

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Cooper End/Semi			Issued on Date	15/12/2022
Assessment Reference	Cooper End/Semi	Prop Type Ref	Cooper		
Property	2 Bed, WC, B, 2 Storey				
SAP Rating	86 B	DER	14.11	TER	18.36
Environmental	89 B	% DER<TER	23.15		
CO ₂ Emissions (t/year)	0.93	DFEE	39.52	TFEE	51.07
General Requirements Compliance	Pass	% DFEE<TFEE	22.62		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.11 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 7.23 m², No overhang
Windows facing South: 4.33 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.025 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (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) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.0100			
Infiltration rate														0.2005 (18)			
Number of sides sheltered														1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.1855 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821	(44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081	(61)
Total heat required for water heating calculated for each month	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725	(62)
WWHRS	-49.5541	-43.5996	-44.5000	-36.6247	-34.0127	-28.0630	-23.7583	-28.7632	-29.5989	-36.5818	-42.3638	-47.8937	eq. (G10)
Total of WWHRS savings													
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 =													(63)
Output from w/h	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Heat gains from water heating, kWh/month	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264	(65)
Total per year (kWh/year) = Sum(64)m =													(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8550	18.5232	15.0641	11.4045	8.5250	7.1972	7.7768	10.1085	13.5677	17.2273	20.1068	21.4346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.5241	221.8021	216.0617	203.8410	188.4146	173.9160	164.2300	161.9520	167.6924	179.9131	195.3395	209.8381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	(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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	(71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968	(72)
Total internal gains	375.6667	373.4654	359.8067	337.8664	315.6253	294.2601	280.4488	286.5340	297.8788	320.0308	345.4191	364.4239	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				3.9000	10.6334	0.4600	0.0000			0.7700			14.6888 (74)
South				4.3300	46.7521	0.4600	0.0000			0.7700			71.7030 (78)
North				3.3300	10.6334	0.4300	0.0000			0.7700			11.7240 (74)

Solar gains	98.1157	167.9071	235.3575	306.8356	361.7658	368.2247	351.1487	308.0398	259.3853	186.7456	117.5760	83.9769 (83)	
Total gains	473.7825	541.3725	595.1642	644.7019	677.3911	662.4848	631.5976	594.5738	557.2642	506.7764	462.9951	448.4008 (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	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	
util living area	0.9892	0.9808	0.9636	0.9219	0.8320	0.6821	0.5284	0.5769	0.7922	0.9392	0.9814	0.9913	(86)
MIT	19.5307	19.7192	20.0097	20.3721	20.7003	20.9035	20.9732	20.9618	20.8176	20.4005	19.8873	19.4757	(87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	(88)
util rest of house	0.9869	0.9768	0.9556	0.9039	0.7923	0.6093	0.4293	0.4773	0.7314	0.9214	0.9768	0.9894	(89)
MIT 2	18.1166	18.3898	18.8090	19.3223	19.7649	20.0090	20.0749	20.0669	19.9191	19.3706	18.6361	18.0366	(90)
Living area fraction	18.3550	18.6139	19.0113	19.4993	19.9225	20.1597	20.2263	20.2177	20.0705	19.5442	18.8470	18.2792	(91)
MIT	18.3550	18.6139	19.0113	19.4993	19.9225	20.1597	20.2263	20.2177	20.0705	19.5442	18.8470	18.2792	(92)
Temperature adjustment													
adjusted MIT	18.2050	18.4639	18.8613	19.3493	19.7725	20.0097	20.0763	20.0677	19.9205	19.3942	18.6970	18.1292	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9666	0.9413	0.8856	0.7764	0.6024	0.4277	0.4748	0.7183	0.9038	0.9666	0.9834	(94)
Useful gains	464.2792	523.3037	560.2045	570.9627	525.9139	399.0501	270.1609	282.2788	400.3058	458.0270	447.5289	440.9545	(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	1104.1517	1077.0666	981.5761	829.7445	641.0155	429.5701	276.0432	291.2410	462.1889	698.3214	920.8826	1106.0739	(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	476.0651	372.1287	313.5005	186.3229	85.6356	0.0000	0.0000	0.0000	0.0000	178.7790	340.8146	494.8488	(98)

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Space heating
Space heating per m2 (98) / (4) = 2448.0952 (98)
30.5859 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2705.0775 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	476.0651	372.1287	313.5005	186.3229	85.6356	0.0000	0.0000	0.0000	0.0000	178.7790	340.8146	494.8488	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	526.0388	411.1919	346.4093	205.8817	94.6249	0.0000	0.0000	0.0000	0.0000	197.5459	376.5907	546.7943	(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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Efficiency of water heater	89.8556	89.7951	89.6691	89.3863	88.7954	87.3000	87.3000	87.3000	87.3000	89.3180	89.7190	89.8889	(216)
Fuel for water heating, kWh/month	128.8756	112.9349	118.2789	107.3382	106.0462	96.1937	93.3375	103.0738	103.0554	113.0946	118.3039	125.3534	(217)
Water heating fuel used												1325.8861	(219)
Annual totals kWh/year													
Space heating fuel - main system												2705.0775	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												54.8107	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												129.8107	(231)
Electricity for lighting (calculated in Appendix L)												368.3056	(232)
Total delivered energy for all uses												4529.0799	(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	2705.0775	0.2160	584.2967	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1325.8861	0.2160	286.3914	(264)
Space and water heating			870.6882	(265)
Pumps and fans	129.8107	0.5190	67.3717	(267)
Energy for lighting	368.3056	0.5190	191.1506	(268)
Total CO2, kg/year			1129.2105	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1100	(273)

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

DER		14.1100	ZC1
Total Floor Area	TFA	80.0400	
Assumed number of occupants	N	2.4636	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2525	ZC2
CO2 emissions from cooking, equation (L16)		2.2255	ZC3
Total CO2 emissions		32.5880	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		32.5880	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 196.8984 (5)
Dwelling volume			

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							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1524 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4024 (18)					
Number of sides sheltered							1 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3722 (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	0.4745	0.4652	0.4559	0.4094	0.4001	0.3536	0.3536	0.3443	0.3722	0.4001	0.4187	0.4373 (22b)
Effective ac	0.6126	0.6082	0.6039	0.5838	0.5800	0.5625	0.5625	0.5593	0.5693	0.5800	0.5877	0.5956 (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					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.5600	1.3258	15.3258		(27)					
FP McCann System			40.0200	0.1300	5.2026		(28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.1800	13.4550		(29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.1300	5.2026		(30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.3360		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7591 (36)					
Total fabric heat loss						(33) + (36) =	50.0951 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.8041	Feb 39.5200	Mar 39.2416	Apr 37.9336	May 37.6889	Jun 36.5498	Jul 36.5498	Aug 36.3388	Sep 36.9886	Oct 37.6889	Nov 38.1840	Dec 38.7015 (38)
Heat transfer coeff	89.8992	89.6151	89.3366	88.0287	87.7840	86.6449	86.6449	86.4339	87.0836	87.7840	88.2790	88.7966 (39)
Average = Sum(39)m / 12 =												88.0275 (39)
HLP	Jan 1.1232	Feb 1.1196	Mar 1.1161	Apr 1.0998	May 1.0968	Jun 1.0825	Jul 1.0825	Aug 1.0799	Sep 1.0880	Oct 1.0968	Nov 1.1029	Dec 1.1094 (40)
HLP (average)												1.0998 (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												2.4636 (42)
Average daily hot water use (litres/day)												92.7110 (43)
Daily hot water use	Jan 101.9821	Feb 98.2736	Mar 94.5652	Apr 90.8567	May 87.1483	Jun 83.4399	Jul 83.4399	Aug 87.1483	Sep 90.8567	Oct 94.5652	Nov 98.2736	Dec 101.9821 (44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644 (45)
Energy content (annual)										Total = Sum(45)m =		1458.7045 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.2328	48.1894	44.8061	44.4098	41.1484	42.5200	44.4098	44.8061	48.1894	48.4637	50.9589 (61)
Solar input	202.1954	177.5052	184.6826	163.8042	158.5913	139.6784	133.8225	149.1808	150.8283	171.7481	183.3377	197.4233 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	202.1954	177.5052	184.6826	163.8042	158.5913	139.6784	133.8225	149.1808	150.8283	171.7481	183.3377	197.4233 (64)
	63.0258	55.2888	57.4313	50.7684	49.0678	43.0483	40.9881	45.9388	46.4539	53.1306	56.9615	61.4391 (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	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8550	18.5232	15.0641	11.4045	8.5250	7.1972	7.7768	10.1085	13.5677	17.2273	20.1068	21.4346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.5241	221.8021	216.0617	203.8410	188.4146	173.9160	164.2300	161.9520	167.6924	179.9131	195.3395	209.8381	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	(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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	(71)
Water heating gains (Table 5)	84.7122	82.2749	77.1927	70.5117	65.9514	59.7893	55.0915	61.7457	64.5193	71.4121	79.1132	82.5795	(72)
Total internal gains	388.0456	385.5545	371.2727	348.7114	325.8452	303.8567	290.0526	296.7605	308.7337	331.5068	357.5138	376.8065	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.2300	10.6334	0.6300	0.7000	0.7700		23.4954	
South					4.3300	46.7521	0.6300	0.7000	0.7700		61.8672 (78)	
Solar gains	85.3626	146.2234	205.3644	268.4270	317.0999	323.0226	307.9367	269.7170	226.5599	162.7344	102.3183	73.0458 (83)
Total gains	473.4081	531.7779	576.6371	617.1384	642.9451	626.8794	597.9892	566.4776	535.2937	494.2412	459.8321	449.8524 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8285	62.0245	62.2179	63.1423	63.3183	64.1508	64.1508	64.3073	63.8275	63.3183	62.9632	62.5963	
alpha	5.1219	5.1350	5.1479	5.2095	5.2212	5.2767	5.2767	5.2872	5.2552	5.2212	5.1975	5.1731	
util living area	0.9981	0.9962	0.9913	0.9746	0.9211	0.7850	0.6147	0.6658	0.8845	0.9810	0.9962	0.9986	(86)
MIT	19.7869	19.9227	20.1455	20.4509	20.7344	20.9259	20.9838	20.9757	20.8488	20.4927	20.0899	19.7676	(87)
Th 2	19.9819	19.9848	19.9877	20.0010	20.0035	20.0151	20.0151	20.0173	20.0106	20.0035	19.9984	19.9932	(88)
util rest of house	0.9975	0.9949	0.9881	0.9643	0.8870	0.6997	0.4887	0.5410	0.8232	0.9713	0.9946	0.9981	(89)
MIT 2	18.3628	18.5630	18.8894	19.3383	19.7282	19.9620	20.0087	20.0065	19.8819	19.4040	18.8175	18.3425	(90)
Living area fraction	18.6028	18.7922	19.1011	19.5258	19.8978	20.1244	20.1730	20.1699	20.0449	19.5875	19.0319	18.5827	(91)
MIT	18.6028	18.7922	19.1011	19.5258	19.8978	20.1244	20.1730	20.1699	20.0449	19.5875	19.0319	18.5827	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6028	18.7922	19.1011	19.5258	19.8978	20.1244	20.1730	20.1699	20.0449	19.5875	19.0319	18.5827	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	471.6126	527.8950	567.5033	591.1108	567.4508	445.2581	304.8822	318.1700	442.0292	477.2542	456.3241	448.5314	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1285.8103	1244.9510	1125.7369	935.3776	719.6338	478.6648	309.5859	325.8433	517.7015	788.9591	1053.3376	1277.1341	(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	605.7631	481.8616	415.3258	247.8721	113.2241	0.0000	0.0000	0.0000	0.0000	231.9085	429.8498	616.4804	(98)
Space heating												3142.2855	(98)
Space heating per m2												39.2589	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3364.3314 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	605.7631	481.8616	415.3258	247.8721	113.2241	0.0000	0.0000	0.0000	0.0000	231.9085	429.8498	616.4804	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	648.5686	515.9118	444.6743	265.3877	121.2250	0.0000	0.0000	0.0000	0.0000	248.2960	460.2246	660.0433	(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	202.1954	177.5052	184.6826	163.8042	158.5913	139.6784	133.8225	149.1808	150.8283	171.7481	183.3377	197.4233	(64)
Efficiency of water heater (217)m	87.6413	87.4393	87.0306	86.0914	84.2195	80.3000	80.3000	80.3000	80.3000	85.8079	87.1236	87.7236	(217)
Fuel for water heating, kWh/month	230.7077	203.0039	212.2041	190.2677	188.3072	173.9457	166.6532	185.7793	187.8310	200.1542	210.4341	225.0515	(219)
Water heating fuel used												2374.3397	(219)
Annual totals kWh/year													
Space heating fuel - main system												3364.3314	(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)												368.3056	(232)
Total delivered energy for all uses												6181.9766	(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	3364.3314	0.2160	726.6956 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2374.3397	0.2160	512.8574 (264)
Space and water heating			1239.5530 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.3056	0.5190	191.1506 (268)
Total CO2, kg/m2/year			1469.6285 (272)
Emissions per m2 for space and water heating			15.4867 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3882 (272b)
Emissions per m2 for pumps and fans			0.4863 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4867 * 1.00) + 2.3882 + 0.4863, rounded to 2 d.p.			18.3600 (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	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1524 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3529 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3264 (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	0.4162	0.4080	0.3998	0.3590	0.3509	0.3101	0.3101	0.3019	0.3264	0.3509	0.3672	0.3835 (22b)
Effective ac	0.5866	0.5832	0.5799	0.5645	0.5616	0.5481	0.5481	0.5456	0.5533	0.5616	0.5674	0.5735 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)
Total net area of external elements Aum(A, m ²)			168.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6799		(33)
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)
Timber GF			20.5700			9.0000	185.1300 (32c)
Timber 1F			76.2500			9.0000	686.2500 (32c)
AAC GF			49.2000			39.0000	1918.8000 (32c)
Internal Floor			40.0200			12.6000	504.2520 (32d)
Internal Ceiling			40.0200			9.0000	360.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 12758.5920 (34)
159.4027 (35)
4.2388 (36)
(33) + (36) = 46.9187 (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	38.1148	37.8963	37.6821	36.6762	36.4880	35.6119	35.6119	35.4497	35.9494	36.4880	36.8688	37.2668 (38)
Heat transfer coeff	85.0335	84.8150	84.6009	83.5950	83.4068	82.5307	82.5307	82.3684	82.8681	83.4068	83.7875	84.1855 (39)
Average = Sum(39)m / 12 =												83.5941 (39)
HLP	1.0624	1.0597	1.0570	1.0444	1.0421	1.0311	1.0311	1.0291	1.0353	1.0421	1.0468	1.0518 (40)
HLP (average)												1.0444 (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												2.4636 (42)
Average daily hot water use (litres/day)												92.7110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644 (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	1458.7045 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.1377	28.1079	29.0048	25.2871	24.2636	20.9376	19.4018	22.2638	22.5297	26.2562	28.6607	31.1237 (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	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8550	18.5232	15.0641	11.4045	8.5250	7.1972	7.7768	10.1085	13.5677	17.2273	20.1068	21.4346 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.5241	221.8021	216.0617	203.8410	188.4146	173.9160	164.2300	161.9520	167.6924	179.9131	195.3395	209.8381 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181 (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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448 (71)
Water heating gains (Table 5)	43.1959	41.8272	38.9850	35.1210	32.6123	29.0800	26.0777	29.9245	31.2913	35.2906	39.8066	41.8329 (72)
Total internal gains	343.5293	342.1068	330.0650	310.3208	289.5062	270.1474	258.0387	261.9393	272.5057	292.3853	315.2071	333.0600 (73)

6. Solar gains

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

North	3.9000	10.6334	0.4600	0.0000	0.7700	14.6888 (74)
South	4.3300	46.7521	0.4600	0.0000	0.7700	71.7030 (78)
North	3.3300	10.6334	0.4300	0.0000	0.7700	11.7240 (74)

Solar gains	98.1157	167.9071	235.3575	306.8356	361.7658	368.2247	351.1487	308.0398	259.3853	186.7456	117.5760	83.9769 (83)
Total gains	441.6450	510.0139	565.4225	617.1563	651.2720	638.3722	609.1874	569.9791	531.8910	479.1309	432.7831	417.0369 (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	41.6783	41.7857	41.8915	42.3955	42.4912	42.9423	42.9423	43.0268	42.7674	42.4912	42.2981	42.0981
alpha	3.7786	3.7857	3.7928	3.8264	3.8327	3.8628	3.8628	3.8685	3.8512	3.8327	3.8199	3.8065
util living area	0.9916	0.9848	0.9707	0.9352	0.8561	0.7133	0.5606	0.6115	0.8215	0.9512	0.9856	0.9932 (86)
MIT	19.3480	19.5469	19.8582	20.2659	20.6311	20.8765	20.9633	20.9485	20.7716	20.3038	19.7534	19.3131 (87)
Th 2	20.0317	20.0339	20.0361	20.0465	20.0484	20.0575	20.0575	20.0592	20.0540	20.0484	20.0445	20.0404 (88)
util rest of house	0.9898	0.9815	0.9639	0.9191	0.8187	0.6394	0.4548	0.5066	0.7630	0.9360	0.9818	0.9917 (89)
MIT 2	18.5168	18.7159	19.0252	19.4304	19.7726	19.9859	20.0434	20.0377	19.9057	19.4742	18.9303	18.4887 (90)
Living area fraction	18.6569	18.8559	19.1656	19.5712	19.9173	20.1360	20.1984	20.1912	20.0516	19.6140	19.0690	18.6276 (92)
Temperature adjustment	18.6569	18.8559	19.1656	19.5712	19.9173	20.1360	20.1984	20.1912	20.0516	19.6140	19.0690	18.6276 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	435.5508	497.8144	540.6252	561.2648	529.3640	412.4740	287.1967	297.7308	405.7630	444.2706	422.6799	412.3288 (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	1220.8159	1183.6717	1071.5212	892.0596	685.3789	456.8880	296.9811	312.2768	493.2004	751.8275	1002.8558	1214.5964 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	584.2372	460.8961	394.9866	238.1723	116.0751	0.0000	0.0000	0.0000	0.0000	228.8224	417.7266	596.8871 (98)
Space heating												3037.8034 (98)
Space heating per m2												37.9536 (99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	775.7882	610.7269	626.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8241	0.8868	0.8631	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	639.2941	541.5958	540.3155	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	838.5592	802.5903	758.4795	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	143.4709	194.1799	162.3140	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			499.9648 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	35.8677	48.5450	40.5785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												124.9912 (107)
Energy for space heating												1.5616 (108)
Energy for space cooling												37.9536 (99)
Total												1.5616 (108)
Dwelling Fabric Energy Efficiency (DFEE)												39.5152 (109)
												39.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 196.8984 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1524 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.4024 (18)		
Number of sides sheltered												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3722 (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	0.4745	0.4652	0.4559	0.4094	0.4001	0.3536	0.3536	0.3443	0.3722	0.4001	0.4187	0.4373 (22b)		
Effective ac	0.6126	0.6082	0.6039	0.5838	0.5800	0.5625	0.5625	0.5593	0.5693	0.5800	0.5877	0.5956 (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					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.5600	1.3258	15.3258		(27)					
FP McCann System			40.0200	0.1300	5.2026		(28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.1800	13.4550		(29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.1300	5.2026		(30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.3360		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7591 (36)					
Total fabric heat loss						(33) + (36) =	50.0951 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.8041	Feb 39.5200	Mar 39.2416	Apr 37.9336	May 37.6889	Jun 36.5498	Jul 36.5498	Aug 36.3388	Sep 36.9886	Oct 37.6889	Nov 38.1840	Dec 38.7015 (38)
Heat transfer coeff	89.8992	89.6151	89.3366	88.0287	87.7840	86.6449	86.6449	86.4339	87.0836	87.7840	88.2790	88.7966 (39)
Average = Sum(39)m / 12 =												88.0275 (39)
HLP	Jan 1.1232	Feb 1.1196	Mar 1.1161	Apr 1.0998	May 1.0968	Jun 1.0825	Jul 1.0825	Aug 1.0799	Sep 1.0880	Oct 1.0968	Nov 1.1029	Dec 1.1094 (40)
HLP (average)												1.0998 (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												2.4636 (42)
Average daily hot water use (litres/day)												92.7110 (43)
Daily hot water use	Jan 101.9821	Feb 98.2736	Mar 94.5652	Apr 90.8567	May 87.1483	Jun 83.4399	Jul 83.4399	Aug 87.1483	Sep 90.8567	Oct 94.5652	Nov 98.2736	Dec 101.9821 (44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644 (45)
Energy content (annual)										Total = Sum(45)m =		1458.7045 (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	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
	32.1377	28.1079	29.0048	25.2871	24.2636	20.9376	19.4018	22.2638	22.5297	26.2562	28.6607	31.1237 (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	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810	123.1810 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8550	18.5232	15.0641	11.4045	8.5250	7.1972	7.7768	10.1085	13.5677	17.2273	20.1068	21.4346 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.5241	221.8021	216.0617	203.8410	188.4146	173.9160	164.2300	161.9520	167.6924	179.9131	195.3395	209.8381 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181	35.3181 (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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448 (71)
Water heating gains (Table 5)	43.1959	41.8272	38.9850	35.1210	32.6123	29.0800	26.0777	29.9245	31.2913	35.2906	39.8066	41.8329 (72)
Total internal gains	343.5293	342.1068	330.0650	310.3208	289.5062	270.1474	258.0387	261.9393	272.5057	292.3853	315.2071	333.0600 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					7.2300	10.6334	0.6300	0.7000			0.7700	23.4954 (74)
South					4.3300	46.7521	0.6300	0.7000			0.7700	61.8672 (78)
Solar gains	85.3626	146.2234	205.3644	268.4270	317.0999	323.0226	307.9367	269.7170	226.5599	162.7344	102.3183	73.0458 (83)
Total gains	428.8919	488.3302	535.4294	578.7477	606.6061	593.1701	565.9754	531.6564	499.0656	455.1197	417.5254	406.1058 (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	61.8285	62.0245	62.2179	63.1423	63.3183	64.1508	64.1508	64.3073	63.8275	63.3183	62.9632	62.5963
alpha	5.1219	5.1350	5.1479	5.2095	5.2212	5.2767	5.2767	5.2872	5.2552	5.2212	5.1975	5.1731
util living area	0.9988	0.9975	0.9938	0.9805	0.9353	0.8111	0.6438	0.6995	0.9070	0.9866	0.9976	0.9991 (86)
MIT	19.7349	19.8724	20.0988	20.4107	20.7049	20.9128	20.9799	20.9694	20.8241	20.4503	20.0407	19.7162 (87)
Th 2	19.9819	19.9848	19.9877	20.0010	20.0035	20.0151	20.0151	20.0173	20.0106	20.0035	19.9984	19.9932 (88)
util rest of house	0.9984	0.9966	0.9914	0.9723	0.9056	0.7287	0.5145	0.5729	0.8528	0.9795	0.9965	0.9988 (89)
MIT 2	18.8246	18.9640	19.1918	19.5102	19.7907	19.9713	20.0096	20.0077	19.9049	19.5536	19.1433	18.8149 (90)
Living area fraction									fLA = Living area / (4) =			0.1685 (91)
MIT	18.9780	19.1171	19.3447	19.6619	19.9448	20.1299	20.1731	20.1698	20.0598	19.7047	19.2945	18.9668 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9780	19.1171	19.3447	19.6619	19.9448	20.1299	20.1731	20.1698	20.0598	19.7047	19.2945	18.9668 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9979	0.9955	0.9894	0.9687	0.9034	0.7396	0.5365	0.5942	0.8561	0.9765	0.9955	0.9984 (94)
Useful gains	427.9752	486.1353	529.7333	560.6161	548.0232	438.6909	303.6448	315.9046	427.2597	444.4401	415.6598	405.4532 (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	1319.5380	1274.0680	1147.4976	947.3589	723.7603	479.1408	309.5918	325.8386	519.0026	799.2490	1076.5198	1311.2420 (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	663.3227	529.4907	459.6166	278.4548	130.7484	0.0000	0.0000	0.0000	0.0000	263.9778	475.8192	673.9069 (98)
Space heating												3475.3371 (98)
Space heating per m2										(98) / (4) =		43.4200 (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	814.4616	641.1719	656.8976	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8252	0.8996	0.8737	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.0978	576.7714	573.8999	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	785.7256	752.0827	713.6867	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	81.8120	130.4316	104.0014	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												316.2450 (104)
Cooled fraction												fC = cooled area / (4) = 1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	20.4530	32.6079	26.0003	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											79.0612 (107)
Space cooling per m2											0.9878 (108)
Energy for space heating											43.4200 (99)
Energy for space cooling											0.9878 (108)
Total											44.4078 (109)
Target Fabric Energy Efficiency (TFEE)											51.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (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	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821	(44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644	(45)
Energy content (annual)	Total = Sum(45)m = 1458.7045												(45)
Distribution loss (46)m = 0.15 x (45)m	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081	(61)
Total heat required for water heating calculated for each month	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725	(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	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725	(64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1623.9405												(64)
Heat gains from water heating, kWh/month	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264	(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	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1375	46.3080	37.6602	28.5112	21.3125	17.9929	19.4419	25.2714	33.9192	43.0682	50.2669	53.5865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.6479	331.0479	322.4801	304.2403	281.2158	259.5760	245.1194	241.7194	250.2872	268.5270	291.5515	313.1912	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	(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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	(71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968	(72)
Total internal gains	556.6365	552.0595	530.3847	496.9358	462.7775	432.2794	414.5668	423.0277	442.3885	476.0491	513.3547	541.4923	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.9000	11.9814	0.4600	0.0000	0.7700	16.5509 (74)			
South				4.3300	50.9848	0.4600	0.0000	0.7700	78.1947 (78)			
North				3.3300	11.9814	0.4300	0.0000	0.7700	13.2103 (74)			
Solar gains	107.9559	166.5623	231.9403	314.3169	363.2689	396.5539	373.7481	333.7542	278.0038	198.1298	132.5854	91.4835 (83)
Total gains	664.5924	718.6218	762.3249	811.2527	826.0464	828.8333	788.3150	756.7819	720.3923	674.1789	645.9401	632.9758 (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	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754
util living area	0.9615	0.9464	0.9105	0.8307	0.6833	0.4653	0.3102	0.3328	0.5957	0.8375	0.9357	0.9669 (86)
MIT	19.9315	20.0699	20.3389	20.6444	20.8786	20.9805	20.9972	20.9962	20.9461	20.6885	20.2668	19.8852 (87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899 (88)
util rest of house	0.9539	0.9361	0.8930	0.7980	0.6260	0.3860	0.2202	0.2396	0.5167	0.7990	0.9213	0.9603 (89)
MIT 2	18.6937	18.8905	19.2695	19.6839	19.9748	20.0779	20.0891	20.0887	20.0496	19.7499	19.1741	18.6280 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9023	19.0892	19.4497	19.8458	20.1272	20.2300	20.2421	20.2417	20.2007	19.9081	19.3583	18.8399 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.7523	18.9392	19.2997	19.6958	19.9772	20.0800	20.0921	20.0917	20.0507	19.7581	19.2083	18.6899 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9394	0.9195	0.8746	0.7819	0.6184	0.3851	0.2204	0.2398	0.5131	0.7828	0.9038	0.9467	(94)	
Useful gains	624.2990	660.8076	666.7557	634.2991	510.8304	319.2205	173.7362	181.4963	369.6111	527.7237	583.7916	599.2146	(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	1084.0869	1059.2286	944.9195	777.8523	554.0356	323.9795	174.0710	181.9752	385.1769	647.8080	890.0171	1079.1349	(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	342.0822	267.7389	206.9539	103.3583	32.1446	0.0000	0.0000	0.0000	0.0000	89.3427	220.4823	357.0607	(98)	
Space heating													1619.1637	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1619 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821	(44)
Energy content (annual)	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644	(45)
Distribution loss (46)m = 0.15 x (45)m	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697	(46)
Water storage loss:													
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081	(61)
Total heat required for water heating calculated for each month	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725	(62)
WWHRS	-49.5541	-43.5996	-44.5000	-36.6247	-34.0127	-28.0630	-23.7583	-28.7632	-29.5989	-36.5818	-42.3638	-47.8937	eq. (G10)
Total of WWHRS savings													-445.3138
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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Heat gains from water heating, kWh/month	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264	(65)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1375	46.3080	37.6602	28.5112	21.3125	17.9929	19.4419	25.2714	33.9192	43.0682	50.2669	53.5865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.6479	331.0479	322.4801	304.2403	281.2158	259.5760	245.1194	241.7194	250.2872	268.5270	291.5515	313.1912	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	(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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	(71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968	(72)
Total internal gains	556.6365	552.0595	530.3847	496.9358	462.7775	432.2794	414.5668	423.0277	442.3885	476.0491	513.3547	541.4923	(73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					3.9000	10.6334	0.4600	0.0000	0.7700	14.6888 (74)		
South					4.3300	46.7521	0.4600	0.0000	0.7700	71.7030 (78)		
North					3.3300	10.6334	0.4300	0.0000	0.7700	11.7240 (74)		
Solar gains	98.1157	167.9071	235.3575	306.8356	361.7658	368.2247	351.1487	308.0398	259.3853	186.7456	117.5760	83.9769 (83)
Total gains	654.7522	719.9666	765.7422	803.7714	824.5432	800.5041	765.7156	731.0675	701.7739	662.7947	630.9307	625.4693 (84)

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	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754
util living area												
	0.9684	0.9527	0.9238	0.8634	0.7528	0.5923	0.4451	0.4833	0.6904	0.8762	0.9506	0.9732 (86)
MIT	19.8142	19.9847	20.2392	20.5427	20.7981	20.9417	20.9853	20.9795	20.8913	20.5800	20.1364	19.7571 (87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899 (88)
util rest of house												
	0.9624	0.9439	0.9093	0.8370	0.7063	0.5213	0.3578	0.3944	0.6234	0.8468	0.9398	0.9680 (89)
MIT 2	18.5246	18.7682	19.1291	19.5482	19.8795	20.0432	20.0821	20.0782	19.9941	19.6072	18.9892	18.4428 (90)
Living area fraction												
	18.7420	18.9732	19.3162	19.7159	20.0344	20.1946	20.2343	20.2301	20.1454	19.7712	19.1826	18.6643 (92)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.5920	18.8232	19.1662	19.5659	19.8844	20.0446	20.0843	20.0801	19.9954	19.6212	19.0326	18.5143 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9492	0.9281	0.8913	0.8194	0.6948	0.5176	0.3573	0.3934	0.6158	0.8288	0.9235	0.9559 (94)
Useful gains	621.4903	668.2034	682.4895	658.5733	572.8978	414.3233	273.5701	287.5959	432.1649	549.3241	582.6936	597.8851 (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	1134.8828	1105.6025	1005.7819	846.9434	649.8959	432.3398	276.6782	292.2245	468.1325	716.3458	947.5294	1136.6578 (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	381.9640	293.9321	240.5296	135.6265	57.2866	0.0000	0.0000	0.0000	0.0000	124.2642	262.6817	400.8469 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

1897.1317 (98)
(98) / (4) = 23.7023 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2096.2781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	381.9640	293.9321	240.5296	135.6265	57.2866	0.0000	0.0000	0.0000	0.0000	124.2642	262.6817	400.8469	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	422.0597	324.7869	265.7786	149.8635	63.3001	0.0000	0.0000	0.0000	0.0000	137.3085	290.2561	442.9247	(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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Efficiency of water heater (217)m	89.7348	89.6570	89.4961	89.1461	88.4834	87.3000	87.3000	87.3000	87.3000	89.0366	89.5553	89.7779	(216)
Fuel for water heating, kWh/month	129.0490	113.1089	118.5075	107.6274	106.4201	96.1937	93.3375	103.0738	103.0554	113.4521	118.5202	125.5083	(217)
Water heating fuel used												1327.8539	(219)
Annual totals kWh/year													
Space heating fuel - main system												2096.2781	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												54.8107	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												129.8107	(231)
Electricity for lighting (calculated in Appendix L)												368.3056	(232)
Total delivered energy for all uses												3922.2483	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2096.2781	3.4800	72.9505	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1327.8539	3.4800	46.2093	(247)
Mechanical ventilation fans	54.8107	13.1900	7.2295	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	368.3056	13.1900	48.5795	(250)
Additional standing charges			120.0000	(251)
Total energy cost			304.8613	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	1.0240	(257)
SAP value	85.7151	
SAP rating (Section 12)	86	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2096.2781	0.2160	452.7961	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1327.8539	0.2160	286.8165	(264)
Space and water heating			739.6125	(265)
Pumps and fans	129.8107	0.5190	67.3717	(267)
Energy for lighting	368.3056	0.5190	191.1506	(268)
Total kg/year			998.1348	(272)
CO2 emissions per m2			12.4700	(273)
EI value			89.3034	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8867 = 3.924$, stars = 5
Water heating environmental impact	$0.216 / 0.8867 = 0.2436$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821 (44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644 (45)
Energy content (annual)										Total =	Sum(45)m =	1458.7045 (45)
Distribution loss	(46)m =	0.15 x (45)m										
	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081 (61)
Total heat required for water heating calculated for each month												
	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725 (62)
WWHRS	-49.5541	-43.5996	-44.5000	-36.6247	-34.0127	-28.0630	-23.7583	-28.7632	-29.5989	-36.5818	-42.3638	-47.8937 eq.(G10)
Total of WWHRS savings												-445.3138
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												
	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788 (64)
								Total per year (kWh/year) =	Sum(64)m =			1178.6267 (64)
Heat gains from water heating, kWh/month												
	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1375	46.3080	37.6602	28.5112	21.3125	17.9929	19.4419	25.2714	33.9192	43.0682	50.2669	53.5865 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.6479	331.0479	322.4801	304.2403	281.2158	259.5760	245.1194	241.7194	250.2872	268.5270	291.5515	313.1912 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453 (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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448 (71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968 (72)
Total internal gains	556.6365	552.0595	530.3847	496.9358	462.7775	432.2794	414.5668	423.0277	442.3885	476.0491	513.3547	541.4923 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.9000	11.9814	0.4600	0.0000	0.7700	16.5509 (74)			
South				4.3300	50.9848	0.4600	0.0000	0.7700	78.1947 (78)			
North				3.3300	11.9814	0.4300	0.0000	0.7700	13.2103 (74)			
Solar gains	107.9559	166.5623	231.9403	314.3169	363.2689	396.5539	373.7481	333.7542	278.0038	198.1298	132.5854	91.4835 (83)
Total gains	664.5924	718.6218	762.3249	811.2527	826.0464	828.8333	788.3150	756.7819	720.3923	674.1789	645.9401	632.9758 (84)

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	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754
util living area												
	0.9615	0.9464	0.9105	0.8307	0.6833	0.4653	0.3102	0.3328	0.5957	0.8375	0.9357	0.9669 (86)
MIT	19.9315	20.0699	20.3389	20.6444	20.8786	20.9805	20.9972	20.9962	20.9461	20.6885	20.2668	19.8852 (87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899 (88)
util rest of house												
	0.9539	0.9361	0.8930	0.7980	0.6260	0.3860	0.2202	0.2396	0.5167	0.7990	0.9213	0.9603 (89)
MIT 2	18.6937	18.8905	19.2695	19.6839	19.9748	20.0779	20.0891	20.0887	20.0496	19.7499	19.1741	18.6280 (90)
Living area fraction									fLA = Living area / (4) =			0.1685 (91)
MIT	18.9023	19.0892	19.4497	19.8458	20.1272	20.2300	20.2421	20.2417	20.2007	19.9081	19.3583	18.8399 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7523	18.9392	19.2997	19.6958	19.9772	20.0800	20.0921	20.0917	20.0507	19.7581	19.2083	18.6899 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9394	0.9195	0.8746	0.7819	0.6184	0.3851	0.2204	0.2398	0.5131	0.7828	0.9038	0.9467 (94)
Useful gains	624.2990	660.8076	666.7557	634.2991	510.8304	319.2205	173.7362	181.4963	369.6111	527.7237	583.7916	599.2146 (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	1084.0869	1059.2286	944.9195	777.8523	554.0356	323.9795	174.0710	181.9752	385.1769	647.8080	890.0171	1079.1349 (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	342.0822	267.7389	206.9539	103.3583	32.1446	0.0000	0.0000	0.0000	0.0000	89.3427	220.4823	357.0607 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating 1619.1637 (98)
 Space heating per m2 (98) / (4) = 20.2294 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1789.1311 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.0822	267.7389	206.9539	103.3583	32.1446	0.0000	0.0000	0.0000	0.0000	89.3427	220.4823	357.0607	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	377.9914	295.8441	228.6783	114.2080	35.5189	0.0000	0.0000	0.0000	0.0000	98.7213	243.6269	394.5422	(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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Efficiency of water heater	89.6687	89.5978	89.3898	88.9307	88.0927	87.3000	87.3000	87.3000	87.3000	88.7732	89.4347	87.3000	(216)
(217)m												89.7112	(217)
Fuel for water heating, kWh/month	129.1441	113.1837	118.6485	107.8881	106.8921	96.1937	93.3375	103.0738	103.0554	113.7886	118.6800	125.6017	(219)
Water heating fuel used												1329.4872	(219)
Annual totals kWh/year													
Space heating fuel - main system												1789.1311	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													54.8107 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													129.8107 (231)
Electricity for lighting (calculated in Appendix L)													368.3056 (232)
Total delivered energy for all uses													3616.7345 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1789.1311	3.9200	70.1339 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1329.4872	3.9200	52.1159 (247)
Mechanical ventilation fans	54.8107	16.9600	9.2959 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	368.3056	16.9600	62.4646 (250)
Additional standing charges			88.0000 (251)
Total energy cost			294.7303 (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	1789.1311	0.2160	386.4523 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1329.4872	0.2160	287.1692 (264)
Space and water heating			673.6216 (265)
Pumps and fans	129.8107	0.5190	67.3717 (267)
Energy for lighting	368.3056	0.5190	191.1506 (268)
Total kg/year			932.1439 (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	1789.1311	1.2200	2182.7400 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1329.4872	1.2200	1621.9744 (264)
Space and water heating			3804.7143 (265)
Pumps and fans	129.8107	3.0700	398.5188 (267)
Energy for lighting	368.3056	3.0700	1130.6980 (268)
Primary energy kWh/year			5333.9312 (272)
Primary energy kWh/m2/year			66.6408 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 89

(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	+ 10.7	-£ 309	-947 kg (101.6%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 20	-134 kg (14.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	11.83 kg/m²	A 96 A 99
Total Savings	£309	11.83 kg/m²	
Potential energy efficiency rating:		A 96	
Potential environmental impact rating:			A 99

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	£84	£84	£0
Mains gas	£210	£210	£0
Space heating	£180	£180	£0
Water heating	£52	£52	£0
Lighting	£62	£62	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£294	-£15	£309
Total cost of uses	£294	-£15	£309
Delivered energy	45 kWh/m²	22 kWh/m²	23 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.0 tonnes	0.9 tonnes
CO2 emissions per m²	12 kg/m²	0 kg/m²	12 kg/m²
Primary energy	67 kWh/m²	-3 kWh/m²	70 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821 (44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644 (45)
Energy content (annual)	22.2222											1458.7045 (45)
Distribution loss (46)m = 0.15 x (45)m	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697 (46)
Water storage loss;												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081 (61)
Total heat required for water heating calculated for each month	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725 (62)
WWHRS	-49.5541	-43.5996	-44.5000	-36.6247	-34.0127	-28.0630	-23.7583	-28.7632	-29.5989	-36.5818	-42.3638	-47.8937 eq.(G10)
Total of WWHRS savings												-445.3138
Solar input	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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788 (64)
								Total per year (kWh/year)	= Sum(64)m =			1178.6267 (64)
Heat gains from water heating, kWh/month	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1375	46.3080	37.6602	28.5112	21.3125	17.9929	19.4419	25.2714	33.9192	43.0682	50.2669	53.5865 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.6479	331.0479	322.4801	304.2403	281.2158	259.5760	245.1194	241.7194	250.2872	268.5270	291.5515	313.1912 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453 (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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448 (71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968 (72)
Total internal gains	556.6365	552.0595	530.3847	496.9358	462.7775	432.2794	414.5668	423.0277	442.3885	476.0491	513.3547	541.4923 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9000	10.6334	0.4600	0.0000	0.7700	14.6888 (74)
South	4.3300	46.7521	0.4600	0.0000	0.7700	71.7030 (78)
North	3.3300	10.6334	0.4300	0.0000	0.7700	11.7240 (74)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754
util living area												
	0.9684	0.9527	0.9238	0.8634	0.7528	0.5923	0.4451	0.4833	0.6904	0.8762	0.9506	0.9732 (86)
MIT	19.8142	19.9847	20.2392	20.5427	20.7981	20.9417	20.9853	20.9795	20.8913	20.5800	20.1364	19.7571 (87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899 (88)
util rest of house												
	0.9624	0.9439	0.9093	0.8370	0.7063	0.5213	0.3578	0.3944	0.6234	0.8468	0.9398	0.9680 (89)
MIT 2	18.5246	18.7682	19.1291	19.5482	19.8795	20.0432	20.0821	20.0782	19.9941	19.6072	18.9892	18.4428 (90)
Living area fraction												
	18.7420	18.9732	19.3162	19.7159	20.0344	20.1946	20.2343	20.2301	20.1454	19.7712	19.1826	18.6643 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5920	18.8232	19.1662	19.5659	19.8844	20.0446	20.0843	20.0801	19.9954	19.6212	19.0326	18.5143 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9492	0.9281	0.8913	0.8194	0.6948	0.5176	0.3573	0.3934	0.6158	0.8288	0.9235	0.9559 (94)
Useful gains	621.4903	668.2034	682.4895	658.5733	572.8978	414.3233	273.5701	287.5959	432.1649	549.3241	582.6936	597.8851 (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	1134.8828	1105.6025	1005.7819	846.9434	649.8959	432.3398	276.6782	292.2245	468.1325	716.3458	947.5294	1136.6578 (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	381.9640	293.9321	240.5296	135.6265	57.2866	0.0000	0.0000	0.0000	0.0000	124.2642	262.6817	400.8469 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating 1897.1317 (98)
 Space heating per m2 (98) / (4) = 23.7023 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2096.2781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	381.9640	293.9321	240.5296	135.6265	57.2866	0.0000	0.0000	0.0000	0.0000	124.2642	262.6817	400.8469	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	422.0597	324.7869	265.7786	149.8635	63.3001	0.0000	0.0000	0.0000	0.0000	137.3085	290.2561	442.9247	(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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Efficiency of water heater (217)m	89.7348	89.6570	89.4961	89.1461	88.4834	87.3000	87.3000	87.3000	87.3000	89.0366	89.5553	87.3000	(216)
Fuel for water heating, kWh/month	129.0490	113.1089	118.5075	107.6274	106.4201	96.1937	93.3375	103.0738	103.0554	113.4521	118.5202	125.5083	(219)
Water heating fuel used												1327.8539	(219)
Annual totals kWh/year													
Space heating fuel - main system												2096.2781	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												54.8107	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												129.8107	(231)
Electricity for lighting (calculated in Appendix L)												368.3056	(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												2195.0089	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2096.2781	3.4800	72.9505 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1327.8539	3.4800	46.2093 (247)
Mechanical ventilation fans	54.8107	13.1900	7.2295 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	368.3056	13.1900	48.5795 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			77.0384 (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] = 0.2588 (257)
SAP value	96.3902
SAP rating (Section 12)	96 (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	2096.2781	0.2160	452.7961 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1327.8539	0.2160	286.8165 (264)
Space and water heating			739.6125 (265)
Pumps and fans	129.8107	0.5190	67.3717 (267)
Energy for lighting	368.3056	0.5190	191.1506 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			101.6976 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

CO2 emissions per m2	1.2700 (273)
EI value	98.9102
EI rating	99 (274)
EI band	A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0200 (1b)	x 2.3100 (2b)	= 92.4462 (1b) - (3b)
First floor	40.0200 (1c)	x 2.6100 (2c)	= 104.4522 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 196.8984 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			8.2300	1.1450	9.4237		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			40.0200	0.1100	4.4022	75.0000	3001.5000 (28a)					
100mm Knauf Supafil 34	88.4600	13.7100	74.7500	0.2500	18.6875	52.8000	3946.8000 (29a)					
Plane Ceiling-500mm Loft Roll	40.0200		40.0200	0.0900	3.6018	9.0000	360.1800 (30)					
Total net area of external elements Aum(A, m2)			168.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.6799		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			20.5700			9.0000	185.1300 (32c)					
Timber 1F			76.2500			9.0000	686.2500 (32c)					
AAC GF			49.2000			39.0000	1918.8000 (32c)					
Internal Floor			40.0200			12.6000	504.2520 (32d)					
Internal Ceiling			40.0200			9.0000	360.1800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12758.5920 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.4027 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2388 (36)					
Total fabric heat loss						(33) + (36) =	46.9187 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.4882	Feb 32.4882	Mar 32.4882	Apr 32.4882	May 32.4882	Jun 32.4882	Jul 32.4882	Aug 32.4882	Sep 32.4882	Oct 32.4882	Nov 32.4882	Dec 32.4882 (38)
Heat transfer coeff	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070	79.4070 (39)
Average = Sum(39)m / 12 =												79.4070 (39)
HLP	Jan 0.9921	Feb 0.9921	Mar 0.9921	Apr 0.9921	May 0.9921	Jun 0.9921	Jul 0.9921	Aug 0.9921	Sep 0.9921	Oct 0.9921	Nov 0.9921	Dec 0.9921 (40)
HLP (average)												0.9921 (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	2.4636 (42)
Average daily hot water use (litres/day)	92.7110 (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	101.9821	98.2736	94.5652	90.8567	87.1483	83.4399	83.4399	87.1483	90.8567	94.5652	98.2736	101.9821	(44)
Energy conte	151.2365	132.2724	136.4932	118.9981	114.1815	98.5300	91.3025	104.7710	106.0223	123.5587	134.8740	146.4644	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	22.6855	19.8409	20.4740	17.8497	17.1272	14.7795	13.6954	15.7156	15.9033	18.5338	20.2311	21.9697	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1195	12.7373	14.0663	13.5723	13.9954	13.5101	13.9394	13.9757	13.5440	14.0370	13.6309	14.1081	(61)
Total heat required for water heating calculated for each month	165.3560	145.0096	150.5596	132.5704	128.1769	112.0401	105.2419	118.7467	119.5662	137.5957	148.5049	160.5725	(62)
WWHRS	-49.5541	-43.5996	-44.5000	-36.6247	-34.0127	-28.0630	-23.7583	-28.7632	-29.5989	-36.5818	-42.3638	-47.8937	eq. (G10)
Total of WWHRS savings													-445.3138
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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Heat gains from water heating, kWh/month	53.8160	47.1649	48.9006	42.9599	41.4642	36.1387	33.8429	38.3303	38.6384	44.5925	48.2533	52.2264	(65)
Total per year (kWh/year) = Sum(64)m =													1178.6267 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	147.8172	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.1375	46.3080	37.6602	28.5112	21.3125	17.9929	19.4419	25.2714	33.9192	43.0682	50.2669	53.5865	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.6479	331.0479	322.4801	304.2403	281.2158	259.5760	245.1194	241.7194	250.2872	268.5270	291.5515	313.1912	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	52.2453	(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)	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	-98.5448	(71)
Water heating gains (Table 5)	72.3333	70.1858	65.7266	59.6666	55.7315	50.1927	45.4878	51.5192	53.6644	59.9362	67.0185	70.1968	(72)
Total internal gains	556.6365	552.0595	530.3847	496.9358	462.7775	432.2794	414.5668	423.0277	442.3885	476.0491	513.3547	541.4923	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.9000	11.9814	0.4600	0.0000	0.7700		16.5509 (74)		
South				4.3300	50.9848	0.4600	0.0000	0.7700		78.1947 (78)		
North				3.3300	11.9814	0.4300	0.0000	0.7700		13.2103 (74)		

Solar gains	107.9559	166.5623	231.9403	314.3169	363.2689	396.5539	373.7481	333.7542	278.0038	198.1298	132.5854	91.4835 (83)
Total gains	664.5924	718.6218	762.3249	811.2527	826.0464	828.8333	788.3150	756.7819	720.3923	674.1789	645.9401	632.9758 (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	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	44.6315	
alpha	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	3.9754	
util living area	0.9615	0.9464	0.9105	0.8307	0.6833	0.4653	0.3102	0.3328	0.5957	0.8375	0.9357	0.9669	(86)
MIT	19.9315	20.0699	20.3389	20.6444	20.8786	20.9805	20.9972	20.9962	20.9461	20.6885	20.2668	19.8852	(87)
Th 2	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	20.0899	(88)
util rest of house	0.9539	0.9361	0.8930	0.7980	0.6260	0.3860	0.2202	0.2396	0.5167	0.7990	0.9213	0.9603	(89)
MIT 2	18.6937	18.8905	19.2695	19.6839	19.9748	20.0779	20.0891	20.0887	20.0496	19.7499	19.1741	18.6280	(90)
Living area fraction	18.9023	19.0892	19.4497	19.8458	20.1272	20.2300	20.2421	20.2417	20.2007	19.9081	19.3583	18.8399	(91)
MIT	18.9023	19.0892	19.4497	19.8458	20.1272	20.2300	20.2421	20.2417	20.2007	19.9081	19.3583	18.8399	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.7523	18.9392	19.2997	19.6958	19.9772	20.0800	20.0921	20.0917	20.0507	19.7581	19.2083	18.6899	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9394	0.9195	0.8746	0.7819	0.6184	0.3851	0.2204	0.2398	0.5131	0.7828	0.9038	0.9467	(94)
Useful gains	624.2990	660.8076	666.7557	634.2991	510.8304	319.2205	173.7362	181.4963	369.6111	527.7237	583.7916	599.2146	(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	1084.0869	1059.2286	944.9195	777.8523	554.0356	323.9795	174.0710	181.9752	385.1769	647.8080	890.0171	1079.1349	(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	342.0822	267.7389	206.9539	103.3583	32.1446	0.0000	0.0000	0.0000	0.0000	89.3427	220.4823	357.0607	(98)

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Space heating 1619.1637 (98)
 Space heating per m2 (98) / (4) = 20.2294 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1789.1311 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.0822	267.7389	206.9539	103.3583	32.1446	0.0000	0.0000	0.0000	0.0000	89.3427	220.4823	357.0607	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	377.9914	295.8441	228.6783	114.2080	35.5189	0.0000	0.0000	0.0000	0.0000	98.7213	243.6269	394.5422	(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	115.8019	101.4100	106.0596	95.9457	94.1642	83.9771	81.4836	89.9835	89.9674	101.0139	106.1411	112.6788	(64)
Efficiency of water heater (217)m	89.6687	89.5978	89.3898	88.9307	88.0927	87.3000	87.3000	87.3000	87.3000	88.7732	89.4347	89.7112	(216)
Fuel for water heating, kWh/month	129.1441	113.1837	118.6485	107.8881	106.8921	96.1937	93.3375	103.0738	103.0554	113.7886	118.6800	125.6017	(219)
Water heating fuel used												1329.4872	(219)
Annual totals kWh/year													
Space heating fuel - main system												1789.1311	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												54.8107	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												129.8107	(231)
Electricity for lighting (calculated in Appendix L)												368.3056	(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												1792.5749	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1789.1311	3.9200	70.1339 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1329.4872	3.9200	52.1159 (247)
Mechanical ventilation fans	54.8107	16.9600	9.2959 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	368.3056	16.9600	62.4646 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			-14.6471 (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	1789.1311	0.2160	386.4523 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1329.4872	0.2160	287.1692 (264)
Space and water heating			673.6216 (265)
Pumps and fans	129.8107	0.5190	67.3717 (267)
Energy for lighting	368.3056	0.5190	191.1506 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-14.5950 (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	1789.1311	1.2200	2182.7400 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1329.4872	1.2200	1621.9744 (264)

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Space and water heating			3804.7143 (265)
Pumps and fans	129.8107	3.0700	398.5188 (267)
Energy for lighting	368.3056	3.0700	1130.6980 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-266.2389 (272)
Primary energy kWh/m2/year			-3.3263 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	159.4 (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	259.91 (P1)
Transmission heat loss coefficient	46.92 (37)
Summer heat loss coefficient	306.82 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.9000	81.1852	0.4600	0.0000	0.9000	131.0816
South	4.3300	112.2060	0.4600	0.0000	0.9000	201.1427
North	3.3300	81.1852	0.4300	0.0000	0.9000	104.6241
total:						436.8484

	Jun	Jul	Aug	
Solar gains	464	437	390	(P3/P4)
Internal gains	429	412	420	
Total summer gains	893	848	810	(P5)
Summer gain/loss ratio	2.91	2.77	2.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 159.4)	0.88	0.88	0.88	
Threshold temperature	19.79	21.55	21.32	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			