

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Elmslie - End/Semi			Issued on Date	15/12/2022
Assessment Reference	Elmslie - End/Semi	Prop Type Ref			
Property	Plot, 3 Bed, K, WC, B, ES				
SAP Rating	86 B	DER	13.94	TER	17.97
Environmental	89 B	% DER<TER	22.44		
CO ₂ Emissions (t/year)	1.01	DFEE	39.35	TFEE	50.96
General Requirements Compliance	Pass	% DFEE<TFEE	22.78		
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 87 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.97 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.3 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 30

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing South East: 4.40 m², No overhang

Windows facing South West: 0.66 m², No overhang

Windows facing North West: 6.95 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 0.027 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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total =	Sum (45)m =	1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month												
WWHRS	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (62)
Total of WWHRS savings	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (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	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	394.5245	392.2349	377.8447	354.7117	331.2006	308.6848	294.1799	300.4726	312.4808	335.8318	362.5831	382.6648 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				4.4000	36.7938		0.4600		0.0000		0.7700		57.3425 (77)
Southwest				0.6600	36.7938		0.4600		0.0000		0.7700		8.6014 (79)
Northwest				3.8000	11.2829		0.4600		0.0000		0.7700		15.1864 (81)
Northwest				3.1500	11.2829		0.4300		0.0000		0.7700		11.7677 (81)
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007		78.4462 (83)
Total gains	487.4225	559.4274	630.3858	707.4828	762.7166	753.0838	715.9680	661.0670	599.3462	527.0272	475.4838		461.1111 (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	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9858	0.9758	0.9537	0.9002	0.7947	0.6400	0.4948	0.5492	0.7722	0.9301	0.9769	0.9883 (86)
MIT	19.3505	19.5561	19.8937	20.3162	20.6809	20.8953	20.9686	20.9542	20.7865	20.3110	19.7414	19.2916 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9831	0.9713	0.9449	0.8805	0.7544	0.5713	0.4036	0.4564	0.7138	0.9123	0.9718	0.9861 (89)
MIT 2	17.8817	18.1797	18.6662	19.2634	19.7540	20.0135	20.0856	20.0748	19.8976	19.2674	18.4514	17.7962 (90)
Living area fraction	18.2288	18.5050	18.9563	19.5121	19.9730	20.2218	20.2943	20.2826	20.1077	19.5140	18.7562	18.1496 (91)
MIT	18.2288	18.5050	18.9563	19.5121	19.9730	20.2218	20.2943	20.2826	20.1077	19.5140	18.7562	18.1496 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0788	18.3550	18.8063	19.3621	19.8230	20.0718	20.1443	20.1326	19.9577	19.3640	18.6062	17.9996 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	474.9571	536.5732	585.1085	609.0046	564.5105	428.1886	291.9796	303.7211	421.3146	470.7875	456.3916	451.1694 (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	1164.9147	1137.5381	1040.4233	884.5128	686.7563	462.6112	299.6484	315.5692	495.2313	740.9460	972.7797	1166.6721 (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	513.3284	403.8484	338.7542	198.3659	90.9509	0.0000	0.0000	0.0000	0.0000	200.9980	371.7995	532.3340 (98)

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Space heating
Space heating per m2 (98) / (4) = 2650.3793 (98)
30.5484 (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													2928.5959 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	513.3284	403.8484	338.7542	198.3659	90.9509	0.0000	0.0000	0.0000	0.0000	200.9980	371.7995	532.3340	(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)	567.2137	446.2413	374.3141	219.1889	100.4982	0.0000	0.0000	0.0000	0.0000	222.0972	410.8281	588.2143	(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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225	(64)
Efficiency of water heater (217)m	89.8656	89.8092	89.6826	89.3931	88.8020	87.3000	87.3000	87.3000	87.3000	89.3661	89.7382	89.8975	(216)
Fuel for water heating, kWh/month	136.2538	119.4160	124.9954	113.1934	111.6971	101.1668	97.9201	108.3135	108.3544	119.0769	124.8656	132.5093	(217)
Water heating fuel used												1397.7622	(219)
Annual totals kWh/year													
Space heating fuel - main system												2928.5959	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												59.7406	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												134.7406	(231)
Electricity for lighting (calculated in Appendix L)												394.5058	(232)
Total delivered energy for all uses												4855.6044	(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	2928.5959	0.2160	632.5767	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1397.7622	0.2160	301.9166	(264)
Space and water heating			934.4933	(265)
Pumps and fans	134.7406	0.5190	69.9304	(267)
Energy for lighting	394.5058	0.5190	204.7485	(268)
Total CO2, kg/year			1209.1722	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9400	(273)

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

DER	13.9400	ZC1
Total Floor Area	86.7600	TFA
Assumed number of occupants	2.5787	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.9134	ZC2
CO2 emissions from cooking, equation (L16)	2.0849	ZC3
Total CO2 emissions	31.9383	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	31.9383	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 213.4296 (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) =	0.1406 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3906 (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) =					0.3613 (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	0.4606	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4064	0.4245	(22b)				
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(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			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			12.0100	1.3258	15.9223		(27)					
FP McCann System			43.3800	0.1300	5.6394		(28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.1800	14.0418		(29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.1300	5.6394		(30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	43.2229		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5117 (36)					
Total fabric heat loss						(33) + (36) =	52.7346 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.6876	Feb 42.3975	Mar 42.1131	Apr 40.7773	May 40.5274	Jun 39.3640	Jul 39.3640	Aug 39.1485	Sep 39.8121	Oct 40.5274	Nov 41.0330	Dec 41.5615 (38)
Heat transfer coeff	95.4223	95.1321	94.8477	93.5120	93.2620	92.0986	92.0986	91.8832	92.5468	93.2620	93.7676	94.2962 (39)
Average = Sum(39)m / 12 =												93.5108 (39)
HLP	Jan 1.0998	Feb 1.0965	Mar 1.0932	Apr 1.0778	May 1.0749	Jun 1.0615	Jul 1.0615	Aug 1.0590	Sep 1.0667	Oct 1.0749	Nov 1.0808	Dec 1.0869 (40)
HLP (average)												1.0778 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)												Total = Sum(45)m = 1501.7171 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.6103	46.1273	45.7193	42.3618	43.7738	45.7193	46.1273	49.6103	49.3151	50.9589 (61)
Solar input	206.6548	182.2001	190.1283	168.6343	163.2677	143.7971	137.7686	153.5797	155.2758	176.8124	188.1661	201.7421 (62)
	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	206.6548	182.2001	190.1283	168.6343	163.2677	143.7971	137.7686	153.5797	155.2758	176.8124	188.1661	201.7421 (64)
Heat gains from water heating, kWh/month	64.5086	56.7843	59.1248	52.2654	50.5147	44.3177	42.1967	47.2934	47.8237	54.6973	58.4967	62.8751 (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	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	(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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	86.7051	84.5004	79.4688	72.5908	67.8961	61.5523	56.7160	63.5664	66.4218	73.5178	81.2455	84.5096	(72)
Total internal gains	406.7137	404.4290	389.5997	365.8315	341.6798	318.5258	304.0302	310.9606	323.6137	347.6000	374.7845	394.8589	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Southeast				4.4000	36.7938	0.6300	0.7000	0.7700	49.4766 (77)				
Southwest				0.6600	36.7938	0.6300	0.7000	0.7700	7.4215 (79)				
Northwest				6.9500	11.2829	0.6300	0.7000	0.7700	23.9651 (81)				
Solar gains	80.8631	145.7000	220.4970	308.6467	378.0582	389.5532	369.6494	315.6900	250.6805	166.7305	98.3050	68.2640	(83)
Total gains	487.5768	550.1290	610.0967	674.4782	719.7380	708.0790	673.6797	626.6506	574.2942	514.3305	473.0895	463.1229	(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	63.1404	63.3330	63.5229	64.4303	64.6029	65.4190	65.4190	65.5724	65.1022	64.6029	64.2546	63.8944	
alpha	5.2094	5.2222	5.2349	5.2954	5.3069	5.3613	5.3613	5.3715	5.3401	5.3069	5.2836	5.2596	
util living area	0.9985	0.9969	0.9921	0.9729	0.9086	0.7567	0.5852	0.6457	0.8833	0.9835	0.9970	0.9989	(86)
MIT	19.7910	19.9253	20.1577	20.4786	20.7658	20.9410	20.9879	20.9801	20.8557	20.4907	20.0882	19.7718	(87)
Th 2	20.0010	20.0037	20.0064	20.0190	20.0213	20.0324	20.0324	20.0344	20.0281	20.0213	20.0166	20.0116	(88)
util rest of house	0.9981	0.9959	0.9891	0.9620	0.8714	0.6704	0.4649	0.5243	0.8224	0.9750	0.9957	0.9985	(89)
MIT 2	18.3823	18.5804	18.9209	19.3910	19.7820	19.9911	20.0277	20.0257	19.9052	19.4150	18.8282	18.3619	(90)
Living area fraction	18.7152	18.8982	19.2131	19.6480	20.0144	20.2155	20.2545	20.2512	20.1298	19.6692	19.1259	18.6951	(91)
MIT	18.7152	18.8982	19.2131	19.6480	20.0144	20.2155	20.2545	20.2512	20.1298	19.6692	19.1259	18.6951	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7152	18.8982	19.2131	19.6480	20.0144	20.2155	20.2545	20.2512	20.1298	19.6692	19.1259	18.6951	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9971	0.9942	0.9858	0.9567	0.8710	0.6881	0.4935	0.5530	0.8299	0.9708	0.9941	0.9978	(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	1375.5294	1331.6748	1205.8097	1005.0624	775.4214	517.1826	336.5780	353.8621	558.0406	845.8109	1127.6434	1366.8284	(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	661.6930	527.3525	449.6387	259.0523	110.4796	0.0000	0.0000	0.0000	0.0000	257.8113	473.2960	673.1260	(98)
Space heating												3412.4494	(98)
Space heating per m2												39.3321	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3653.5861 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	661.6930	527.3525	449.6387	259.0523	110.4796	0.0000	0.0000	0.0000	0.0000	257.8113	473.2960	673.1260	(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)	708.4508	564.6172	481.4119	277.3580	118.2865	0.0000	0.0000	0.0000	0.0000	276.0292	506.7409	720.6916	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	206.6548	182.2001	190.1283	168.6343	163.2677	143.7971	137.7686	153.5797	155.2758	176.8124	188.1661	201.7421	(64)
Efficiency of water heater (217)m	87.7727	87.5716	87.1427	86.1286	84.0917	80.3000	80.3000	80.3000	80.3000	85.9995	87.2772	80.3000	(216)
Fuel for water heating, kWh/month	235.4433	208.0583	218.1805	195.7936	194.1543	179.0748	171.5673	191.2574	193.3696	205.5970	215.5959	229.6388	(219)
Water heating fuel used												2437.7308	(219)
Annual totals kWh/year													
Space heating fuel - main system												3653.5861	(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)												394.5058	(232)
Total delivered energy for all uses												6560.8226	(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	3653.5861	0.2160	789.1746 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2437.7308	0.2160	526.5498 (264)
Space and water heating			1315.7244 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Total CO2, kg/m2/year			1559.3979 (272)
Emissions per m2 for space and water heating			15.1651 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3599 (272b)
Emissions per m2 for pumps and fans			0.4487 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1651 * 1.00) + 2.3599 + 0.4487, rounded to 2 d.p.			17.9700 (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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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) = 0.1406 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3411 (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) =	0.3155 (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	0.4022	0.3944	0.3865	0.3470	0.3391	0.2997	0.2997	0.2918	0.3155	0.3391	0.3549	0.3707 (22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)
Total net area of external elements Aum(A, m ²)			178.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)
Timber GF			54.6000			9.0000	491.4000 (32c)
Timber FF			91.4300			9.0000	822.8700 (32c)
Internal Floor			43.3800			12.6000	546.5880 (32d)
Internal Ceiling			43.3800			9.0000	390.4200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11900.5260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							137.1660 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)
Total fabric heat loss							(33) + (36) = 49.3283 (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	40.9137	40.6924	40.4756	39.4569	39.2663	38.3791	38.3791	38.2148	38.7209	39.2663	39.6519	40.0550 (38)
Heat transfer coeff	90.2420	90.0208	89.8039	88.7853	88.5947	87.7075	87.7075	87.5432	88.0492	88.5947	88.9802	89.3833 (39)
Average = Sum(39)m / 12 =												88.7843 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0401	1.0376	1.0351	1.0233	1.0211	1.0109	1.0109	1.0090	1.0149	1.0211	1.0256	1.0302 (40)
HLP (average)												1.0233 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1501.7171 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.0854	28.9367	29.8601	26.0327	24.9790	21.5550	19.9739	22.9203	23.1941	27.0304	29.5058	32.0414 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	(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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	44.4696	43.0606	40.1345	36.1566	33.5740	29.9375	26.8466	30.8069	32.2140	36.3312	40.9803	43.0664	(72)
Total internal gains	361.4782	359.9892	347.2654	326.3973	304.3577	283.9110	271.1609	275.2011	286.4059	307.4133	331.5194	350.4158	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				4.4000	36.7938	0.4600	0.0000	0.7700	57.3425 (77)			
Southwest				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (79)			
Northwest				3.8000	11.2829	0.4600	0.0000	0.7700	15.1864 (81)			
Northwest				3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)			
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)
Total gains	454.3761	527.1817	599.8065	679.1685	735.8736	728.3100	692.9490	635.7954	573.2713	498.6087	444.4201	428.8620 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.6315	36.7215	36.8102	37.2326	37.3126	37.6901	37.6901	37.7608	37.5438	37.3126	37.1510	36.9834	
alpha	3.4421	3.4481	3.4540	3.4822	3.4875	3.5127	3.5127	3.5174	3.5029	3.4875	3.4767	3.4656	
util living area	0.9887	0.9803	0.9617	0.9146	0.8189	0.6683	0.5229	0.5800	0.7999	0.9424	0.9816	0.9907	(86)
MIT	19.1626	19.3790	19.7383	20.2090	20.6134	20.8693	20.9587	20.9405	20.7393	20.2114	19.6034	19.1242	(87)
Th 2	20.0500	20.0521	20.0542	20.0639	20.0657	20.0742	20.0742	20.0758	20.0710	20.0657	20.0621	20.0582	(88)
util rest of house	0.9865	0.9765	0.9540	0.8966	0.7799	0.5979	0.4256	0.4822	0.7431	0.9268	0.9774	0.9889	(89)
MIT 2	18.3598	18.5760	18.9322	19.3967	19.7737	19.9960	20.0571	20.0492	19.8964	19.4081	18.8078	18.3277	(90)
Living area fraction	18.5495	18.7657	19.1227	19.5886	19.9721	20.2023	20.2702	20.2598	20.0956	19.5979	18.9958	18.5159	(91)
MIT	18.5495	18.7657	19.1227	19.5886	19.9721	20.2023	20.2702	20.2598	20.0956	19.5979	18.9958	18.5159	(92)
Temperature adjustment	18.5495	18.7657	19.1227	19.5886	19.9721	20.2023	20.2702	20.2598	20.0956	19.5979	18.9958	18.5159	(93)
adjusted MIT	18.5495	18.7657	19.1227	19.5886	19.9721	20.2023	20.2702	20.2598	20.0956	19.5979	18.9958	18.5159	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	446.1107	511.2447	566.5116	601.6133	570.7160	443.0660	309.8596	319.7176	426.9851	457.2174	431.5381	422.3601	(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	1285.9017	1248.2020	1133.5636	948.9924	732.8610	491.3666	321.9009	337.8993	527.9085	797.1653	1058.4916	1279.6046	(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	624.8045	495.2353	421.8867	250.1129	120.6359	0.0000	0.0000	0.0000	0.0000	252.9212	451.4065	637.7899	(98)
Space heating												3254.7931	(98)
Space heating per m2												37.5149	(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	824.4502	649.0353	665.3281	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8296	0.8869	0.8595	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	683.9360	575.6226	571.8703	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	948.7611	905.4506	840.5213	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	190.6741	245.3920	199.8763	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			635.9424 (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	47.6685	61.3480	49.9691	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												158.9856 (107)
Energy for space heating												1.8325 (108)
Energy for space cooling												37.5149 (99)
Total												1.8325 (108)
Dwelling Fabric Energy Efficiency (DFEE)												39.3474 (109)
												39.3 (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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1406 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3906 (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) =					0.3613 (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	0.4606	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4064	0.4245	(22b)				
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(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			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			12.0100	1.3258	15.9223		(27)					
FP McCann System			43.3800	0.1300	5.6394		(28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.1800	14.0418		(29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.1300	5.6394		(30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	43.2229		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5117 (36)					
Total fabric heat loss						(33) + (36) =	52.7346 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.6876	Feb 42.3975	Mar 42.1131	Apr 40.7773	May 40.5274	Jun 39.3640	Jul 39.3640	Aug 39.1485	Sep 39.8121	Oct 40.5274	Nov 41.0330	Dec 41.5615 (38)
Heat transfer coeff	95.4223	95.1321	94.8477	93.5120	93.2620	92.0986	92.0986	91.8832	92.5468	93.2620	93.7676	94.2962 (39)
Average = Sum(39)m / 12 =												93.5108 (39)
HLP	Jan 1.0998	Feb 1.0965	Mar 1.0932	Apr 1.0778	May 1.0749	Jun 1.0615	Jul 1.0615	Aug 1.0590	Sep 1.0667	Oct 1.0749	Nov 1.0808	Dec 1.0869 (40)
HLP (average)												1.0778 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)											Total = Sum(45)m =	1501.7171 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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)
	33.0854	28.9367	29.8601	26.0327	24.9790	21.5550	19.9739	22.9203	23.1941	27.0304	29.5058	32.0414 (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	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	44.4696	43.0606	40.1345	36.1566	33.5740	29.9375	26.8466	30.8069	32.2140	36.3312	40.9803	43.0664 (72)
Total internal gains	361.4782	359.9892	347.2654	326.3973	304.3577	283.9110	271.1609	275.2011	286.4059	307.4133	331.5194	350.4158 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Southeast				4.4000	36.7938	0.6300	0.7000	0.7700		49.4766 (77)		
Southwest				0.6600	36.7938	0.6300	0.7000	0.7700		7.4215 (79)		
Northwest				6.9500	11.2829	0.6300	0.7000	0.7700		23.9651 (81)		
Solar gains	80.8631	145.7000	220.4970	308.6467	378.0582	389.5532	369.6494	315.6900	250.6805	166.7305	98.3050	68.2640 (83)
Total gains	442.3413	505.6892	567.7624	635.0440	682.4159	673.4642	640.8103	590.8911	537.0864	474.1439	429.8244	418.6797 (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	63.1404	63.3330	63.5229	64.4303	64.6029	65.4190	65.4190	65.5724	65.1022	64.6029	64.2546	63.8944
alpha	5.2094	5.2222	5.2349	5.2954	5.3069	5.3613	5.3613	5.3715	5.3401	5.3069	5.2836	5.2596
util living area	0.9991	0.9979	0.9943	0.9788	0.9234	0.7817	0.6113	0.6771	0.9053	0.9884	0.9981	0.9993 (86)
MIT	19.7419	19.8774	20.1132	20.4407	20.7397	20.9307	20.9851	20.9752	20.8326	20.4499	20.0414	19.7234 (87)
Th 2	20.0010	20.0037	20.0064	20.0190	20.0213	20.0324	20.0324	20.0344	20.0281	20.0213	20.0166	20.0116 (88)
util rest of house	0.9988	0.9972	0.9921	0.9701	0.8902	0.6972	0.4876	0.5534	0.8511	0.9822	0.9973	0.9991 (89)
MIT 2	18.8469	18.9843	19.2213	19.5542	19.8364	19.9985	20.0283	20.0268	19.9275	19.5681	19.1587	18.8369 (90)
Living area fraction									fLA = Living area / (4) =			0.2363 (91)
MIT	19.0583	19.1953	19.4320	19.7637	20.0498	20.2188	20.2544	20.2509	20.1414	19.7765	19.3673	19.0464 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0583	19.1953	19.4320	19.7637	20.0498	20.2188	20.2544	20.2509	20.1414	19.7765	19.3673	19.0464 (93)

8. Space heating requirement

Utilisation	0.9984	0.9964	0.9904	0.9671	0.8914	0.7151	0.5172	0.5829	0.8587	0.9801	0.9965	0.9988 (94)
Useful gains	441.6128	503.8728	562.3096	614.1797	608.2930	481.5719	331.4201	344.4375	461.1938	464.7082	428.3379	418.1662 (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	1408.2750	1359.9427	1226.5720	1015.8826	778.7196	517.4804	336.5668	353.8285	559.1096	855.8173	1150.2742	1399.9572 (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	719.1966	575.2790	494.2112	289.2261	126.7974	0.0000	0.0000	0.0000	0.0000	290.9851	519.7942	730.4525 (98)
Space heating												3745.9422 (98)
Space heating per m2												43.1759 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	865.7271	681.5298	698.3121	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8518	0.9179	0.8892	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	737.3984	625.5546	620.9729	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	884.6556	844.5093	788.0356	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	106.0251	162.9023	124.2947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												393.2221 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	26.5063	40.7256	31.0737	0.0000	0.0000	0.0000 (107)
Space cooling											98.3055 (107)
Space cooling per m2											1.1331 (108)
Energy for space heating											43.1759 (99)
Energy for space cooling											1.1331 (108)
Total											44.3090 (109)
Target Fabric Energy Efficiency (TFEE)											51.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total =	Sum (45)m =	1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (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	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (64)
RHI water heating demand												1673.3966 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	585.7329	580.8876	557.9388	522.5375	486.3359	454.1075	435.4705	444.3189	464.8857	500.5049	539.9468	569.7411 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
Southeast				4.4000	40.4699	0.4600	0.0000		0.7700	63.0716 (77)		
Southwest				0.6600	40.4699	0.4600	0.0000		0.7700	9.4607 (79)		
Northwest				3.8000	12.9236	0.4600	0.0000		0.7700	17.3946 (81)		
Northwest				3.1500	12.9236	0.4300	0.0000		0.7700	13.4788 (81)		
Solar gains	103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)
Total gains	689.1386	748.8791	809.9414	887.2371	922.0888	934.6516	886.5355	838.0093	775.8862	706.0144	668.8003	656.1529 (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	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
Feb	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
Mar	0.9541	0.9373	0.8957	0.8043	0.6494	0.4377	0.2931	0.3191	0.5814	0.8267	0.9274	0.9600 (86)
Apr	19.7838	19.9373	20.2485	20.6019	20.8627	20.9759	20.9960	20.9945	20.9305	20.6262	20.1520	19.7349 (87)
May	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
Jun	0.9462	0.9267	0.8779	0.7718	0.5952	0.3647	0.2096	0.2316	0.5069	0.7900	0.9130	0.9530 (89)
Jul	18.5055	18.7240	19.1629	19.6431	19.9703	20.0886	20.1033	20.1027	20.0493	19.6864	19.0341	18.4361 (90)
Aug	18.8076	19.0107	19.4194	19.8696	20.1811	20.2983	20.3142	20.3134	20.2575	19.9085	19.2982	18.7430 (92)
Sep	18.6576	18.8607	19.2694	19.7196	20.0311	20.1483	20.1642	20.1634	20.1075	19.7585	19.1482	18.5930 (93)
Oct												
Nov												
Dec												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9296	0.9082	0.8581	0.7562	0.5905	0.3683	0.2153	0.2374	0.5072	0.7737	0.8939	0.9373 (94)
Ext temp.	640.6195	680.1504	694.9708	670.9248	544.4690	344.2553	190.8294	198.9444	393.5166	546.2501	597.8329	615.0086 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1146.2144	1121.1113	1003.4898	830.1941	594.4408	350.7131	191.4261	199.8099	414.9037	689.7497	942.5167	1140.7542 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	376.1626	296.3258	229.5381	114.6739	37.1790	0.0000	0.0000	0.0000	0.0000	106.7637	248.1724	391.1548 (98)
												1799.9703 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1800 (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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total =	Sum (45)m =	1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month												
WWHRS	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (62)
Total of WWHRS savings	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (65)
										Total per year (kWh/year) =	Sum (64)m =	1242.7102 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	585.7329	580.8876	557.9388	522.5375	486.3359	454.1075	435.4705	444.3189	464.8857	500.5049	539.9468	569.7411 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				4.4000	36.7938	0.4600		0.0000		0.7700		57.3425 (77)
Southwest				0.6600	36.7938	0.4600		0.0000		0.7700		8.6014 (79)
Northwest				3.8000	11.2829	0.4600		0.0000		0.7700		15.1864 (81)
Northwest				3.1500	11.2829	0.4300		0.0000		0.7700		11.7677 (81)

Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)
Total gains	678.6308	748.0801	810.4799	875.3087	917.8518	898.5065	857.2586	804.9133	751.7511	691.7003	652.8475	648.1874 (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	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9617	0.9445	0.9105	0.8394	0.7188	0.5596	0.4216	0.4644	0.6749	0.8658	0.9428	0.9670 (86)
MIT	19.6554	19.8407	20.1359	20.4896	20.7759	20.9323	20.9812	20.9732	20.8655	20.5034	20.0089	19.5946 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9553	0.9353	0.8956	0.8127	0.6739	0.4935	0.3407	0.3811	0.6117	0.8374	0.9318	0.9614 (89)
MIT 2	18.3203	18.5853	19.0041	19.4928	19.8659	20.0477	20.0937	20.0880	19.9806	19.5228	18.8308	18.2332 (90)
Living area fraction	18.6358	18.8819	19.2715	19.7283	20.0809	20.2567	20.3034	20.2971	20.1896	19.7545	19.1091	18.5549 (92)
MIT	18.6358	18.8819	19.2715	19.7283	20.0809	20.2567	20.3034	20.2971	20.1896	19.7545	19.1091	18.5549 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4858	18.7319	19.1215	19.5783	19.9309	20.1067	20.1534	20.1471	20.0396	19.6045	18.9591	18.4049 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	637.8879	686.3951	709.8712	695.7477	609.8462	443.5520	295.9382	310.0546	456.0747	566.3557	596.5843	613.9197 (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	1199.3256	1169.4076	1067.0742	902.7905	695.8755	465.5580	300.4195	316.7988	502.1629	761.2810	1002.6211	1200.9432 (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	417.7096	324.5843	265.7591	149.0708	64.0057	0.0000	0.0000	0.0000	0.0000	145.0244	292.3465	436.7455 (98)

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Space heating 2095.2459 (98)
 Space heating per m2 (98) / (4) = 24.1499 (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 2315.1888 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	417.7096	324.5843	265.7591	149.0708	64.0057	0.0000	0.0000	0.0000	0.0000	145.0244	292.3465	436.7455 (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)	461.5576	358.6567	293.6564	164.7191	70.7246	0.0000	0.0000	0.0000	0.0000	160.2479	323.0348	482.5917 (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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Efficiency of water heater (217)m	89.7542	89.6836	89.5264	89.1783	88.5277	87.3000	87.3000	87.3000	87.3000	89.1175	89.5901	87.3000 (216)
Fuel for water heating, kWh/month	136.4229	119.5833	125.2135	113.4661	112.0431	101.1668	97.9201	108.3135	108.3544	119.4090	125.0721	132.6610 (219)
Water heating fuel used												1399.6257 (219)
Annual totals kWh/year												
Space heating fuel - main system												2315.1888 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)
 mechanical ventilation fans (SFP = 0.2294) 59.7406 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 134.7406 (231)
 Electricity for lighting (calculated in Appendix L) 394.5058 (232)
 Total delivered energy for all uses 4244.0609 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2315.1888	3.4800	80.5686 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1399.6257	3.4800	48.7070 (247)
Mechanical ventilation fans	59.7406	13.1900	7.8798 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.5058	13.1900	52.0353 (250)
Additional standing charges			120.0000 (251)
Total energy cost			319.0831 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.0171 (257)
 SAP value 85.8113
 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	2315.1888	0.2160	500.0808 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1399.6257	0.2160	302.3192 (264)
Space and water heating			802.3999 (265)
Pumps and fans	134.7406	0.5190	69.9304 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Total kg/year			1077.0788 (272)
CO2 emissions per m2			12.4100 (273)
EI value			89.0461
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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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	$3.48 / 0.8870 = 3.923$, stars = 5
Water heating environmental impact	$0.216 / 0.8870 = 0.2435$, 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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Designed)

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Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total = Sum (45)m =		1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month												
WWHRS	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (62)
Total of WWHRS savings	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (65)
										Total per year (kWh/year) = Sum (64)m =		1242.7102 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	585.7329	580.8876	557.9388	522.5375	486.3359	454.1075	435.4705	444.3189	464.8857	500.5049	539.9468	569.7411 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast					4.4000	40.4699	0.4600	0.0000	0.7700	63.0716 (77)		
Southwest					0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (79)		
Northwest					3.8000	12.9236	0.4600	0.0000	0.7700	17.3946 (81)		
Northwest					3.1500	12.9236	0.4300	0.0000	0.7700	13.4788 (81)		
Solar gains	103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)
Total gains	689.1386	748.8791	809.9414	887.2371	922.0888	934.6516	886.5355	838.0093	775.8862	706.0144	668.8003	656.1529 (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	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9541	0.9373	0.8957	0.8043	0.6494	0.4377	0.2931	0.3191	0.5814	0.8267	0.9274	0.9600 (86)
MIT	19.7838	19.9373	20.2485	20.6019	20.8627	20.9759	20.9960	20.9945	20.9305	20.6262	20.1520	19.7349 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9462	0.9267	0.8779	0.7718	0.5952	0.3647	0.2096	0.2316	0.5069	0.7900	0.9130	0.9530 (89)
MIT 2	18.5055	18.7240	19.1629	19.6431	19.9703	20.0886	20.1033	20.1027	20.0493	19.6864	19.0341	18.4361 (90)
Living area fraction	18.8076	19.0107	19.4194	19.8696	20.1811	20.2983	20.3142	20.3134	20.2575	19.9085	19.2982	18.7430 (92)
MIT	18.8076	19.0107	19.4194	19.8696	20.1811	20.2983	20.3142	20.3134	20.2575	19.9085	19.2982	18.7430 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6576	18.8607	19.2694	19.7196	20.0311	20.1483	20.1642	20.1634	20.1075	19.7585	19.1482	18.5930 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	640.6195	680.1504	694.9708	670.9248	544.4690	344.2553	190.8294	198.9444	393.5166	546.2501	597.8329	615.0086 (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	1146.2144	1121.1113	1003.4898	830.1941	594.4408	350.7131	191.4261	199.8099	414.9037	689.7497	942.5167	1140.7542 (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	376.1626	296.3258	229.5381	114.6739	37.1790	0.0000	0.0000	0.0000	0.0000	106.7637	248.1724	391.1548 (98)

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Space heating 1799.9703 (98)
 Space heating per m2 (98) / (4) = 20.7465 (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													1988.9174 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.1626	296.3258	229.5381	114.6739	37.1790	0.0000	0.0000	0.0000	0.0000	106.7637	248.1724	391.1548	(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)	415.6493	327.4318	253.6333	126.7115	41.0818	0.0000	0.0000	0.0000	0.0000	117.9710	274.2236	432.2152	(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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225	(64)
Efficiency of water heater	89.6926	89.6270	89.4245	88.9712	88.1498	87.3000	87.3000	87.3000	87.3000	88.8738	89.4797	89.7322	(216)
Fuel for water heating, kWh/month	136.5165	119.6589	125.3563	113.7302	112.5235	101.1668	97.9201	108.3135	108.3544	119.7364	125.2263	132.7534	(217)
Water heating fuel used												1401.2561	(219)
Annual totals kWh/year													
Space heating fuel - main system												1988.9174	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												59.7406	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												134.7406	(231)
Electricity for lighting (calculated in Appendix L)												394.5058	(232)
Total delivered energy for all uses												3919.4199	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1988.9174	3.9200	77.9656	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1401.2561	3.9200	54.9292	(247)
Mechanical ventilation fans	59.7406	16.9600	10.1320	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	394.5058	16.9600	66.9082	(250)
Additional standing charges			88.0000	(251)
Total energy cost			310.6550	(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	1988.9174	0.2160	429.6062	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1401.2561	0.2160	302.6713	(264)
Space and water heating			732.2775	(265)
Pumps and fans	134.7406	0.5190	69.9304	(267)
Energy for lighting	394.5058	0.5190	204.7485	(268)
Total kg/year			1006.9563	(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	1988.9174	1.2200	2426.4793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1401.2561	1.2200	1709.5325	(264)
Space and water heating			4136.0118	(265)
Pumps and fans	134.7406	3.0700	413.6535	(267)
Energy for lighting	394.5058	3.0700	1211.1327	(268)
Primary energy kWh/year			5760.7980	(272)
Primary energy kWh/m2/year			66.3992	(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	+ 10.1	-£ 309	-947 kg (94.0%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 22	-140 kg (13.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	10.91 kg/m²	A 96 A 98
Total Savings	£309	10.91 kg/m²	
Potential energy efficiency rating:		A 96	
Potential environmental impact rating:			A 98

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	£90	£90	£0
Mains gas	£221	£221	£0
Space heating	£189	£189	£0
Water heating	£55	£55	£0
Lighting	£67	£67	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£311	£2	£309
Total cost of uses	£311	£2	£309
Delivered energy	45 kWh/m²	24 kWh/m²	21 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.1 tonnes	0.9 tonnes
CO2 emissions per m²	12 kg/m²	1 kg/m²	11 kg/m²
Primary energy	66 kWh/m²	2 kWh/m²	65 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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total =	Sum (45)m =	1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month												
WWHRS	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (62)
Total of WWHRS savings	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (65)
										Total per year (kWh/year) =	Sum (64)m =	1242.7102 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	585.7329	580.8876	557.9388	522.5375	486.3359	454.1075	435.4705	444.3189	464.8857	500.5049	539.9468	569.7411 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
Southeast					4.4000	36.7938	0.4600	0.0000	0.7700			57.3425 (77)
Southwest					0.6600	36.7938	0.4600	0.0000	0.7700			8.6014 (79)
Northwest					3.8000	11.2829	0.4600	0.0000	0.7700			15.1864 (81)
Northwest					3.1500	11.2829	0.4300	0.0000	0.7700			11.7677 (81)
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)
Total gains	678.6308	748.0801	810.4799	875.3087	917.8518	898.5065	857.2586	804.9133	751.7511	691.7003	652.8475	648.1874 (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	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9617	0.9445	0.9105	0.8394	0.7188	0.5596	0.4216	0.4644	0.6749	0.8658	0.9428	0.9670 (86)
MIT	19.6554	19.8407	20.1359	20.4896	20.7759	20.9323	20.9812	20.9732	20.8655	20.5034	20.0089	19.5946 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9553	0.9353	0.8956	0.8127	0.6739	0.4935	0.3407	0.3811	0.6117	0.8374	0.9318	0.9614 (89)
MIT 2	18.3203	18.5853	19.0041	19.4928	19.8659	20.0477	20.0937	20.0880	19.9806	19.5228	18.8308	18.2332 (90)
Living area fraction	18.6358	18.8819	19.2715	19.7283	20.0809	20.2567	20.3034	20.2971	20.1896	19.7545	19.1091	18.5549 (92)
MIT	18.6358	18.8819	19.2715	19.7283	20.0809	20.2567	20.3034	20.2971	20.1896	19.7545	19.1091	18.5549 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4858	18.7319	19.1215	19.5783	19.9309	20.1067	20.1534	20.1471	20.0396	19.6045	18.9591	18.4049 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	637.8879	686.3951	709.8712	695.7477	609.8462	443.5520	295.9382	310.0546	456.0747	566.3557	596.5843	613.9197 (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	1199.3256	1169.4076	1067.0742	902.7905	695.8755	465.5580	300.4195	316.7988	502.1629	761.2810	1002.6211	1200.9432 (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	417.7096	324.5843	265.7591	149.0708	64.0057	0.0000	0.0000	0.0000	0.0000	145.0244	292.3465	436.7455 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating 2095.2459 (98)
 Space heating per m2 (98) / (4) = 24.1499 (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													2315.1888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	417.7096	324.5843	265.7591	149.0708	64.0057	0.0000	0.0000	0.0000	0.0000	145.0244	292.3465	436.7455	(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)	461.5576	358.6567	293.6564	164.7191	70.7246	0.0000	0.0000	0.0000	0.0000	160.2479	323.0348	482.5917	(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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225	(64)
Efficiency of water heater (217)m	89.7542	89.6836	89.5264	89.1783	88.5277	87.3000	87.3000	87.3000	87.3000	89.1175	89.5901	87.3000	(216)
Fuel for water heating, kWh/month	136.4229	119.5833	125.2135	113.4661	112.0431	101.1668	97.9201	108.3135	108.3544	119.4090	125.0721	132.6610	(219)
Water heating fuel used												1399.6257	(219)
Annual totals kWh/year													
Space heating fuel - main system												2315.1888	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												59.7406	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												134.7406	(231)
Electricity for lighting (calculated in Appendix L)												394.5058	(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												2516.8215	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2315.1888	3.4800	80.5686 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1399.6257	3.4800	48.7070 (247)
Mechanical ventilation fans	59.7406	13.1900	7.8798 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	394.5058	13.1900	52.0353 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			91.2603 (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] = 0.2909 (257)
SAP value	95.9419
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	2315.1888	0.2160	500.0808 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1399.6257	0.2160	302.3192 (264)
Space and water heating			802.3999 (265)
Pumps and fans	134.7406	0.5190	69.9304 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			180.6415 (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	2.0800 (273)
EI value	98.1629
EI rating	98 (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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (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			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (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												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total =	Sum (45)m =	1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (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	14.6840	13.2496	14.6273	14.1021	14.5333	14.0197	14.4591	14.5072	14.0646	14.5884	14.1749	14.6693 (61)
Total heat required for water heating calculated for each month												
WWHRS	170.3799	149.4223	155.1453	136.6091	132.0817	115.4550	108.4539	122.3675	123.2131	141.7905	153.0259	165.4525 (62)
Total of WWHRS savings	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225 (64)
Heat gains from water heating, kWh/month	55.4399	48.5898	50.3791	44.2591	42.7182	37.2322	34.8680	39.4904	39.8080	45.9418	49.7117	53.8027 (65)
										Total per year (kWh/year) =	Sum (64)m =	1242.7102 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (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)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	74.5160	72.3063	67.7138	61.4710	57.4169	51.7113	46.8656	53.0784	55.2889	61.7497	69.0440	72.3155 (72)
Total internal gains	585.7329	580.8876	557.9388	522.5375	486.3359	454.1075	435.4705	444.3189	464.8857	500.5049	539.9468	569.7411 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d			Gains W
Southeast					4.4000	40.4699	0.4600		0.0000	0.7700			63.0716 (77)
Southwest					0.6600	40.4699	0.4600		0.0000	0.7700			9.4607 (79)
Northwest					3.8000	12.9236	0.4600		0.0000	0.7700			17.3946 (81)
Northwest					3.1500	12.9236	0.4300		0.0000	0.7700			13.4788 (81)

Solar gains	103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)	
Total gains	689.1386	748.8791	809.9414	887.2371	922.0888	934.6516	886.5355	838.0093	775.8862	706.0144	668.8003	656.1529 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
util living area	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
	0.9541	0.9373	0.8957	0.8043	0.6494	0.4377	0.2931	0.3191	0.5814	0.8267	0.9274	0.9600 (86)
MIT	19.7838	19.9373	20.2485	20.6019	20.8627	20.9759	20.9960	20.9945	20.9305	20.6262	20.1520	19.7349 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9462	0.9267	0.8779	0.7718	0.5952	0.3647	0.2096	0.2316	0.5069	0.7900	0.9130	0.9530 (89)
MIT 2	18.5055	18.7240	19.1629	19.6431	19.9703	20.0886	20.1033	20.1027	20.0493	19.6864	19.0341	18.4361 (90)
Living area fraction	18.8076	19.0107	19.4194	19.8696	20.1811	20.2983	20.3142	20.3134	20.2575	19.9085	19.2982	18.7430 (91)
MIT	18.8076	19.0107	19.4194	19.8696	20.1811	20.2983	20.3142	20.3134	20.2575	19.9085	19.2982	18.7430 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6576	18.8607	19.2694	19.7196	20.0311	20.1483	20.1642	20.1634	20.1075	19.7585	19.1482	18.5930 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9296	0.9082	0.8581	0.7562	0.5905	0.3683	0.2153	0.2374	0.5072	0.7737	0.8939	0.9373 (94)
Ext temp.	640.6195	680.1504	694.9708	670.9248	544.4690	344.2553	190.8294	198.9444	393.5166	546.2501	597.8329	615.0086 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1146.2144	1121.1113	1003.4898	830.1941	594.4408	350.7131	191.4261	199.8099	414.9037	689.7497	942.5167	1140.7542 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
	376.1626	296.3258	229.5381	114.6739	37.1790	0.0000	0.0000	0.0000	0.0000	106.7637	248.1724	391.1548 (98)

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Space heating 1799.9703 (98)
 Space heating per m2 (98) / (4) = 20.7465 (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													1988.9174 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.1626	296.3258	229.5381	114.6739	37.1790	0.0000	0.0000	0.0000	0.0000	106.7637	248.1724	391.1548	(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)	415.6493	327.4318	253.6333	126.7115	41.0818	0.0000	0.0000	0.0000	0.0000	117.9710	274.2236	432.2152	(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	122.4453	107.2466	112.0992	101.1871	99.1892	88.3186	85.4842	94.5577	94.5934	106.4143	112.0521	119.1225	(64)
Efficiency of water heater (217)m	89.6926	89.6270	89.4245	88.9712	88.1498	87.3000	87.3000	87.3000	87.3000	88.8738	89.4797	89.7322	(216)
Fuel for water heating, kWh/month	136.5165	119.6589	125.3563	113.7302	112.5235	101.1668	97.9201	108.3135	108.3544	119.7364	125.2263	132.7534	(219)
Water heating fuel used												1401.2561	(219)
Annual totals kWh/year													
Space heating fuel - main system												1988.9174	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)												59.7406	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												134.7406	(231)
Electricity for lighting (calculated in Appendix L)												394.5058	(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												2095.2603	(238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1988.9174	3.9200	77.9656 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1401.2561	3.9200	54.9292 (247)
Mechanical ventilation fans	59.7406	16.9600	10.1320 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	394.5058	16.9600	66.9082 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			1.2775 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1988.9174	0.2160	429.6062 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1401.2561	0.2160	302.6713 (264)
Space and water heating			732.2775 (265)
Pumps and fans	134.7406	0.5190	69.9304 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			60.2175 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	1988.9174	1.2200	2426.4793 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1401.2561	1.2200	1709.5325 (264)

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Space and water heating			4136.0118 (265)
Pumps and fans	134.7406	3.0700	413.6535 (267)
Energy for lighting	394.5058	3.0700	1211.1327 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			160.6279 (272)
Primary energy kWh/m2/year			1.8514 (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 East
Overshading	Average or unknown
Thermal mass parameter	137.2 (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	281.73 (P1)
Transmission heat loss coefficient	49.33 (37)
Summer heat loss coefficient	331.06 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	4.4000	119.9223	0.4600	0.0000	0.9000	218.4505
South West	0.6600	119.9223	0.4600	0.0000	0.9000	32.7676
North West	3.8000	98.8453	0.4600	0.0000	0.9000	155.5034
North West	3.1500	98.8453	0.4300	0.0000	0.9000	120.4973
total:						527.2188

	Jun	Jul	Aug	
Solar gains	562	527	460	(P3/P4)
Internal gains	451	432	441	
Total summer gains	1013	960	901	(P5)
Summer gain/loss ratio	3.06	2.90	2.72	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 137.2)	1.04	1.04	1.04	
Threshold temperature	20.10	21.84	21.56	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			