.0221	2003.6638	1840.1367	1659.0056	1403.5244	1186.5640	1103.5371 (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	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309		
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221		
util living area	0.9758	0.9536	0.9098	0.8204	0.6816	0.5202	0.3893	0.4379	0.6570	0.8735	0.9588	0.9803	(86)	
MIT	19.3536	19.6475	20.0417	20.4703	20.7817	20.9351	20.9816	20.9724	20.8559	20.4218	19.7936	19.2880	(87)	
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)	
util rest of house	0.9712	0.9451	0.8937	0.7899	0.6318	0.4507	0.3062	0.3506	0.5881	0.8442	0.9499	0.9765	(89)	
MIT 2	17.8196	18.2438	18.8024	19.3894	19.7871	19.9602	20.0022	19.9961	19.8841	19.3412	18.4598	17.7275	(90)	
Living area fraction									fLA = Living area / (4) =			0.0997	(91)	
MIT	17.9726	18.3838	18.9260	19.4972	19.8863	20.0574	20.0998	20.0935	19.9810	19.4490	18.5929	17.8831	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.8226	18.2338	18.7760	19.3472	19.7363	19.9074	19.9498	19.9435	19.8310	19.2990	18.4429	17.7331	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9566	0.9248	0.8687	0.7662	0.6168	0.4429	0.3008	0.3443	0.5742	0.8182	0.9301	0.9636	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	1127.4762	1329.3711	1464.3016	1486.4613	1304.2827	928.3867	602.7025	633.5215	952.6368	1148.3812	1103.6597	1063.4027	(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	2473.2473	2429.1883	2235.3849	1902.3681	1463.3680	966.4532	609.9872	645.2426	1043.5809	1584.0401	2065.4692	2464.3046	(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	1001.2537	739.0772	573.6860	299.4529	118.3595	0.0000	0.0000	0.0000	0.0000	324.1302	692.5028	1042.2710	(98)
Space heating												4790.7334	(98)
Space heating per m2												(98) / (4) =	28.5775 (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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5299.4838 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1001.2537	739.0772	573.6860	299.4529	118.3595	0.0000	0.0000	0.0000	0.0000	324.1302	692.5028	1042.2710	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1107.5815	817.5633	634.6084	331.2533	130.9286	0.0000	0.0000	0.0000	0.0000	358.5511	766.0429	1152.9547	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Efficiency of water heater	88.5378	88.2489	87.6723	86.4033	83.9960	79.7000	79.7000	79.7000	79.7000	86.4945	88.0574	79.7000	(216)
(217)m	88.5378	88.2489	87.6723	86.4033	83.9960	79.7000	79.7000	79.7000	79.7000	86.4945	88.0574	88.6325	(217)
Fuel for water heating, kWh/month	210.0782	185.7928	197.3865	182.1834	185.1905	176.3797	172.1796	186.6671	185.5829	189.9065	194.3445	205.1422	(219)
Water heating fuel used												2270.8338	(219)
Annual totals kWh/year													
Space heating fuel - main system												5299.4838	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													121.5431 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													196.5431 (231)
Electricity for lighting (calculated in Appendix L)													533.8788 (232)
Total delivered energy for all uses													8300.7396 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5299.4838	3.4800	184.4220 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2270.8338	3.4800	79.0250 (247)
Mechanical ventilation fans	121.5431	13.1900	16.0315 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	533.8788	13.1900	70.4186 (250)
Additional standing charges			120.0000 (251)
Total energy cost			479.7897 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9477 (257)
SAP value		86.7801
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5299.4838	0.2160	1144.6885 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2270.8338	0.2160	490.5001 (264)
Space and water heating			1635.1886 (265)
Pumps and fans	196.5431	0.5190	102.0059 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Total kg/year			2014.2776 (272)
CO2 emissions per m2			12.0200 (273)
EI value			87.3066

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating
EI band

87 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8474 = 4.107$, stars = 5
Water heating environmental impact	$0.216 / 0.8474 = 0.2549$, 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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour				
										heating	heating							
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans																0 * 10 =	0.0000 (7a)	
Number of passive vents																0 * 10 =	0.0000 (7b)	
Number of flueless gas fires																0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour			
Pressure test															0.0000 / (5) =		0.0000 (8)	
Measured/design AP50															Yes			
Infiltration rate															4.0100			
Number of sides sheltered															0.2005 (18)			
															0 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
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																		
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)						
Mechanical extract ventilation - decentralised																		
If mechanical ventilation:																	0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)						

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			30.3100	1.1450	34.7061		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			84.4100	0.1100	9.2851	75.0000	6330.7500 (28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560 (29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900 (30)
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800 (30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			83.2300			13.8000	1148.5740 (32d)
Internal Ceiling			83.2300			9.0000	749.0700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23816.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.0684 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261 (36)
Total fabric heat loss							(33) + (36) = 110.8749 (37)

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

(38)m	Jan 71.2192	Feb 71.2192	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192 (38)
Heat transfer coeff	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.0942 (39)
HLP	Jan 1.0862	Feb 1.0862	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862 (40)
HLP (average)												1.0862 (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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9126 (55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings													-323.2853
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	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	831.2580	825.6468	794.8631	746.6092	696.1807	651.7093	626.1817	636.1629	664.3447	712.8373	766.8055	808.6213	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				12.3500	12.9236	0.4600	0.0000		0.7700	56.5324 (75)		
Southeast				5.9000	40.4699	0.4600	0.0000		0.7700	84.5732 (77)		
Southwest				9.2300	40.4699	0.4600	0.0000		0.7700	132.3069 (79)		
Northwest				2.8300	12.9236	0.4600	0.0000		0.7700	12.9544 (81)		
Southwest				7.3500	40.4699	0.4300	0.0000		0.7700	98.4870 (79)		
Solar gains	384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418 (83)
Total gains	1216.1119	1436.8421	1677.5997	1972.3515	2121.1615	2206.4643	2092.1592	1942.7483	1735.2674	1450.5175	1243.4468	1132.0631 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9695	0.9478	0.8964	0.7832	0.6134	0.4007	0.2676	0.2965	0.5596	0.8332	0.9443	0.9751	(86)
MIT	19.5142	19.7512	20.1579	20.5875	20.8652	20.9772	20.9960	20.9942	20.9264	20.5644	19.9672	19.4491	(87)
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9636	0.9381	0.8774	0.7466	0.5548	0.3260	0.1834	0.2066	0.4796	0.7945	0.9319	0.9702	(89)
MIT 2	18.0548	18.3935	18.9664	19.5444	19.8852	19.9979	20.0109	20.0102	19.9563	19.5310	18.7079	17.9615	(90)
Living area fraction									fLA = Living area / (4) =				0.0997 (91)
MIT	18.2004	18.5289	19.0853	19.6484	19.9829	20.0956	20.1091	20.1084	20.0531	19.6341	18.8335	18.1099	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.0504	18.3789	18.9353	19.4984	19.8329	19.9456	19.9591	19.9584	19.9031	19.4841	18.6835	17.9599	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9469	0.9166	0.8519	0.7250	0.5434	0.3209	0.1788	0.2016	0.4702	0.7699	0.9095	0.9553	(94)

FULL SAP CALCULATION PRINTOUT

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Useful gains	1151.5825	1317.0620	1429.1828	1430.0048	1152.6939	707.9718	374.0992	391.7055	815.9151	1116.6912	1130.9033	1081.4115	(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	2358.1898	2326.9655	2100.5054	1747.8158	1244.2362	718.4628	374.9572	393.0291	856.3986	1435.6457	1945.4021	2341.7134	(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	897.7159	678.6551	499.4640	228.8239	68.1075	0.0000	0.0000	0.0000	0.0000	237.3022	586.4392	937.6646	(98)
Space heating												4134.1723	(98)
Space heating per m2												(98) / (4) =	24.6610 (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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4573.1995 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	897.7159	678.6551	499.4640	228.8239	68.1075	0.0000	0.0000	0.0000	0.0000	237.3022	586.4392	937.6646	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	993.0485	750.7247	552.5045	253.1238	75.3402	0.0000	0.0000	0.0000	0.0000	262.5024	648.7159	1037.2396	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Efficiency of water heater	88.3639	88.0985	87.3813	85.7103	82.6800	79.7000	79.7000	79.7000	79.7000	85.6940	87.7391	79.7000	(216)
(217)m	88.3639	88.0985	87.3813	85.7103	82.6800	79.7000	79.7000	79.7000	79.7000	85.6940	87.7391	88.4709	(217)
Fuel for water heating, kWh/month	210.4916	186.1098	198.0438	183.6563	188.1381	176.3797	172.1796	186.6671	185.5829	191.6805	195.0496	205.5170	(219)
Water heating fuel used												2279.4960	(219)
Annual totals kWh/year													
Space heating fuel - main system												4573.1995	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													121.5431 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													196.5431 (231)
Electricity for lighting (calculated in Appendix L)													533.8788 (232)
Total delivered energy for all uses													7583.1174 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4573.1995	3.9200	179.2694 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2279.4960	3.9200	89.3562 (247)
Mechanical ventilation fans	121.5431	16.9600	20.6137 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	533.8788	16.9600	90.5459 (250)
Additional standing charges			88.0000 (251)
Total energy cost			480.5052 (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	4573.1995	0.2160	987.8111 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.4960	0.2160	492.3711 (264)
Space and water heating			1480.1822 (265)
Pumps and fans	196.5431	0.5190	102.0059 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Total kg/year			1859.2712 (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	4573.1995	1.2200	5579.3034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.4960	1.2200	2780.9851 (264)
Space and water heating			8360.2884 (265)
Pumps and fans	196.5431	3.0700	603.3873 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Energy for lighting	533.8788	3.0700	1639.0080 (268)
Primary energy kWh/year			10602.6838 (272)
Primary energy kWh/m ² /year			63.2467 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	+ 6.3	-£ 309	-947 kg (50.9%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 38	-228 kg (12.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 5.65 kg/m ²	A 93	A 93
Total Savings	£309 5.65 kg/m ²		

Potential energy efficiency rating:	A 93
Potential environmental impact rating:	A 93

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	£124	£124	£0
Mains gas	£357	£357	£0
Space heating	£301	£301	£0
Water heating	£89	£89	£0
Lighting	£91	£91	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£481	£172	£309
Total cost of uses	£481	£172	£309
Delivered energy	45 kWh/m ²	34 kWh/m ²	11 kWh/m ²
Carbon dioxide emissions	1.9 tonnes	0.9 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	5 kg/m ²	6 kg/m ²
Primary energy	63 kWh/m ²	30 kWh/m ²	33 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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (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					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2005 (21)

	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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			30.3100	1.1450	34.7061		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			84.4100	0.1100	9.2851	75.0000	6330.7500 (28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560 (29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900 (30)
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800 (30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			83.2300			13.8000	1148.5740 (32d)
Internal Ceiling			83.2300			9.0000	749.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.0684 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261 (36)
Total fabric heat loss						(33) + (36) =	110.8749 (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	72.0222	71.3083	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192 (38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.1685 (39)
HLP	1.0910	1.0868	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862 (40)
HLP (average)												1.0867 (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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9126 (55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings													-323.2853
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	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	831.2580	825.6468	794.8631	746.6092	696.1807	651.7093	626.1817	636.1629	664.3447	712.8373	766.8055	808.6213	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829	0.4600	0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938	0.4600	0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938	0.4600	0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829	0.4600	0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938	0.4300	0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains	1178.6443	1437.5249	1685.5853	1939.9712	2114.7325	2096.0221	2003.6638	1840.1367	1659.0056	1403.5244	1186.5640	1103.5371 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9758	0.9536	0.9098	0.8204	0.6816	0.5202	0.3893	0.4379	0.6570	0.8735	0.9588	0.9803	(86)
MIT	19.3536	19.6475	20.0417	20.4703	20.7817	20.9351	20.9816	20.9724	20.8559	20.4218	19.7936	19.2880	(87)
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9712	0.9451	0.8937	0.7899	0.6318	0.4507	0.3062	0.3506	0.5881	0.8442	0.9499	0.9765	(89)
MIT 2	17.8196	18.2438	18.8024	19.3894	19.7871	19.9602	20.0022	19.9961	19.8841	19.3412	18.4598	17.7275	(90)
Living area fraction									fLA = Living area / (4) =			0.0997	(91)
MIT	17.9726	18.3838	18.9260	19.4972	19.8863	20.0574	20.0998	20.0935	19.9810	19.4490	18.5929	17.8831	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8226	18.2338	18.7760	19.3472	19.7363	19.9074	19.9498	19.9435	19.8310	19.2990	18.4429	17.7331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9566	0.9248	0.8687	0.7662	0.6168	0.4429	0.3008	0.3443	0.5742	0.8182	0.9301	0.9636	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	1127.4762	1329.3711	1464.3016	1486.4613	1304.2827	928.3867	602.7025	633.5215	952.6368	1148.3812	1103.6597	1063.4027	(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	2473.2473	2429.1883	2235.3849	1902.3681	1463.3680	966.4532	609.9872	645.2426	1043.5809	1584.0401	2065.4692	2464.3046	(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	1001.2537	739.0772	573.6860	299.4529	118.3595	0.0000	0.0000	0.0000	0.0000	324.1302	692.5028	1042.2710	(98)
Space heating												4790.7334	(98)
Space heating per m2												28.5775	(99)

(98) / (4) = 28.5775 (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 %)	90.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5299.4838	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1001.2537	739.0772	573.6860	299.4529	118.3595	0.0000	0.0000	0.0000	0.0000	324.1302	692.5028	1042.2710	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1107.5815	817.5633	634.6084	331.2533	130.9286	0.0000	0.0000	0.0000	0.0000	358.5511	766.0429	1152.9547	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating requirement	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Efficiency of water heater	88.5378	88.2489	87.6723	86.4033	83.9960	79.7000	79.7000	79.7000	79.7000	86.4945	88.0574	79.7000	(216)
(217)m	210.0782	185.7928	197.3865	182.1834	185.1905	176.3797	172.1796	186.6671	185.5829	189.9065	194.3445	205.1422	(219)
Fuel for water heating, kWh/month	210.0782	185.7928	197.3865	182.1834	185.1905	176.3797	172.1796	186.6671	185.5829	189.9065	194.3445	205.1422	(219)
Water heating fuel used												2270.8338	(219)
Annual totals kWh/year												5299.4838	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)		
mechanical ventilation fans (SFP = 0.2308)		121.5431 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		196.5431 (231)
Electricity for lighting (calculated in Appendix L)		533.8788 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =	-1727.2394	-1727.2394 (233)
Total delivered energy for all uses		6573.5002 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5299.4838	3.4800	184.4220	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2270.8338	3.4800	79.0250	(247)
Mechanical ventilation fans	121.5431	13.1900	16.0315	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	533.8788	13.1900	70.4186	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			251.9668	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4977 (257)
SAP value		93.0574
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5299.4838	0.2160	1144.6885	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2270.8338	0.2160	490.5001	(264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space and water heating			1635.1886 (265)
Pumps and fans	196.5431	0.5190	102.0059 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			1117.8403 (272)
CO2 emissions per m2			6.6700 (273)
EI value			92.9557
EI rating			93 (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	84.4100 (1b)	x 2.5400 (2b)	= 214.4014 (1b) - (3b)
First floor	83.2300 (1c)	x 2.6100 (2c)	= 217.2303 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	167.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 431.6317 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			30.3100	1.1450	34.7061		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			84.4100	0.1100	9.2851	75.0000	6330.7500 (28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560 (29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900 (30)
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200 (30)
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800 (30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			83.2300			13.8000	1148.5740 (32d)
Internal Ceiling			83.2300			9.0000	749.0700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.0684 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261 (36)
Total fabric heat loss						(33) + (36) =	110.8749 (37)

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

(38)m	Jan 71.2192	Feb 71.2192	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192 (38)
Heat transfer coeff	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.0942 (39)
HLP	Jan 1.0862	Feb 1.0862	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862 (40)
HLP (average)												1.0862 (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	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)	Total = Sum (45)m =												1643.9683 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9126 (55)
Total storage loss	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(56)
If cylinder contains dedicated solar storage	28.2906	25.5528	28.2906	27.3780	28.2906	27.3780	28.2906	28.2906	27.3780	28.2906	27.3780	28.2906	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	221.9973	195.6357	205.3817	184.0016	180.2362	160.9338	154.4514	169.6305	169.3777	190.8044	201.8938	216.6193	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	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	-323.2853
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	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Heat gains from water heating, kWh/month	97.9151	86.8175	92.3904	84.5041	84.0296	76.8341	75.4561	80.5032	79.6417	87.5435	90.4533	96.1269	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(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)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	131.6064	129.1928	124.1807	117.3668	112.9430	106.7140	101.4195	108.2032	110.6134	117.6660	125.6295	129.2029	(72)
Total internal gains	831.2580	825.6468	794.8631	746.6092	696.1807	651.7093	626.1817	636.1629	664.3447	712.8373	766.8055	808.6213	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				12.3500	12.9236	0.4600	0.0000		0.7700	56.5324 (75)		
Southeast				5.9000	40.4699	0.4600	0.0000		0.7700	84.5732 (77)		
Southwest				9.2300	40.4699	0.4600	0.0000		0.7700	132.3069 (79)		
Northwest				2.8300	12.9236	0.4600	0.0000		0.7700	12.9544 (81)		
Southwest				7.3500	40.4699	0.4300	0.0000		0.7700	98.4870 (79)		
Solar gains	384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418 (83)
Total gains	1216.1119	1436.8421	1677.5997	1972.3515	2121.1615	2206.4643	2092.1592	1942.7483	1735.2674	1450.5175	1243.4468	1132.0631 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9695	0.9478	0.8964	0.7832	0.6134	0.4007	0.2676	0.2965	0.5596	0.8332	0.9443	0.9751	(86)
MIT	19.5142	19.7512	20.1579	20.5875	20.8652	20.9772	20.9960	20.9942	20.9264	20.5644	19.9672	19.4491	(87)
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9636	0.9381	0.8774	0.7466	0.5548	0.3260	0.1834	0.2066	0.4796	0.7945	0.9319	0.9702	(89)
MIT 2	18.0548	18.3935	18.9664	19.5444	19.8852	19.9979	20.0109	20.0102	19.9563	19.5310	18.7079	17.9615	(90)
Living area fraction	18.2004	18.5289	19.0853	19.6484	19.9829	20.0956	20.1091	20.1084	20.0531	19.6341	18.8335	18.1099	(91)
MIT	18.2004	18.5289	19.0853	19.6484	19.9829	20.0956	20.1091	20.1084	20.0531	19.6341	18.8335	18.1099	(92)
Temperature adjustment	18.0504	18.3789	18.9353	19.4984	19.8329	19.9456	19.9591	19.9584	19.9031	19.4841	18.6835	-0.1500	
adjusted MIT	18.0504	18.3789	18.9353	19.4984	19.8329	19.9456	19.9591	19.9584	19.9031	19.4841	18.6835	17.9599	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9469	0.9166	0.8519	0.7250	0.5434	0.3209	0.1788	0.2016	0.4702	0.7699	0.9095	0.9553	(94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Useful gains	1151.5825	1317.0620	1429.1828	1430.0048	1152.6939	707.9718	374.0992	391.7055	815.9151	1116.6912	1130.9033	1081.4115	(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	2358.1898	2326.9655	2100.5054	1747.8158	1244.2362	718.4628	374.9572	393.0291	856.3986	1435.6457	1945.4021	2341.7134	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	897.7159	678.6551	499.4640	228.8239	68.1075	0.0000	0.0000	0.0000	0.0000	237.3022	586.4392	937.6646	(98)
Space heating per m2												4134.1723	(98)
												(98) / (4) =	24.6610 (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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4573.1995 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	897.7159	678.6551	499.4640	228.8239	68.1075	0.0000	0.0000	0.0000	0.0000	237.3022	586.4392	937.6646	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	993.0485	750.7247	552.5045	253.1238	75.3402	0.0000	0.0000	0.0000	0.0000	262.5024	648.7159	1037.2396	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.9986	163.9600	173.0533	157.4124	155.5526	140.5746	137.2272	148.7737	147.9096	164.2587	171.1347	181.8227	(64)
Efficiency of water heater	88.3639	88.0985	87.3813	85.7103	82.6800	79.7000	79.7000	79.7000	79.7000	85.6940	87.7391	79.7000	(216)
Fuel for water heating, kWh/month	210.4916	186.1098	198.0438	183.6563	188.1381	176.3797	172.1796	186.6671	185.5829	191.6805	195.0496	205.5170	(219)
Water heating fuel used												2279.4960	(219)
Annual totals kWh/year													
Space heating fuel - main system												4573.1995	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													121.5431 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													196.5431 (231)
Electricity for lighting (calculated in Appendix L)													533.8788 (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												5758.9577	(238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	4573.1995	3.9200	179.2694 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2279.4960	3.9200	89.3562 (247)
Mechanical ventilation fans	121.5431	16.9600	20.6137 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	533.8788	16.9600	90.5459 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			171.1277 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4573.1995	0.2160	987.8111 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.4960	0.2160	492.3711 (264)
Space and water heating			1480.1822 (265)
Pumps and fans	196.5431	0.5190	102.0059 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			912.5323 (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 CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	4573.1995	1.2200	5579.3034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.4960	1.2200	2780.9851 (264)
Space and water heating			8360.2884 (265)
Pumps and fans	196.5431	3.0700	603.3873 (267)
Energy for lighting	533.8788	3.0700	1639.0080 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			5002.5137 (272)
Primary energy kWh/m ² /year			29.8408 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	142.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	569.75 (P1)
Transmission heat loss coefficient	110.87 (37)
Summer heat loss coefficient	680.63 (P2)

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

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

[Jul]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	12.3500	98.8453	0.4600	0.0000	0.9000	505.3860
South East	5.9000	119.9223	0.4600	0.0000	0.9000	292.9223
South West	9.2300	119.9223	0.4600	0.0000	0.9000	458.2497
North West	2.8300	98.8453	0.4600	0.0000	0.9000	115.8091
South West	7.3500	119.9223	0.4300	0.0000	0.9000	341.1131

total: 1713.4802

	Jun	Jul	Aug	
Solar gains	1817	1713	1527	(P4)
Internal gains	649	623	633	
Total summer gains	2466	2337	2160	(P5)

Summer gain/loss ratio	3.62	3.43	3.17	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 142.1)	1.01	1.01	1.01	
Threshold temperature	20.63	22.34	21.98	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium