

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X412 Det				Issued on Date	15/12/2022
Assessment Reference	X412 Det	Prop Type Ref	Juniper			
Property	4 Bed, K, WC, B, En					
SAP Rating		86 B	DER	13.60	TER	17.47
Environmental		88 B	% DER<TER	22.13		
CO ₂ Emissions (t/year)		1.29	DFEE	44.32	TFEE	57.23
General Requirements Compliance		Pass	% DFEE<TFEE	22.55		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 113 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) 17.47 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.60 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)44.3 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	1.23 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:

Average

Windows facing North East: 11.62 m², No overhang

Windows facing South East: 1.44 m², No overhang

Windows facing South West: 9.81 m², No overhang

Windows facing North West: 2.02 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

Thermal bridging y-value 0.021 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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			19.2000	1.1450	21.9847			(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000	(28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160	(29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400	(30)					
Total net area of external elements Aum(A, m2)			262.6300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.6078			(33)					
1F Timber			154.9000			9.0000	1394.1000	(32c)					
GF Masonry			34.4600			39.0000	1343.9400	(32c)					
GF Timber			62.1900			9.0000	559.7100	(32c)					
Internal Floor			56.5600			12.6000	712.6560	(32d)					
Internal Ceiling			56.5600			9.0000	509.0400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15736.9020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478	(36)					
Total fabric heat loss						(33) + (36) =	79.1556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 45.6781	Feb 45.2253	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688	(38)
Heat transfer coeff	124.8337	124.3809	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	(39)
Average = Sum(39)m / 12 =												124.3716	(39)
HLP	Jan 1.1036	Feb 1.0995	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990	(40)
HLP (average)												1.0995	(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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (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	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												1596.4778 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Total heat required for water heating calculated for each month												
WWHRS	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Total of WWHRS savings	-51.9738	-45.7315	-46.6743	-38.3942	-35.6456	-29.4029	-24.8794	-30.1249	-31.0062	-38.3355	-44.4143	-50.2368 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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Total per year (kWh/year) = Sum(64)m =												1295.3892 (64)
Heat gains from water heating, kWh/month	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (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	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6108	21.8591	17.7770	13.4583	10.0603	8.4933	9.1773	11.9290	16.0111	20.3298	23.7278	25.2948 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.9646	278.8282	271.6119	256.2493	236.8567	218.6304	206.4541	203.5904	210.8067	226.1694	245.5620	263.7883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616 (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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Water heating gains (Table 5)	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
Total internal gains	447.7886	445.5525	429.3780	403.0671	375.9686	350.1122	333.4699	339.9603	353.6072	380.1503	410.6884	433.9580 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				5.9300	11.2829		0.4600		0.0000		0.7700		23.6988 (75)
Southeast				1.4400	36.7938		0.4600		0.0000		0.7700		18.7666 (77)
Southwest				9.8100	36.7938		0.4600		0.0000		0.7700		127.8476 (79)
Northwest				2.0200	11.2829		0.4600		0.0000		0.7700		8.0728 (81)
Northeast				5.6900	11.2829		0.4300		0.0000		0.7700		21.2566 (75)
Solar gains	199.6423	357.6785	536.1768	742.7686	903.5404	928.4911	882.0620	757.3056	606.9615	407.9256	242.3331	168.7767	(83)
Total gains	647.4310	803.2310	965.5548	1145.8356	1279.5089	1278.6033	1215.5319	1097.2659	960.5687	788.0758	653.0215	602.7347	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0175	35.1450	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
alpha	3.3345	3.3430	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
util living area	0.9859	0.9712	0.9383	0.8617	0.7294	0.5672	0.4323	0.4912	0.7245	0.9156	0.9756	0.9888 (86)
MIT	19.1263	19.4147	19.8370	20.3295	20.7108	20.9086	20.9721	20.9573	20.7900	20.2589	19.5849	19.0639 (87)
Th 2	19.9979	20.0012	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9832	0.9657	0.9265	0.8356	0.6813	0.4944	0.3412	0.3958	0.6576	0.8936	0.9700	0.9866 (89)
MIT 2	17.4876	17.9068	18.5122	19.1986	19.6971	19.9267	19.9861	19.9760	19.8077	19.1190	18.1579	17.3992 (90)
Living area fraction									fLA = Living area / (4) =			0.2245 (91)
MIT	17.8556	18.2454	18.8097	19.4525	19.9247	20.1472	20.2075	20.1963	20.0283	19.3749	18.4783	17.7730 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7056	18.0954	18.6597	19.3025	19.7747	19.9972	20.0575	20.0463	19.8783	19.2249	18.3283	17.6230 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	630.4231	763.8379	874.6939	932.7293	856.3889	631.6967	421.1647	439.1801	622.7583	686.9534	624.5787	589.8007 (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	1673.4712	1641.2539	1511.7477	1293.2864	1003.8809	671.0021	429.8525	453.3245	718.3843	1072.2892	1395.9502	1668.8085 (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												

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776.0278	589.6235	473.9680	259.6012	109.7340	0.0000	0.0000	0.0000	0.0000	286.6898	555.3875	802.7818 (98)
Space heating											3853.8136 (98)
Space heating per m2										(98) / (4) =	34.0684 (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												4258.3576 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	776.0278	589.6235	473.9680	259.6012	109.7340	0.0000	0.0000	0.0000	0.0000	286.6898	555.3875	802.7818 (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)	857.4893	651.5177	523.7216	286.8521	121.2531	0.0000	0.0000	0.0000	0.0000	316.7844	613.6878	887.0517 (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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Efficiency of water heater	90.0337	89.9743	89.8487	89.5517	88.9191	87.3000	87.3000	87.3000	87.3000	89.5836	89.9270	87.3000 (216)
Fuel for water heating, kWh/month	141.8365	124.2650	130.0249	117.7720	116.2438	105.3634	101.9727	112.8987	112.9662	123.8780	129.9560	137.9141 (219)
Water heating fuel used												1455.0912 (219)
Annual totals kWh/year												
Space heating fuel - main system												4258.3576 (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)	76.6248 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	151.6248 (231)
Electricity for lighting (calculated in Appendix L)	434.6345 (232)
Total delivered energy for all uses	6299.7081 (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	4258.3576	0.2160	919.8052 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1455.0912	0.2160	314.2997 (264)
Space and water heating			1234.1049 (265)
Pumps and fans	151.6248	0.5190	78.6933 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Total CO2, kg/year			1538.3735 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6000 (273)

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

DER		13.6000 ZC1
Total Floor Area	TFA	113.1200
Assumed number of occupants	N	2.8323
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.4564 ZC2
CO2 emissions from cooking, equation (L16)		1.6529 ZC3
Total CO2 emissions		29.7093 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		29.7093 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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1461 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3961	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3961 (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	0.5051	0.4951	0.4852	0.4357	0.4258	0.3763	0.3763	0.3664	0.3961	0.4258	0.4456	0.4654 (22b)
Effective ac	0.6275	0.6226	0.6177	0.5949	0.5907	0.5708	0.5708	0.5671	0.5785	0.5907	0.5993	0.6083 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			24.8900	1.3258	32.9981		(27)					
FP McCann System			56.5600	0.1300	7.3528		(28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.1800	22.0446		(29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.1300	7.3528		(30)					
Total net area of external elements Aum(A, m2)			262.6300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		71.8983		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.9935 (36)					
Total fabric heat loss						(33) + (36) =	83.8918 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.6903	Feb 56.2429	Mar 55.8044	Apr 53.7446	May 53.3592	Jun 51.5652	Jul 51.5652	Aug 51.2330	Sep 52.2562	Oct 53.3592	Nov 54.1388	Dec 54.9539 (38)
Heat transfer coeff	140.5821	140.1347	139.6962	137.6364	137.2510	135.4570	135.4570	135.1248	136.1481	137.2510	138.0307	138.8457 (39)
Average = Sum(39)m / 12 =												137.6346 (39)
HLP	Jan 1.2428	Feb 1.2388	Mar 1.2349	Apr 1.2167	May 1.2133	Jun 1.1975	Jul 1.1975	Aug 1.1945	Sep 1.2036	Oct 1.2133	Nov 1.2202	Dec 1.2274 (40)
HLP (average)												1.2167 (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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (43)
Daily hot water use	Jan 111.6142	Feb 107.5555	Mar 103.4968	Apr 99.4381	May 95.3794	Jun 91.3207	Jul 91.3207	Aug 95.3794	Sep 99.4381	Oct 103.4968	Nov 107.5555	Dec 111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												1596.4778 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

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	50.9589	49.0380	48.6043	45.0349	46.5360	48.6043	49.0380	50.9589	49.3151	50.9589 (61)
Solar input	216.4795	190.7928	200.3438	179.2753	173.5701	152.8709	146.4620	163.2708	165.0739	186.1876	196.9278	211.2568 (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	216.4795	190.7928	200.3438	179.2753	173.5701	152.8709	146.4620	163.2708	165.0739	186.1876	196.9278	211.2568 (64)
Heat gains from water heating, kWh/month	67.7753	59.6413	62.4102	55.5634	53.7022	47.1142	44.8594	50.2777	50.8414	57.7033	61.4100	66.0388 (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	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6108	21.8591	17.7770	13.4583	10.0603	8.4933	9.1773	11.9290	16.0111	20.3298	23.7278	25.2948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.9646	278.8282	271.6119	256.2493	236.8567	218.6304	206.4541	203.5904	210.8067	226.1694	245.5620	263.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	(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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	(71)
Water heating gains (Table 5)	91.0959	88.7520	83.8847	77.1714	72.1804	65.4364	60.2949	67.5775	70.6131	77.5582	85.2917	88.7618	(72)
Total internal gains	460.1559	457.9240	441.7583	415.3637	387.5820	361.0447	344.4109	351.5817	365.9156	392.5420	423.0662	446.3296	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					11.6200	11.2829	0.6300	0.7000	0.7700		40.0682 (75)	
Southeast					1.4400	36.7938	0.6300	0.7000	0.7700		16.1923 (77)	
Southwest					9.8100	36.7938	0.6300	0.7000	0.7700		110.3102 (79)	
Northwest					2.0200	11.2829	0.6300	0.7000	0.7700		6.9654 (81)	
Solar gains	173.5362	311.2190	467.3201	648.5869	789.9577	812.1706	771.3978	661.6596	529.4204	355.1519	210.7014	146.6699 (83)
Total gains	633.6921	769.1430	909.0784	1063.9506	1177.5397	1173.2153	1115.8087	1013.2412	895.3360	747.6939	633.7676	592.9994 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8788	56.0572	56.2331	57.0747	57.2349	57.9930	57.9930	58.1356	57.6986	57.2349	56.9117	56.5776	
alpha	4.7253	4.7371	4.7489	4.8050	4.8157	4.8662	4.8662	4.8757	4.8466	4.8157	4.7941	4.7718	
util living area	0.9985	0.9960	0.9876	0.9547	0.8596	0.6856	0.5221	0.5902	0.8483	0.9783	0.9967	0.9989	(86)
MIT	19.5998	19.7825	20.0779	20.4671	20.7832	20.9485	20.9889	20.9806	20.8520	20.4288	19.9450	19.5753	(87)
Th 2	19.8859	19.8891	19.8922	19.9066	19.9094	19.9220	19.9220	19.9244	19.9171	19.9094	19.9039	19.8981	(88)
util rest of house	0.9980	0.9945	0.9830	0.9375	0.8093	0.5910	0.4004	0.4637	0.7745	0.9671	0.9953	0.9985	(89)
MIT 2	18.0221	18.2909	18.7220	19.2849	19.7005	19.8888	19.9181	19.9166	19.7984	19.2426	18.5393	17.9946	(90)
Living area fraction	18.3763	18.6258	19.0265	19.5504	19.9436	20.1267	20.1585	20.1555	20.0350	19.5090	18.8549	18.3495	(92)
Temperature adjustment	18.3763	18.6258	19.0265	19.5504	19.9436	20.1267	20.1585	20.1555	20.0350	19.5090	18.8549	18.3495	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	631.7058	763.1068	889.1333	989.8714	955.1110	715.8476	477.3876	498.6150	701.8058	718.8526	629.4877	591.6347	(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	1978.8808	1923.4674	1749.9006	1465.8789	1131.4402	748.6369	482.0305	507.4658	808.0408	1222.7680	1622.5398	1964.5998	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1002.2982	779.7623	640.4109	342.7254	131.1889	0.0000	0.0000	0.0000	0.0000	374.9130	714.9976	1021.4860	(98)
Space heating												5007.7823	(98)
Space heating per m2												44.2696	(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													5361.6513 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1002.2982	779.7623	640.4109	342.7254	131.1889	0.0000	0.0000	0.0000	0.0000	374.9130	714.9976	1021.4860	(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)	1073.1244	834.8633	685.6647	366.9437	140.4592	0.0000	0.0000	0.0000	0.0000	401.4058	765.5220	1093.6681	(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	216.4795	190.7928	200.3438	179.2753	173.5701	152.8709	146.4620	163.2708	165.0739	186.1876	196.9278	211.2568	(64)
Efficiency of water heater (217)m	88.4245	88.2187	87.7694	86.6567	84.3571	80.3000	80.3000	80.3000	80.3000	86.7782	88.0095	88.4926	(216)
Fuel for water heating, kWh/month	244.8184	216.2724	228.2616	206.8800	205.7564	190.3747	182.3935	203.3260	205.5715	214.5558	223.7573	238.7283	(219)
Water heating fuel used												2560.6958	(219)
Annual totals kWh/year													
Space heating fuel - main system												5361.6513	(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)												434.6345	(232)
Total delivered energy for all uses												8431.9816	(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	5361.6513	0.2160	1158.1167 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2560.6958	0.2160	553.1103 (264)
Space and water heating			1711.2270 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Total CO2, kg/m2/year			1975.7273 (272)
Emissions per m2 for space and water heating			15.1275 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9941 (272b)
Emissions per m2 for pumps and fans			0.3441 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1275 * 1.00) + 1.9941 + 0.3441, rounded to 2 d.p.			17.4700 (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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1461 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3466 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3466 (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	0.4419	0.4333	0.4246	0.3813	0.3726	0.3293	0.3293	0.3206	0.3466	0.3726	0.3899	0.4073 (22b)
Effective ac	0.5977	0.5939	0.5901	0.5727	0.5694	0.5542	0.5542	0.5514	0.5601	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			19.2000	1.1450	21.9847		(27)
French Door (Uw = 1.40)			5.6900	1.3258	7.5436		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000 (28a)
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160 (29a)
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400 (30)
Total net area of external elements Aum(A, m ²)			262.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.6078		(33)
1F Timber			154.9000			9.0000	1394.1000 (32c)
GF Masonry			34.4600			39.0000	1343.9400 (32c)
GF Timber			62.1900			9.0000	559.7100 (32c)
Internal Floor			56.5600			12.6000	712.6560 (32d)
Internal Ceiling			56.5600			9.0000	509.0400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 15736.9020 (34)
139.1169 (35)
5.5478 (36)
(33) + (36) = 79.1556 (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	53.9907	53.6482	53.3124	51.7352	51.4401	50.0665	50.0665	49.8121	50.5956	51.4401	52.0371	52.6612 (38)
Heat transfer coeff	133.1464	132.8038	132.4680	130.8909	130.5958	129.2221	129.2221	128.9677	129.7512	130.5958	131.1927	131.8168 (39)
Average = Sum(39)m / 12 =												130.8894 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1770	1.1740	1.1710	1.1571	1.1545	1.1423	1.1423	1.1401	1.1470	1.1545	1.1598	1.1653 (40)
HLP (average)												1.1571 (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
Average daily hot water use (litres/day)
2.8323 (42)
101.4674 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (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 = 1596.4778 (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	35.1731	30.7626	31.7443	27.6754	26.5552	22.9152	21.2343	24.3666	24.6576	28.7361	31.3677	34.0633 (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	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6108	21.8591	17.7770	13.4583	10.0603	8.4933	9.1773	11.9290	16.0111	20.3298	23.7278	25.2948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.9646	278.8282	271.6119	256.2493	236.8567	218.6304	206.4541	203.5904	210.8067	226.1694	245.5620	263.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	(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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	(71)
Water heating gains (Table 5)	47.2757	45.7777	42.6671	38.4381	35.6925	31.8266	28.5407	32.7508	34.2467	38.6238	43.5663	45.7840	(72)
Total internal gains	413.3358	411.9497	397.5407	373.6304	348.0942	324.4350	309.6568	313.7550	326.5492	350.6076	378.3408	400.3518	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast					5.9300	11.2829		0.4600	0.0000	0.7700	23.6988 (75)					
Southeast					1.4400	36.7938		0.4600	0.0000	0.7700	18.7666 (77)					
Southwest					9.8100	36.7938		0.4600	0.0000	0.7700	127.8476 (79)					
Northwest					2.0200	11.2829		0.4600	0.0000	0.7700	8.0728 (81)					
Northeast					5.6900	11.2829		0.4300	0.0000	0.7700	21.2566 (75)					
Solar gains					199.6423	357.6785	536.1768	742.7686	903.5404	928.4911	882.0620	757.3056	606.9615	407.9256	242.3331	168.7767 (83)
Total gains					612.9781	769.6283	933.7175	1116.3990	1251.6345	1252.9260	1191.7187	1071.0606	933.5108	758.5332	620.6739	569.1284 (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	32.8313	32.9159	32.9994	33.3970	33.4725	33.8283	33.8283	33.8950	33.6903	33.4725	33.3202	33.1624	
alpha	3.1888	3.1944	3.2000	3.2265	3.2315	3.2552	3.2552	3.2597	3.2460	3.2315	3.2213	3.2108	
util living area	0.9880	0.9752	0.9463	0.8763	0.7521	0.5901	0.4537	0.5147	0.7483	0.9265	0.9793	0.9905	(86)
MIT	18.9471	19.2378	19.6817	20.2274	20.6511	20.8876	20.9642	20.9462	20.7482	20.1631	19.4499	18.8984	(87)
Th 2	19.9384	19.9408	19.9432	19.9545	19.9566	19.9664	19.9664	19.9682	19.9626	19.9566	19.9523	19.9479	(88)
util rest of house	0.9856	0.9702	0.9355	0.8514	0.7040	0.5143	0.3562	0.4136	0.6812	0.9063	0.9744	0.9886	(89)
MIT 2	18.0629	18.3524	18.7900	19.3210	19.7048	19.9035	19.9529	19.9462	19.8030	19.2741	18.5735	18.0215	(90)
Living area fraction	MIT	18.2615	18.5512	18.9902	19.5246	19.9173	20.1245	20.1800	20.1707	20.0152	19.4737	18.7703	0.2245 (91)
Temperature adjustment	adjusted MIT	18.2615	18.5512	18.9902	19.5246	19.9173	20.1245	20.1800	20.1707	20.0152	19.4737	18.7703	0.0000 (92)
adjusted MIT	18.2615	18.5512	18.9902	19.5246	19.9173	20.1245	20.1800	20.1707	20.0152	19.4737	18.7703	18.2184	0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	600.9145	740.1311	862.0254	937.2049	878.6144	659.7259	449.3729	465.3320	639.4682	678.6206	600.0853	560.0883	(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	1858.9177	1812.9347	1654.5520	1390.6578	1073.1437	713.8835	462.6132	486.3024	767.5067	1158.8721	1531.0603	1847.8567	(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	935.9544	720.9241	589.6398	326.4861	144.7299	0.0000	0.0000	0.0000	0.0000	357.3072	670.3020	958.0997	(98)
Space heating													4703.4432 (98)
Space heating per m2													(98) / (4) = 41.5792 (99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1214.6879	956.2437	980.1548	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8534	0.9021	0.8729	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1036.5925	862.6513	855.6139	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1576.0956	1502.0784	1363.0745	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	388.4422	475.7337	377.5507	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1241.7266	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.1106	118.9334	94.3877	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												310.4317	(107)
Space cooling per m2												2.7443	(108)
Energy for space heating												41.5792	(99)
Energy for space cooling												2.7443	(108)
Total												44.3235	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3	(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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (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							4 * 10 =	40.0000 (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) =						40.0000 / (5) =	0.1461 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3961	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3961 (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	0.5051	0.4951	0.4852	0.4357	0.4258	0.3763	0.3763	0.3664	0.3961	0.4258	0.4456	0.4654 (22b)
Effective ac	0.6275	0.6226	0.6177	0.5949	0.5907	0.5708	0.5708	0.5671	0.5785	0.5907	0.5993	0.6083 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			24.8900	1.3258	32.9981		(27)					
FP McCann System			56.5600	0.1300	7.3528		(28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.1800	22.0446		(29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.1300	7.3528		(30)					
Total net area of external elements Aum(A, m2)			262.6300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	71.8983		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.9935 (36)					
Total fabric heat loss						(33) + (36) =	83.8918 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 56.6903	Feb 56.2429	Mar 55.8044	Apr 53.7446	May 53.3592	Jun 51.5652	Jul 51.5652	Aug 51.2330	Sep 52.2562	Oct 53.3592	Nov 54.1388	Dec 54.9539 (38)
Heat transfer coeff	140.5821	140.1347	139.6962	137.6364	137.2510	135.4570	135.4570	135.1248	136.1481	137.2510	138.0307	138.8457 (39)
Average = Sum(39)m / 12 =												137.6346 (39)
HLP	Jan 1.2428	Feb 1.2388	Mar 1.2349	Apr 1.2167	May 1.2133	Jun 1.1975	Jul 1.1975	Aug 1.1945	Sep 1.2036	Oct 1.2133	Nov 1.2202	Dec 1.2274 (40)
HLP (average)												1.2167 (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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (43)
Daily hot water use	Jan 111.6142	Feb 107.5555	Mar 103.4968	Apr 99.4381	May 95.3794	Jun 91.3207	Jul 91.3207	Aug 95.3794	Sep 99.4381	Oct 103.4968	Nov 107.5555	Dec 111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)										Total = Sum(45)m =		1596.4778 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (59)
	35.1731	30.7626	31.7443	27.6754	26.5552	22.9152	21.2343	24.3666	24.6576	28.7361	31.3677	34.0633	(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	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	141.6156	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6108	21.8591	17.7770	13.4583	10.0603	8.4933	9.1773	11.9290	16.0111	20.3298	23.7278	25.2948	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.9646	278.8282	271.6119	256.2493	236.8567	218.6304	206.4541	203.5904	210.8067	226.1694	245.5620	263.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	37.1616	(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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	(71)
Water heating gains (Table 5)	47.2757	45.7777	42.6671	38.4381	35.6925	31.8266	28.5407	32.7508	34.2467	38.6238	43.5663	45.7840	(72)
Total internal gains	413.3358	411.9497	397.5407	373.6304	348.0942	324.4350	309.6568	313.7550	326.5492	350.6076	378.3408	400.3518	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	11.6200	11.2829	0.6300	0.7000	0.7700	40.0682 (75)
Southeast	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)
Southwest	9.8100	36.7938	0.6300	0.7000	0.7700	110.3102 (79)
Northwest	2.0200	11.2829	0.6300	0.7000	0.7700	6.9654 (81)

Solar gains	173.5362	311.2190	467.3201	648.5869	789.9577	812.1706	771.3978	661.6596	529.4204	355.1519	210.7014	146.6699	(83)
Total gains	586.8720	723.1688	864.8607	1022.2173	1138.0518	1136.6055	1081.0545	975.4145	855.9696	705.7595	589.0422	547.0217	(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	55.8788	56.0572	56.2331	57.0747	57.2349	57.9930	57.9930	58.1356	57.6986	57.2349	56.9117	56.5776	
alpha	4.7253	4.7371	4.7489	4.8050	4.8157	4.8662	4.8662	4.8757	4.8466	4.8157	4.7941	4.7718	
util living area	0.9989	0.9969	0.9899	0.9607	0.8719	0.7019	0.5373	0.6096	0.8651	0.9827	0.9976	0.9992	(86)
MIT	19.5619	19.7457	20.0438	20.4395	20.7667	20.9431	20.9875	20.9778	20.8364	20.3977	19.9089	19.5378	(87)
Th 2	19.8859	19.8891	19.8922	19.9066	19.9094	19.9220	19.9220	19.9244	19.9171	19.9094	19.9039	19.8981	(88)
util rest of house	0.9985	0.9958	0.9861	0.9453	0.8239	0.6071	0.4128	0.4805	0.7952	0.9735	0.9966	0.9990	(89)
MIT 2	18.5755	18.7613	19.0598	19.4566	19.7541	19.8966	19.9190	19.9182	19.8256	19.4246	18.9363	18.5611	(90)
Living area fraction									fLA = Living area / (4) =			0.2245	(91)
MIT	18.7970	18.9823	19.2808	19.6773	19.9815	20.1316	20.1589	20.1561	20.0526	19.6431	19.1547	18.7804	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7970	18.9823	19.2808	19.6773	19.9815	20.1316	20.1589	20.1561	20.0526	19.6431	19.1547	18.7804	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	585.7062	719.2143	850.3691	962.1972	941.7815	712.4813	476.7836	497.2521	689.5164	684.8935	586.4158	546.2461	(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	2038.0145	1973.4232	1785.4253	1483.3512	1136.6459	749.2896	482.0775	507.5454	810.4359	1241.1688	1663.9169	2024.4258	(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	1080.5174	842.8284	695.6818	375.2309	144.9791	0.0000	0.0000	0.0000	0.0000	413.8688	775.8008	1099.7657	(98)
Space heating												5428.6728	(98)
Space heating per m2										(98) / (4) =		47.9904	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1273.2961	1002.3820	1026.9485	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8763	0.9306	0.9004	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1115.7750	932.8293	924.6443	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1440.1366	1372.7306	1251.2805	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	233.5403	327.2865	243.0173	0.0000	0.0000	0.0000	0.0000	(104)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											803.8442 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	58.3851	81.8216	60.7543	0.0000	0.0000	0.0000 (107)
Space cooling											200.9611 (107)
Space cooling per m2											1.7765 (108)
Energy for space heating											47.9904 (99)
Energy for space cooling											1.7765 (108)
Total											49.7669 (109)
Target Fabric Energy Efficiency (TFEE)											57.2 (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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.2000	1.1450	21.9847		(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000 (28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160 (29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400 (30)					
Total net area of external elements Aum(A, m2)			262.6300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.6078		(33)					
1F Timber			154.9000			9.0000	1394.1000 (32c)					
GF Masonry			34.4600			39.0000	1343.9400 (32c)					
GF Timber			62.1900			9.0000	559.7100 (32c)					
Internal Floor			56.5600			12.6000	712.6560 (32d)					
Internal Ceiling			56.5600			9.0000	509.0400 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15736.9020 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478 (36)					
Total fabric heat loss						(33) + (36) =	79.1556 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.1688	Feb 45.1688	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688 (38)
Heat transfer coeff	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244 (39)
Average = Sum(39)m / 12 =												124.3244 (39)
HLP	Jan 1.0990	Feb 1.0990	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990 (40)
HLP (average)												1.0990 (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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (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												
Energy conte	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy content (annual)	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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												
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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Solar input	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
RHI water heating demand	Solar input (sum of months) = Sum(63)m =											
Heat gains from water heating, kWh/month	128.6855	129.6257	149.3098	161.2798	174.4391	1762.2085	1762 (64)					
	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	61.5270	54.6477	44.4425	33.6459	25.1507	21.2333	22.9433	29.8225	40.0278	50.8244	59.3196	63.2370 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	411.8874	416.1615	405.3909	382.4616	353.5174	326.3140	308.1404	303.8663	314.6369	337.5662	366.5104	393.7138 (68)
Pumps, fans	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Total internal gains	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
	666.6154	661.6621	635.8102	595.4546	553.7075	516.5235	494.9100	504.1174	527.4418	568.0296	613.2164	647.8136 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	5.9300	12.9236	0.4600	0.0000	0.7700	27.1447 (75)
Southeast	1.4400	40.4699	0.4600	0.0000	0.7700	20.6416 (77)
Southwest	9.8100	40.4699	0.4600	0.0000	0.7700	140.6209 (79)
Northwest	2.0200	12.9236	0.4600	0.0000	0.7700	9.2466 (81)
Northeast	5.6900	12.9236	0.4300	0.0000	0.7700	24.3475 (75)

Solar gains	222.0013	358.9476	534.2907	766.9112	911.4968	1003.1515	942.4184	825.8493	657.1216	437.8898	276.2782	185.7411 (83)
Total gains	888.6167	1020.6097	1170.1009	1362.3658	1465.2043	1519.6750	1437.3284	1329.9667	1184.5634	1005.9194	889.4946	833.5546 (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	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
util living area	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
	0.9608	0.9391	0.8873	0.7747	0.6055	0.3966	0.2657	0.2954	0.5575	0.8238	0.9340	0.9670 (86)
MIT	19.5434	19.7598	20.1536	20.5791	20.8607	20.9755	20.9955	20.9936	20.9213	20.5591	19.9813	19.4815 (87)
Th 2	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9535	0.9287	0.8673	0.7375	0.5469	0.3221	0.1813	0.2050	0.4773	0.7841	0.9199	0.9607 (89)
MIT 2	18.0917	18.3997	18.9531	19.5246	19.8703	19.9863	20.0003	19.9995	19.9417	19.5156	18.7215	18.0034 (90)
Living area fraction	18.4177	18.7051	19.2227	19.7614	20.0927	20.2084	20.2237	20.2227	20.1616	19.7499	19.0044	18.3353 (92)
MIT	18.4177	18.7051	19.2227	19.7614	20.0927	20.2084	20.2237	20.2227	20.1616	19.7499	19.0044	18.3353 (92)
Temperature adjustment	18.2677	18.5551	19.0727	19.6114	19.9427	20.0584	20.0737	20.0727	20.0116	19.5999	18.8544	-0.1500
adjusted MIT	18.2677	18.5551	19.0727	19.6114	19.9427	20.0584	20.0737	20.0727	20.0116	19.5999	18.8544	18.1853 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9363	0.9076	0.8448	0.7213	0.5432	0.3264	0.1874	0.2115	0.4782	0.7654	0.8989	0.9449 (94)
Ext temp.	831.9744	926.3022	988.5039	982.7020	795.9606	496.0487	269.4259	281.3014	566.4242	769.9516	799.5587	787.5995 (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	1637.0665	1610.6345	1451.2006	1207.3630	863.1422	504.5609	270.2472	282.5552	598.2053	994.5872	1349.4665	1626.8247 (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)
	598.9885	459.8713	344.2463	161.7559	49.9831	0.0000	0.0000	0.0000	0.0000	167.1289	395.9336	624.3836 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating
RHI space heating demand

2802.2913 (98)
2802 (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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.2000	1.1450	21.9847		(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000 (28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160 (29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400 (30)					
Total net area of external elements Aum(A, m2)			262.6300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	73.6078		(33)					
1F Timber			154.9000			9.0000	1394.1000 (32c)					
GF Masonry			34.4600			39.0000	1343.9400 (32c)					
GF Timber			62.1900			9.0000	559.7100 (32c)					
Internal Floor			56.5600			12.6000	712.6560 (32d)					
Internal Ceiling			56.5600			9.0000	509.0400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...	(30) + (32) + (32a)...	(32e) = 15736.9020 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478 (36)					
Total fabric heat loss						(33) + (36) =	79.1556 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.6781	Feb 45.2253	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688 (38)
Heat transfer coeff	124.8337	124.3809	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	(39)
Average = Sum(39)m / 12 =												124.3716 (39)
HLP	Jan 1.1036	Feb 1.0995	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990 (40)
HLP (average)												1.0995 (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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (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	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Total heat required for water heating calculated for each month												
WWHRS	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Total of WWHRS savings	-51.9738	-45.7315	-46.6743	-38.3942	-35.6456	-29.4029	-24.8794	-30.1249	-31.0062	-38.3355	-44.4143	-50.2368 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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Heat gains from water heating, kWh/month	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (65)
Total per year (kWh/year) = Sum(64)m =												1295.3892 (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	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5270	54.6477	44.4425	33.6459	25.1507	21.2333	22.9433	29.8225	40.0278	50.8244	59.3196	63.2370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.8874	416.1615	405.3909	382.4616	353.5174	326.3140	308.1404	303.8663	314.6369	337.5662	366.5104	393.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262 (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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Water heating gains (Table 5)	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
Total internal gains	666.6154	661.6621	635.8102	595.4546	553.7075	516.5235	494.9100	504.1174	527.4418	568.0296	613.2164	647.8136 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.9300	11.2829		0.4600	0.0000	0.7700		23.6988 (75)
Southeast					1.4400	36.7938		0.4600	0.0000	0.7700		18.7666 (77)
Southwest					9.8100	36.7938		0.4600	0.0000	0.7700		127.8476 (79)
Northwest					2.0200	11.2829		0.4600	0.0000	0.7700		8.0728 (81)
Northeast					5.6900	11.2829		0.4300	0.0000	0.7700		21.2566 (75)
Solar gains	199.6423	357.6785	536.1768	742.7686	903.5404	928.4911	882.0620	757.3056	606.9615	407.9256	242.3331	168.7767 (83)
Total gains	866.2578	1019.3407	1171.9871	1338.2232	1457.2478	1445.0146	1376.9720	1261.4230	1134.4033	975.9551	855.5495	816.5902 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0175	35.1450	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
alpha	3.3345	3.3430	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
util living area	0.9680	0.9457	0.9020	0.8126	0.6742	0.5143	0.3861	0.4352	0.6532	0.8643	0.9495	0.9732 (86)
MIT	19.3857	19.6532	20.0330	20.4593	20.7746	20.9318	20.9801	20.9703	20.8484	20.4170	19.8122	19.3217 (87)
Th 2	19.9979	20.0012	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9622	0.9362	0.8851	0.7815	0.6243	0.4448	0.3030	0.3477	0.5841	0.8338	0.9390	0.9683 (89)
MIT 2	17.8614	18.2462	18.7834	19.3665	19.7692	19.9470	19.9908	19.9842	19.8666	19.3270	18.4806	17.7716 (90)
Living area fraction									fLA = Living area / (4) =			0.2245 (91)
MIT	18.2037	18.5621	19.0640	19.6119	19.9950	20.1681	20.2129	20.2056	20.0871	19.5717	18.7796	18.1197 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0537	18.4121	18.9140	19.4619	19.8450	20.0181	20.0629	20.0556	19.9371	19.4217	18.6296	17.9697 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	820.0251	934.2560	1010.9432	1020.3314	897.4637	644.5367	424.4267	444.7994	657.1528	792.9770	786.8430	779.1573 (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	1716.9211	1680.6511	1543.3584	1313.0985	1012.6166	673.6064	430.5287	454.4848	725.6903	1096.7587	1433.4123	1711.9071 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

667.2906	501.5775	396.1169	210.7923	85.6738	0.0000	0.0000	0.0000	0.0000	226.0136	465.5299	693.9659 (98)
Space heating											3246.9605 (98)
Space heating per m2											(98) / (4) = 28.7037 (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		3587.8017 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	667.2906	501.5775	396.1169	210.7923	85.6738	0.0000	0.0000	0.0000	0.0000	226.0136	465.5299	693.9659 (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)	737.3377	554.2293	437.6982	232.9197	94.6672	0.0000	0.0000	0.0000	0.0000	249.7388	514.3977	766.8131 (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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Efficiency of water heater (217)m	89.9703	89.8993	89.7507	89.4071	88.7218	87.3000	87.3000	87.3000	87.3000	89.4206	89.8392	87.3000 (216)
Fuel for water heating, kWh/month	141.9364	124.3686	130.1669	117.9624	116.5022	105.3634	101.9727	112.8987	112.9662	124.1038	130.0829	138.0038 (219)
Water heating fuel used												1456.3282 (219)
Annual totals kWh/year												
Space heating fuel - main system												3587.8017 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
(MEVD) decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294
mechanical ventilation fans (SFP = 0.2294) 76.6248 (230a)
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 151.6248 (231)
Electricity for lighting (calculated in Appendix L) 434.6345 (232)
Total delivered energy for all uses 5630.3891 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3587.8017	3.4800	124.8555 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1456.3282	3.4800	50.6802 (247)
Mechanical ventilation fans	76.6248	13.1900	10.1068 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	434.6345	13.1900	57.3283 (250)
Additional standing charges			120.0000 (251)
Total energy cost			372.8633 (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] = 0.9904 (257)
SAP value 86.1839
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	3587.8017	0.2160	774.9652 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1456.3282	0.2160	314.5669 (264)
Space and water heating			1089.5320 (265)
Pumps and fans	151.6248	0.5190	78.6933 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Total kg/year			1393.8006 (272)
CO2 emissions per m2			12.3200 (273)
EI value			88.1881
EI rating			88 (274)
EI band			B

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8885 = 3.917$, stars = 5
Water heating environmental impact	$0.216 / 0.8885 = 0.2431$, 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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			19.2000	1.1450	21.9847			(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000	(28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160	(29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400	(30)					
Total net area of external elements Aum(A, m2)			262.6300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.6078			(33)					
1F Timber			154.9000			9.0000	1394.1000	(32c)					
GF Masonry			34.4600			39.0000	1343.9400	(32c)					
GF Timber			62.1900			9.0000	559.7100	(32c)					
Internal Floor			56.5600			12.6000	712.6560	(32d)					
Internal Ceiling			56.5600			9.0000	509.0400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15736.9020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478	(36)					
Total fabric heat loss						(33) + (36) =	79.1556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 45.1688	Feb 45.1688	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688	(38)
Heat transfer coeff	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	(39)
Average = Sum(39)m / 12 =												124.3244	(39)
HLP	Jan 1.0990	Feb 1.0990	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990	(40)
HLP (average)												1.0990	(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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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

Daily hot water use	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Total heat required for water heating calculated for each month												
WWHRS	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Total of WWHRS savings	-51.9738	-45.7315	-46.6743	-38.3942	-35.6456	-29.4029	-24.8794	-30.1249	-31.0062	-38.3355	-44.4143	-50.2368 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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Total per year (kWh/year) = Sum(64)m =												1295.3892 (64)
Heat gains from water heating, kWh/month	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (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	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5270	54.6477	44.4425	33.6459	25.1507	21.2333	22.9433	29.8225	40.0278	50.8244	59.3196	63.2370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.8874	416.1615	405.3909	382.4616	353.5174	326.3140	308.1404	303.8663	314.6369	337.5662	366.5104	393.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262 (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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Water heating gains (Table 5)	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
Total internal gains	666.6154	661.6621	635.8102	595.4546	553.7075	516.5235	494.9100	504.1174	527.4418	568.0296	613.2164	647.8136 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.9300	12.9236		0.4600	0.0000	0.7700		27.1447 (75)
Southeast					1.4400	40.4699		0.4600	0.0000	0.7700		20.6416 (77)
Southwest					9.8100	40.4699		0.4600	0.0000	0.7700		140.6209 (79)
Northwest					2.0200	12.9236		0.4600	0.0000	0.7700		9.2466 (81)
Northeast					5.6900	12.9236		0.4300	0.0000	0.7700		24.3475 (75)
Solar gains	222.0013	358.9476	534.2907	766.9112	911.4968	1003.1515	942.4184	825.8493	657.1216	437.8898	276.2782	185.7411 (83)
Total gains	888.6167	1020.6097	1170.1009	1362.3658	1465.2043	1519.6750	1437.3284	1329.9667	1184.5634	1005.9194	889.4946	833.5546 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
alpha	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
util living area	0.9608	0.9391	0.8873	0.7747	0.6055	0.3966	0.2657	0.2954	0.5575	0.8238	0.9340	0.9670 (86)
MIT	19.5434	19.7598	20.1536	20.5791	20.8607	20.9755	20.9955	20.9936	20.9213	20.5591	19.9813	19.4815 (87)
Th 2	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9535	0.9281	0.8673	0.7375	0.5469	0.3221	0.1813	0.2050	0.4773	0.7841	0.9199	0.9607 (89)
MIT 2	18.0917	18.3997	18.9531	19.5246	19.8703	19.9863	20.0003	19.9995	19.9417	19.5156	18.7215	18.0034 (90)
Living area fraction									fLA = Living area / (4) =			0.2245 (91)
MIT	18.4177	18.7051	19.2227	19.7614	20.0927	20.2084	20.2237	20.2227	20.1616	19.7499	19.0044	18.3353 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2677	18.5551	19.0727	19.6114	19.9427	20.0584	20.0737	20.0727	20.0116	19.5999	18.8544	18.1853 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	831.9744	926.3022	988.5039	982.7020	795.9606	496.0487	269.4259	281.3014	566.4242	769.9516	799.5587	787.5995 (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	1637.0665	1610.6345	1451.2006	1207.3630	863.1422	504.5609	270.2472	282.5552	598.2053	994.5872	1349.4665	1626.8247 (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												

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Space heating	598.9885	459.8713	344.2463	161.7559	49.9831	0.0000	0.0000	0.0000	0.0000	167.1289	395.9336	624.3836 (98)
Space heating per m2												2802.2913 (98)
											(98) / (4) =	24.7727 (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												3096.4544 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.9885	459.8713	344.2463	161.7559	49.9831	0.0000	0.0000	0.0000	0.0000	167.1289	395.9336	624.3836 (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)	661.8658	508.1451	380.3827	178.7358	55.2300	0.0000	0.0000	0.0000	0.0000	184.6728	437.4957	689.9266 (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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Efficiency of water heater (217)m	89.9208	89.8558	89.6672	89.2094	88.3179	87.3000	87.3000	87.3000	87.3000	89.1953	89.7503	87.3000 (216)
Fuel for water heating, kWh/month	142.0145	124.4289	130.2881	118.2239	117.0350	105.3634	101.9727	112.8987	112.9662	124.4172	130.2118	138.0748 (219)
Water heating fuel used												1457.8952 (219)
Annual totals kWh/year												
Space heating fuel - main system												3096.4544 (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)												76.6248 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												151.6248 (231)
Electricity for lighting (calculated in Appendix L)												434.6345 (232)
Total delivered energy for all uses												5140.6089 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3096.4544	3.9200	121.3810 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1457.8952	3.9200	57.1495 (247)
Mechanical ventilation fans	76.6248	16.9600	12.9956 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	434.6345	16.9600	73.7140 (250)
Additional standing charges			88.0000 (251)
Total energy cost			365.9601 (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	3096.4544	0.2160	668.8342 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1457.8952	0.2160	314.9054 (264)
Space and water heating			983.7395 (265)
Pumps and fans	151.6248	0.5190	78.6933 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Total kg/year			1288.0081 (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	3096.4544	1.2200	3777.6744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1457.8952	1.2200	1778.6321 (264)
Space and water heating			5556.3065 (265)
Pumps and fans	151.6248	3.0700	465.4882 (267)
Energy for lighting	434.6345	3.0700	1334.3278 (268)
Primary energy kWh/year			7356.1225 (272)
Primary energy kWh/m2/year			65.0294 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 8.4	-£ 309	-947 kg (73.5%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.8	-£ 22	-145 kg (11.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 8.37 kg/m²	A 95	A 96
Total Savings	£309 8.37 kg/m²		

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

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	£99	£99	£0
Mains gas	£267	£267	£0
Space heating	£235	£235	£0
Water heating	£57	£57	£0
Lighting	£74	£74	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£366	£57	£309
Total cost of uses	£366	£57	£309
Delivered energy	45 kWh/m²	29 kWh/m²	16 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.3 tonnes	0.9 tonnes
CO2 emissions per m²	11 kg/m²	3 kg/m²	8 kg/m²
Primary energy	65 kWh/m²	16 kWh/m²	50 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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.2000	1.1450	21.9847		(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000 (28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160 (29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400 (30)					
Total net area of external elements Aum(A, m2)			262.6300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	73.6078		(33)					
1F Timber			154.9000			9.0000	1394.1000 (32c)					
GF Masonry			34.4600			39.0000	1343.9400 (32c)					
GF Timber			62.1900			9.0000	559.7100 (32c)					
Internal Floor			56.5600			12.6000	712.6560 (32d)					
Internal Ceiling			56.5600			9.0000	509.0400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...	(30) + (32) + (32a)...	(32e) = 15736.9020 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478 (36)					
Total fabric heat loss						(33) + (36) =	79.1556 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 45.6781	Feb 45.2253	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688 (38)
Heat transfer coeff	124.8337	124.3809	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	(39)
Average = Sum(39)m / 12 =												124.3716 (39)
HLP	Jan 1.1036	Feb 1.0995	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990 (40)
HLP (average)												1.0995 (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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (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	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Total heat required for water heating calculated for each month												
WWHRS	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Total of WWHRS savings	-51.9738	-45.7315	-46.6743	-38.3942	-35.6456	-29.4029	-24.8794	-30.1249	-31.0062	-38.3355	-44.4143	-50.2368 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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Heat gains from water heating, kWh/month	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (65)
Total per year (kWh/year) = Sum(64)m =												1295.3892 (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	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5270	54.6477	44.4425	33.6459	25.1507	21.2333	22.9433	29.8225	40.0278	50.8244	59.3196	63.2370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.8874	416.1615	405.3909	382.4616	353.5174	326.3140	308.1404	303.8663	314.6369	337.5662	366.5104	393.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262 (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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Water heating gains (Table 5)	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
Total internal gains	666.6154	661.6621	635.8102	595.4546	553.7075	516.5235	494.9100	504.1174	527.4418	568.0296	613.2164	647.8136 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.9300	11.2829		0.4600	0.0000	0.7700		23.6988 (75)
Southeast					1.4400	36.7938		0.4600	0.0000	0.7700		18.7666 (77)
Southwest					9.8100	36.7938		0.4600	0.0000	0.7700		127.8476 (79)
Northwest					2.0200	11.2829		0.4600	0.0000	0.7700		8.0728 (81)
Northeast					5.6900	11.2829		0.4300	0.0000	0.7700		21.2566 (75)
Solar gains	199.6423	357.6785	536.1768	742.7686	903.5404	928.4911	882.0620	757.3056	606.9615	407.9256	242.3331	168.7767 (83)
Total gains	866.2578	1019.3407	1171.9871	1338.2232	1457.2478	1445.0146	1376.9720	1261.4230	1134.4033	975.9551	855.5495	816.5902 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0175	35.1450	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
alpha	3.3345	3.3430	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
util living area	0.9680	0.9457	0.9020	0.8126	0.6742	0.5143	0.3861	0.4352	0.6532	0.8643	0.9495	0.9732 (86)
MIT	19.3857	19.6532	20.0330	20.4593	20.7746	20.9318	20.9801	20.9703	20.8484	20.4170	19.8122	19.3217 (87)
Th 2	19.9979	20.0012	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9622	0.9362	0.8851	0.7815	0.6243	0.4448	0.3030	0.3477	0.5841	0.8338	0.9390	0.9683 (89)
MIT 2	17.8614	18.2462	18.7834	19.3665	19.7692	19.9470	19.9908	19.9842	19.8666	19.3270	18.4806	17.7716 (90)
Living area fraction									fLA = Living area / (4) =			0.2245 (91)
MIT	18.2037	18.5621	19.0640	19.6119	19.9950	20.1681	20.2129	20.2056	20.0871	19.5717	18.7796	18.1197 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0537	18.4121	18.9140	19.4619	19.8450	20.0181	20.0629	20.0556	19.9371	19.4217	18.6296	17.9697 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	820.0251	934.2560	1010.9432	1020.3314	897.4637	644.5367	424.4267	444.7994	657.1528	792.9770	786.8430	779.1573 (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	1716.9211	1680.6511	1543.3584	1313.0985	1012.6166	673.6064	430.5287	454.4848	725.6903	1096.7587	1433.4123	1711.9071 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

667.2906	501.5775	396.1169	210.7923	85.6738	0.0000	0.0000	0.0000	0.0000	226.0136	465.5299	693.9659 (98)
Space heating											3246.9605 (98)
Space heating per m2											(98) / (4) = 28.7037 (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		3587.8017 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	667.2906	501.5775	396.1169	210.7923	85.6738	0.0000	0.0000	0.0000	0.0000	226.0136	465.5299	693.9659 (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)	737.3377	554.2293	437.6982	232.9197	94.6672	0.0000	0.0000	0.0000	0.0000	249.7388	514.3977	766.8131 (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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Efficiency of water heater	89.9703	89.8993	89.7507	89.4071	88.7218	87.3000	87.3000	87.3000	87.3000	89.4206	89.8392	87.3000 (216)
Fuel for water heating, kWh/month	141.9364	124.3686	130.1669	117.9624	116.5022	105.3634	101.9727	112.8987	112.9662	124.1038	130.0829	138.0038 (219)
Water heating fuel used												1456.3282 (219)
Annual totals kWh/year												
Space heating fuel - main system												3587.8017 (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)	76.6248 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	151.6248 (231)
Electricity for lighting (calculated in Appendix L)	434.6345 (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		3903.1497 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3587.8017	3.4800	124.8555 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1456.3282	3.4800	50.6802 (247)
Mechanical ventilation fans	76.6248	13.1900	10.1068 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	434.6345	13.1900	57.3283 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			145.0404 (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] =	0.3853 (257)
SAP value		94.6257
SAP rating (Section 12)		95 (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	3587.8017	0.2160	774.9652 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1456.3282	0.2160	314.5669 (264)
Space and water heating			1089.5320 (265)
Pumps and fans	151.6248	0.5190	78.6933 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Total kg/year	497.3634 (272)
CO2 emissions per m2	4.4000 (273)
EI value	95.7851
EI rating	96 (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	56.5600 (1b)	x 2.3100 (2b)	= 130.6536 (1b) - (3b)
First floor	56.5600 (1c)	x 2.5300 (2c)	= 143.0968 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 273.7504 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			19.2000	1.1450	21.9847			(27)					
French Door (Uw = 1.40)			5.6900	1.3258	7.5436			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			56.5600	0.1100	6.2216	75.0000	4242.0000	(28a)					
100mm Knauf Supafil 34	149.5100	27.0400	122.4700	0.2500	30.6175	52.8000	6466.4160	(29a)					
Plane Ceiling-500mm Loft Roll	56.5600		56.5600	0.0900	5.0904	9.0000	509.0400	(30)					
Total net area of external elements Aum(A, m2)			262.6300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.6078			(33)					
1F Timber			154.9000			9.0000	1394.1000	(32c)					
GF Masonry			34.4600			39.0000	1343.9400	(32c)					
GF Timber			62.1900			9.0000	559.7100	(32c)					
Internal Floor			56.5600			12.6000	712.6560	(32d)					
Internal Ceiling			56.5600			9.0000	509.0400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15736.9020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							139.1169	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5478	(36)					
Total fabric heat loss						(33) + (36) =	79.1556	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 45.1688	Feb 45.1688	Mar 45.1688	Apr 45.1688	May 45.1688	Jun 45.1688	Jul 45.1688	Aug 45.1688	Sep 45.1688	Oct 45.1688	Nov 45.1688	Dec 45.1688	(38)
Heat transfer coeff	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	124.3244	(39)
Average = Sum(39)m / 12 =												124.3244	(39)
HLP	Jan 1.0990	Feb 1.0990	Mar 1.0990	Apr 1.0990	May 1.0990	Jun 1.0990	Jul 1.0990	Aug 1.0990	Sep 1.0990	Oct 1.0990	Nov 1.0990	Dec 1.0990	(40)
HLP (average)												1.0990	(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												2.8323 (42)
Average daily hot water use (litres/day)												101.4674 (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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	111.6142	107.5555	103.4968	99.4381	95.3794	91.3207	91.3207	95.3794	99.4381	103.4968	107.5555	111.6142 (44)
Energy conte	165.5206	144.7654	149.3849	130.2374	124.9659	107.8360	99.9259	114.6665	116.0360	135.2287	147.6127	160.2979 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	24.8281	21.7148	22.4077	19.5356	18.7449	16.1754	14.9889	17.2000	17.4054	20.2843	22.1419	24.0447 (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	14.1538	12.7727	14.1151	13.6236	14.0426	13.5491	13.9756	14.0190	13.5897	14.0811	13.6671	14.1413 (61)
Total heat required for water heating calculated for each month												
WWHRS	179.6744	157.5381	163.5000	143.8610	139.0085	121.3852	113.9015	128.6855	129.6257	149.3098	161.2798	174.4391 (62)
Total of WWHRS savings	-51.9738	-45.7315	-46.6743	-38.3942	-35.6456	-29.4029	-24.8794	-30.1249	-31.0062	-38.3355	-44.4143	-50.2368 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)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Total per year (kWh/year) = Sum(64)m =												1295.3892 (64)
Heat gains from water heating, kWh/month	58.5740	51.3277	53.1992	46.7098	45.0618	39.2428	36.7193	41.6314	41.9794	48.4838	52.4980	56.8344 (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	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388	169.9388 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.5270	54.6477	44.4425	33.6459	25.1507	21.2333	22.9433	29.8225	40.0278	50.8244	59.3196	63.2370 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	411.8874	416.1615	405.3909	382.4616	353.5174	326.3140	308.1404	303.8663	314.6369	337.5662	366.5104	393.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262	54.8262 (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)	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925	-113.2925 (71)
Water heating gains (Table 5)	78.7286	76.3805	71.5044	64.8748	60.5669	54.5038	49.3539	55.9561	58.3047	65.1664	72.9139	76.3903 (72)
Total internal gains	666.6154	661.6621	635.8102	595.4546	553.7075	516.5235	494.9100	504.1174	527.4418	568.0296	613.2164	647.8136 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W					
Northeast					5.9300	12.9236	0.4600	0.0000			0.7700	27.1447 (75)					
Southeast					1.4400	40.4699	0.4600	0.0000			0.7700	20.6416 (77)					
Southwest					9.8100	40.4699	0.4600	0.0000			0.7700	140.6209 (79)					
Northwest					2.0200	12.9236	0.4600	0.0000			0.7700	9.2466 (81)					
Northeast					5.6900	12.9236	0.4300	0.0000			0.7700	24.3475 (75)					
Solar gains					222.0013	358.9476	534.2907	766.9112	911.4968	1003.1515	942.4184	825.8493	657.1216	437.8898	276.2782	185.7411	(83)
Total gains					888.6167	1020.6097	1170.1009	1362.3658	1465.2043	1519.6750	1437.3284	1329.9667	1184.5634	1005.9194	889.4946	833.5546	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609	35.1609
alpha	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441	3.3441
util living area	0.9608	0.9391	0.8873	0.7747	0.6055	0.3966	0.2657	0.2954	0.5575	0.8238	0.9340	0.9670 (86)
MIT	19.5434	19.7598	20.1536	20.5791	20.8607	20.9755	20.9955	20.9936	20.9213	20.5591	19.9813	19.4815 (87)
Th 2	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016	20.0016 (88)
util rest of house	0.9535	0.9281	0.8673	0.7375	0.5469	0.3221	0.1813	0.2050	0.4773	0.7841	0.9199	0.9607 (89)
MIT 2	18.0917	18.3997	18.9531	19.5246	19.8703	19.9863	20.0003	19.9995	19.9417	19.5156	18.7215	18.0034 (90)
Living area fraction									fLA = Living area / (4) =			0.2245 (91)
MIT	18.4177	18.7051	19.2227	19.7614	20.0927	20.2084	20.2237	20.2227	20.1616	19.7499	19.0044	18.3353 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2677	18.5551	19.0727	19.6114	19.9427	20.0584	20.0737	20.0727	20.0116	19.5999	18.8544	18.1853 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	831.9744	926.3022	988.5039	982.7020	795.9606	496.0487	269.4259	281.3014	566.4242	769.9516	799.5587	787.5995 (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	1637.0665	1610.6345	1451.2006	1207.3630	863.1422	504.5609	270.2472	282.5552	598.2053	994.5872	1349.4665	1626.8247 (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												

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Space heating	598.9885	459.8713	344.2463	161.7559	49.9831	0.0000	0.0000	0.0000	0.0000	167.1289	395.9336	624.3836 (98)
Space heating per m2												2802.2913 (98)
												(98) / (4) = 24.7727 (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												3096.4544 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.9885	459.8713	344.2463	161.7559	49.9831	0.0000	0.0000	0.0000	0.0000	167.1289	395.9336	624.3836 (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)	661.8658	508.1451	380.3827	178.7358	55.2300	0.0000	0.0000	0.0000	0.0000	184.6728	437.4957	689.9266 (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	127.7006	111.8066	116.8257	105.4668	103.3629	91.9822	89.0221	98.5606	98.6195	110.9744	116.8655	124.2023 (64)
Efficiency of water heater (217)m	89.9208	89.8558	89.6672	89.2094	88.3179	87.3000	87.3000	87.3000	87.3000	89.1953	89.7503	87.3000 (216)
Fuel for water heating, kWh/month	142.0145	124.4289	130.2881	118.2239	117.0350	105.3634	101.9727	112.8987	112.9662	124.4172	130.2118	138.0748 (219)
Water heating fuel used												1457.8952 (219)
Annual totals kWh/year												
Space heating fuel - main system												3096.4544 (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)												76.6248 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												151.6248 (231)
Electricity for lighting (calculated in Appendix L)												434.6345 (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												3316.4493 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3096.4544	3.9200	121.3810 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1457.8952	3.9200	57.1495 (247)
Mechanical ventilation fans	76.6248	16.9600	12.9956 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	434.6345	16.9600	73.7140 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			56.5826 (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	3096.4544	0.2160	668.8342 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1457.8952	0.2160	314.9054 (264)
Space and water heating			983.7395 (265)
Pumps and fans	151.6248	0.5190	78.6933 (267)
Energy for lighting	434.6345	0.5190	225.5753 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			341.2692 (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	3096.4544	1.2200	3777.6744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

FULL SAP CALCULATION PRINTOUT

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Water heating (other fuel)	1457.8952	1.2200	1778.6321 (264)
Space and water heating			5556.3065 (265)
Pumps and fans	151.6248	3.0700	465.4882 (267)
Energy for lighting	434.6345	3.0700	1334.3278 (268)
Energy saving/generation technologies			
PV Unit			
Primary energy kWh/year	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/m2/year			15.5229 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	139.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	361.35 (P1)
Transmission heat loss coefficient	79.16 (37)
Summer heat loss coefficient	440.51 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.9300	98.8453	0.4600	0.0000	0.9000	242.6671
South East	1.4400	119.9223	0.4600	0.0000	0.9000	71.4929
South West	9.8100	119.9223	0.4600	0.0000	0.9000	487.0454
North West	2.0200	98.8453	0.4600	0.0000	0.9000	82.6623
North East	5.6900	98.8453	0.4300	0.0000	0.9000	217.6602
total:						1101.5280

	Jun	Jul	Aug	
Solar gains	1173	1102	965	(P4)
Internal gains	514	492	501	
Total summer gains	1686	1593	1466	(P5)
Summer gain/loss ratio	3.83	3.62	3.33	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 139.1)	1.03	1.03	1.03	
Threshold temperature	20.85	22.54	22.16	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			