

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X518 Det (ASHP+PV)				Issued on Date	15/12/2022
Assessment Reference	X518 Det (ASHP+PV)	Prop Type Ref	Birch			
Property	5 Bed, K, WC, U, B, 2En					
SAP Rating		90 B	DER	9.01	TER	22.41
Environmental		91 B	% DER<TER	59.80		
CO ₂ Emissions (t/year)		1.21	DFEE	43.16	TFEE	56.05
General Requirements Compliance		Pass	% DFEE<TFEE	23.00		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 168 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 22.41 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.01 kgCO₂/m²OK

1b TFEE and DFEE

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

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

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.56 kWh/day	
Permitted by DBSCG 2.24	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
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Based on:

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

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.020 W/m ² K
Photovoltaic array	1.20 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			30.3100	1.1450	34.7061			(27)					
French Door (Uw = 1.40)			7.3500	1.3258	9.7443			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			84.4100	0.1100	9.2851		6330.7500	(28a)					
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560	(29a)					
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900	(30)					
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200	(30)					
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800	(30)					
Total net area of external elements Aum(A, m2)			368.1500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488			(33)					
1F Timber			224.2900			9.0000	2018.6100	(32c)					
GF Masonry			93.7300			39.0000	3655.4700	(32c)					
GF Timber			81.2800			9.0000	731.5200	(32c)					
Internal Floor			83.2300			13.8000	1148.5740	(32d)					
Internal Ceiling			83.2300			9.0000	749.0700	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.0684	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261	(36)					
Total fabric heat loss						(33) + (36) =	110.8749	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0222	Feb 71.3083	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192	(38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	(39)
Average = Sum(39)m / 12 =												182.1685	(39)
HLP	Jan 1.0910	Feb 1.0868	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862	(40)
HLP (average)												1.0867	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy content (annual)	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Distribution loss	Total = Sum(45)m = 1643.9683 (45)												
	(46)m = 0.15 x (45)m												
	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	219.8211	193.6701	203.2055	181.8956	178.0600	158.8278	152.2752	167.4543	167.2717	188.6282	199.7878	214.4431	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings													-323.2853
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)
								Total per year (kWh/year) = Sum(64)m =				1902.0550	(64)
Heat gains from water heating, kWh/month													
	96.1742	85.2451	90.6495	82.8193	82.2886	75.1493	73.7152	78.7622	77.9569	85.8025	88.7685	94.3860	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	121.8407	115.0268	110.6030	104.3740	99.0795	105.8632	108.2734	115.3260	123.2895	126.8629	(72)
Total internal gains	566.0228	563.7484	544.8539	513.8560	481.4264	450.8743	431.4564	438.1010	454.3936	485.6302	521.5994	549.4960	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W	
Northeast					12.3500	11.2829	0.4600	0.0000				0.7700			49.3558 (75)	
Southeast					5.9000	36.7938	0.4600	0.0000				0.7700			76.8910 (77)	
Southwest					9.2300	36.7938	0.4600	0.0000				0.7700			120.2888 (79)	
Northwest					2.8300	11.2829	0.4600	0.0000				0.7700			11.3099 (81)	
Southwest					7.3500	36.7938	0.4300	0.0000				0.7700			89.5409 (79)	
Solar gains					347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains					913.4092	1175.6265	1435.5761	1707.2180	1899.9782	1895.1871	1808.9385	1642.0747	1449.0544	1176.3173	941.3579	844.4118 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9885	0.9733	0.9392	0.8609	0.7275	0.5642	0.4273	0.4838	0.7158	0.9154	0.9784	0.9911	(86)
Tweekday	17.5108	17.9641	18.5803	19.2531	19.7294	19.9443	19.9986	19.9899	19.8385	19.1713	18.1926	17.4204	
Tweekend	19.7975	19.9989	20.2768	20.5895	20.8258	20.9462	20.9842	20.9758	20.8773	20.5428	20.0989	19.7562	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.2926	19.4514	19.8839	20.3590	20.7311	20.9173	20.9756	20.9627	20.8085	20.2943	19.5929	19.0804	(87)
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9862	0.9681	0.9274	0.8346	0.6793	0.4918	0.3376	0.3899	0.6485	0.8933	0.9734	0.9893	(89)
Tweekday	17.5108	17.9641	18.5803	19.2531	19.7294	19.9443	19.9986	19.9899	19.8385	19.1713	18.1926	17.4204	
Tweekend	17.5108	17.9641	18.5803	19.2531	19.7294	19.9443	19.9986	19.9899	19.8385	19.1713	18.1926	17.4204	
MIT 2	17.5108	17.9641	18.5803	19.2531	19.7294	19.9443	19.9986	19.9899	19.8385	19.1713	18.1926	17.4204	(90)
Living area fraction									fLA = Living area / (4) =				0.0997 (91)
MIT	17.6885	18.1124	18.7103	19.3634	19.8293	20.0414	20.0961	20.0869	19.9353	19.2833	18.3322	17.5859	(92)
Temperature adjustment													0.0000
adjusted MIT	17.6885	18.1124	18.7103	19.3634	19.8293	20.0414	20.0961	20.0869	19.9353	19.2833	18.3322	17.5859	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9780	0.9540	0.9073	0.8143	0.6695	0.4941	0.3455	0.3973	0.6426	0.8725	0.9608	0.9825	(94)
Useful gains	893.3396	1121.5239	1302.5191	1390.2301	1272.0630	936.3582	624.9259	652.4044	931.2215	1026.2922	904.4632	829.6077	(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	2448.7192	2407.0835	2223.4303	1905.3266	1480.2956	990.8437	636.6139	671.3629	1062.5651	1581.1733	2045.3260	2437.5020	(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	1157.2024	863.8960	685.1579	370.8695	154.9251	0.0000	0.0000	0.0000	0.0000	412.8315	821.4212	1196.2734	(98)
Space heating												5662.5771	(98)
Space heating per m2												33.7782	(99)
												(98) / (4) =	

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 %)													266.4343	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													2125.3186	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1157.2024	863.8960	685.1579	370.8695	154.9251	0.0000	0.0000	0.0000	0.0000	412.8315	821.4212	1196.2734	(98)	
Space heating efficiency (main heating system 1)	266.4343	266.4343	266.4343	266.4343	266.4343	0.0000	0.0000	0.0000	0.0000	266.4343	266.4343	266.4343	(210)	
Space heating fuel (main heating system)	434.3294	324.2436	257.1583	139.1974	58.1476	0.0000	0.0000	0.0000	0.0000	154.9469	308.3016	448.9938	(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	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)	
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)	
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	107.9530	95.1341	100.3506	91.2065	90.0731	81.3182	79.3111	86.0920	85.6258	95.1859	99.2651	105.5007	(219)	
Water heating fuel used												1117.0161	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2125.3186	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													121.5431	(230a)
Total electricity for the above, kWh/year													121.5431	(231)
Electricity for lighting (calculated in Appendix L)													533.8788	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)	
Total delivered energy for all uses												2909.7374	(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	2125.3186	0.5190	1103.0403	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1117.0161	0.5190	579.7314	(264)
Space and water heating			1682.7717	(265)
Pumps and fans	121.5431	0.5190	63.0809	(267)
Energy for lighting	533.8788	0.5190	277.0831	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			1510.1537	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0100	(273)

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

DER		9.0100	ZC1
Total Floor Area		167.6400	
Assumed number of occupants		2.9594	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		11.9878	ZC2
CO2 emissions from cooking, equation (L16)		1.1335	ZC3
Total CO2 emissions		22.1314	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		22.1314	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3427 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4369	0.4283	0.4198	0.3769	0.3684	0.3255	0.3255	0.3170	0.3427	0.3684	0.3855	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			37.6600	1.3258	49.9280		(27)
FP McCann System			84.4100	0.1300	10.9733		(28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.1800	28.7136		(29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.1300	10.5833		(30)
Bay Plane	1.1800		1.1800	0.1300	0.1534		(30)
Sloping Ceiling	1.8200		1.8200	0.1300	0.2366		(30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.7382		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.7905 (36)
Total fabric heat loss						(33) + (36) =	118.5287 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	84.8141	84.2862	83.7687	81.3383	80.8835	78.7667	78.7667	78.3747	79.5821	80.8835	81.8034	82.7652 (38)
Heat transfer coeff	203.3428	202.8149	202.2974	199.8670	199.4123	197.2954	197.2954	196.9034	198.1108	199.4123	200.3322	201.2939 (39)
Average = Sum(39)m / 12 =												199.8648 (39)
HLP	1.2130	1.2098	1.2067	1.1922	1.1895	1.1769	1.1769	1.1746	1.1818	1.1895	1.1950	1.2008 (40)
HLP (average)												1.1922 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Energy content (annual)											Total = Sum(45)m =	1643.9683 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599 (46)
Water storage loss:												
Store volume												200.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):	1.6525 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8924 (55)
Total storage loss	
27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	
27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713	27.6637 (57)
Primary loss	23.2624 (59)
Total heat required for water heating calculated for each month	
221.3704 195.0695 204.7547 183.3948 179.6093 160.3271 153.8245 169.0035 168.7710 190.1775 201.2871 215.9923	(62)
Solar input	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	
221.3704 195.0695 204.7547 183.3948 179.6093 160.3271 153.8245 169.0035 168.7710 190.1775 201.2871 215.9923	(64)
Heat gains from water heating, kWh/month	
97.4136 86.3645 91.8889 84.0187 83.5280 76.3487 74.9546 80.0016 79.1563 87.0419 89.9679 95.6254	(65)

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

Metabolic gains (Table 5), Watts	
(66)m	147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701 147.9701
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
30.2304 26.8504 21.8362 16.5314 12.3574 10.4327 11.2729 14.6529 19.6671 24.9719 29.1459 31.0706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
339.1350 342.6542 333.7860 314.9067 291.0750 268.6766 253.7130 250.1939 259.0620 277.9413 301.7730 324.1715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970 37.7970	(69)
Pumps, fans	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	
-118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761 -118.3761	(71)
Water heating gains (Table 5)	
130.9323 128.5187 123.5066 116.6927 112.2689 106.0399 100.7454 107.5291 109.9393 116.9919 124.9554 128.5287	(72)
Total internal gains	
570.6887 568.4143 549.5198 518.5218 486.0923 455.5401 436.1223 442.7668 459.0594 490.2961 526.2653 554.1619	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.3500	11.2829	0.6300	0.7000	0.7700	42.5854 (75)
Southeast	5.9000	36.7938	0.6300	0.7000	0.7700	66.3436 (77)
Southwest	16.5800	36.7938	0.6300	0.7000	0.7700	186.4367 (79)
Northwest	2.8300	11.2829	0.6300	0.7000	0.7700	9.7584 (81)
Solar gains	305.1241	537.1258	781.1007	1045.2292	1241.3979	1263.4992
Total gains	875.8129	1105.5401	1330.6205	1563.7511	1727.4903	1719.0393

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	57.2514 57.4005 57.5473 58.2471 58.3799 59.0063 59.0063 59.1237 58.7634 58.3799 58.1118 57.8342
alpha	4.8168 4.8267 4.8365 4.8831 4.8920 4.9338 4.9338 4.9416 4.9176 4.8920 4.8741 4.8556
util living area	0.9989 0.9964 0.9879 0.9545 0.8583 0.6839 0.5179 0.5841 0.8419 0.9786 0.9973 0.9992 (86)
MIT	19.6037 19.8009 20.1024 20.4853 20.7932 20.9514 20.9899 20.9824 20.8627 20.4433 19.9486 19.5739 (87)
Th 2	19.9096 19.9121 19.9146 19.9262 19.9284 19.9385 19.9385 19.9404 19.9346 19.9284 19.9240 19.9194 (88)
util rest of house	0.9985 0.9952 0.9835 0.9373 0.8082 0.5903 0.3986 0.4600 0.7676 0.9676 0.9962 0.9990 (89)
MIT 2	18.0442 18.3339 18.7735 19.3252 19.7291 19.9071 19.9349 19.9334 19.8250 19.2772 18.5587 18.0073 (90)
Living area fraction	fLA = Living area / (4) = 0.0997 (91)
MIT	18.1997 18.4802 18.9061 19.4409 19.8352 20.0113 20.0402 20.0380 19.9285 19.3935 18.6973 18.1636 (92)
Temperature adjustment	0.0000
adjusted MIT	18.1997 18.4802 18.9061 19.4409 19.8352 20.0113 20.0402 20.0380 19.9285 19.3935 18.6973 18.1636 (93)

8. Space heating requirement

Utilisation	0.9976	0.9927	0.9776	0.9273	0.8032	0.5972	0.4104	0.4719	0.7671	0.9598	0.9941	0.9983 (94)
Useful gains	873.6703	1097.4230	1300.8337	1450.0371	1387.4673	1026.6092	673.5992	706.4217	1020.9297	1052.3130	889.6202	811.8332 (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	2826.4045	2754.2622	2509.7127	2106.7805	1622.2630	1067.6161	678.7297	716.3334	1154.6975	1753.5389	2323.3137	2810.7851 (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	1452.8343	1113.3960	899.4060	472.8552	174.6880	0.0000	0.0000	0.0000	0.0000	521.7120	1032.2593	1487.2202 (98)
Space heating												7154.3709 (98)
Space heating per m2												(98) / (4) = 42.6770 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7651.7336	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1452.8343	1113.3960	899.4060	472.8552	174.6880	0.0000	0.0000	0.0000	0.0000	521.7120	1032.2593	1487.2202	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1553.8335	1190.7978	961.9315	505.7275	186.8321	0.0000	0.0000	0.0000	0.0000	557.9808	1104.0206	1590.6098	(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	221.3704	195.0695	204.7547	183.3948	179.6093	160.3271	153.8245	169.0035	168.7710	190.1775	201.2871	215.9923	(64)	
Efficiency of water heater (217)m	88.9234	88.7264	88.3043	87.2313	84.7399	79.8000	79.8000	79.8000	79.8000	87.3704	88.5623	88.9869	(216)	
Fuel for water heating, kWh/month	248.9449	219.8551	231.8739	210.2397	211.9536	200.9112	192.7626	211.7839	211.4925	217.6681	227.2831	242.7238	(219)	
Water heating fuel used												2627.4923	(219)	
Annual totals kWh/year														
Space heating fuel - main system												7651.7336	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													533.8788	(232)
Total delivered energy for all uses													10888.1047	(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	7651.7336	0.2160	1652.7745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2627.4923	0.2160	567.5383 (264)
Space and water heating			2220.3128 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Total CO2, kg/m2/year			2536.3209 (272)
Emissions per m2 for space and water heating			13.2445 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.6528 (272b)
Emissions per m2 for pumps and fans			0.2322 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2445 * 1.55) + 1.6528 + 0.2322, rounded to 2 d.p.			22.4100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2932 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2932 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3738	0.3665	0.3591	0.3225	0.3152	0.2785	0.2785	0.2712	0.2932	0.3152	0.3298	0.3445 (22b)
Effective ac	0.5699	0.5671	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5593 (25)

3. Heat losses and heat loss parameter

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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	81.1701	80.7837	80.4050	78.6260	78.2931	76.7437	76.7437	76.4567	77.3405	78.2931	78.9665	79.6704 (38)
Average = Sum(39)m / 12 =	192.0450	191.6586	191.2799	189.5009	189.1680	187.6186	187.6186	187.3317	188.2154	189.1680	189.8414	190.5453 (39)
												189.4993 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1456	1.1433	1.1410	1.1304	1.1284	1.1192	1.1192	1.1175	1.1227	1.1284	1.1324	1.1366 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy content (annual)	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1643.9683 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.2194	31.6777	32.6886	28.4987	27.3452	23.5968	21.8659	25.0915	25.3911	29.5909	32.3008	35.0766 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	48.6820	47.1395	43.9363	39.5815	36.7543	32.7734	29.3897	33.7251	35.2655	39.7727	44.8622	47.1459	(72)
Total internal gains	485.4385	484.0351	466.9495	438.4107	407.5777	379.2736	361.7666	365.9629	381.3856	410.0770	443.1721	469.7791	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9660	0.9263	0.8405	0.6995	0.5201	0.3657	0.4216	0.6762	0.8977	0.9724	0.9885	(94)
Useful gains	820.3994	1058.6663	1257.6181	1371.4627	1277.4595	948.4770	636.1062	661.8238	930.5307	988.1217	839.1560	755.8711	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2667.6061	2606.9009	2380.6093	2001.7126	1538.9386	1017.6412	651.4969	686.6080	1097.0384	1665.7237	2201.0044	2656.0693	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1374.3217	1040.4136	835.5054	453.7799	194.5405	0.0000	0.0000	0.0000	0.0000	504.1359	980.5308	1413.7474	(98)
Space heating												6796.9754	(98)
Space heating per m2												(98) / (4) =	40.5451 (99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1763.6148	1388.3776	1423.7206	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8554	0.9050	0.8762	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1508.6415	1256.4370	1247.4480	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2262.9265	2161.1958	1965.9269	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	543.0852	673.1406	534.5483	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1750.7740 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	135.7713	168.2851	133.6371	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													437.6935 (107)
Energy for space heating													2.6109 (108)
Energy for space cooling													40.5451 (99)
Total													2.6109 (108)
Dwelling Fabric Energy Efficiency (DFEE)													43.1560 (109)
													43.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.0927 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3427 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4369	0.4283	0.4198	0.3769	0.3684	0.3255	0.3255	0.3170	0.3427	0.3684	0.3855	0.4026 (22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5811 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			37.6600	1.3258	49.9280		(27)
FP McCann System			84.4100	0.1300	10.9733		(28a)
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.1800	28.7136		(29a)
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.1300	10.5833		(30)
Bay Plane	1.1800		1.1800	0.1300	0.1534		(30)
Sloping Ceiling	1.8200		1.8200	0.1300	0.2366		(30)
Total net area of external elements Aum(A, m ²)			368.1500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.7382		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.7905 (36)
Total fabric heat loss						(33) + (36) =	118.5287 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	84.8141	84.2862	83.7687	81.3383	80.8835	78.7667	78.7667	78.3747	79.5821	80.8835	81.8034	82.7652 (38)
Heat transfer coeff	203.3428	202.8149	202.2974	199.8670	199.4123	197.2954	197.2954	196.9034	198.1108	199.4123	200.3322	201.2939 (39)
Average = Sum(39)m / 12 =												199.8648 (39)
HLP	1.2130	1.2098	1.2067	1.1922	1.1895	1.1769	1.1769	1.1746	1.1818	1.1895	1.1950	1.2008 (40)
HLP (average)												1.1922 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9594 (42)
Average daily hot water use (litres/day)												104.4858 (43)
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344 (44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663 (45)
Energy content (annual)												1643.9683 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	36.2194	31.6777	32.6886	28.4987	27.3452	23.5968	21.8659	25.0915	25.3911	29.5909	32.3008	35.0766 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701	147.9701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.2304	26.8504	21.8362	16.5314	12.3574	10.4327	11.2729	14.6529	19.6671	24.9719	29.1459	31.0706 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	339.1350	342.6542	333.7860	314.9067	291.0750	268.6766	253.7130	250.1939	259.0620	277.9413	301.7730	324.1715 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970	37.7970 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761 (71)
Water heating gains (Table 5)	48.6820	47.1395	43.9363	39.5815	36.7543	32.7734	29.3897	33.7251	35.2655	39.7727	44.8622	47.1459 (72)
Total internal gains	485.4385	484.0351	466.9495	438.4107	407.5777	379.2736	361.7666	365.9629	381.3856	410.0770	443.1721	469.7791 (73)

6. Solar gains

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

Solar gains	305.1241	537.1258	781.1007	1045.2292	1241.3979	1263.4992	1205.2146	1054.1126	871.8217	606.0902	368.6346	259.0739 (83)
Total gains	790.5626	1021.1609	1248.0502	1483.6399	1648.9757	1642.7728	1566.9812	1420.0755	1253.2073	1016.1672	811.8068	728.8529 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.2514	57.4005	57.5473	58.2471	58.3799	59.0063	59.0063	59.1237	58.7634	58.3799	58.1118	57.8342
alpha	4.8168	4.8267	4.8365	4.8831	4.8920	4.9338	4.9338	4.9416	4.9176	4.8920	4.8741	4.8556
util living area	0.9993	0.9975	0.9907	0.9623	0.8751	0.7072	0.5402	0.6109	0.8650	0.9842	0.9983	0.9995 (86)
MIT	19.5567	19.7549	20.0591	20.4492	20.7711	20.9437	20.9879	20.9787	20.8424	20.4027	19.9030	19.5272 (87)
Th 2	19.9096	19.9121	19.9146	19.9262	19.9284	19.9385	19.9385	19.9404	19.9346	19.9284	19.9240	19.9194 (88)
util rest of house	0.9991	0.9966	0.9872	0.9476	0.8282	0.6135	0.4169	0.4834	0.7958	0.9758	0.9975	0.9994 (89)
MIT 2	18.5891	18.7888	19.0931	19.4826	19.7754	19.9132	19.9355	19.9344	19.8462	19.4452	18.9464	18.5673 (90)
Living area fraction									fLA = Living area / (4) =			0.0997 (91)
MIT	18.6856	18.8852	19.1894	19.5790	19.8747	20.0160	20.0405	20.0386	19.9456	19.5407	19.0418	18.6630 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6856	18.8852	19.1894	19.5790	19.8747	20.0160	20.0405	20.0386	19.9456	19.5407	19.0418	18.6630 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9987	0.9954	0.9841	0.9415	0.8255	0.6209	0.4292	0.4959	0.7966	0.9715	0.9966	0.9991 (94)
Ext temp.	789.5050	1016.4303	1228.1547	1396.8256	1361.1813	1020.0211	672.5499	704.1628	998.3176	987.1825	809.0371	728.1965 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2925.2009	2836.3992	2567.0374	2134.3815	1630.1293	1068.5488	678.7969	716.4504	1158.0760	1782.8889	2392.3312	2911.3207 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1588.9577	1223.0191	996.1287	531.0403	200.0973	0.0000	0.0000	0.0000	0.0000	592.0056	1139.9718	1624.2444 (98)
Space heating per m2										(98) / (4) =		47.0977 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1854.5769	1459.9861	1496.4659	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8705	0.9277	0.8968	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1614.4363	1354.4878	1342.0484	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2051.5859	1959.8443	1790.7646	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2005 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2005 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192 (38)
Heat transfer coeff	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.0942 (39)
HLP	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862 (40)
HLP (average)												1.0862 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)	Total = Sum (45)m =												1643.9683 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.8211	193.6701	203.2055	181.8956	178.0600	158.8278	152.2752	167.4543	167.2717	188.6282	199.7878	214.4431	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	219.8211	193.6701	203.2055	181.8956	178.0600	158.8278	152.2752	167.4543	167.2717	188.6282	199.7878	214.4431	(64)
RHI water heating demand													2225.3403 (64)
Heat gains from water heating, kWh/month	96.1742	85.2451	90.6495	82.8193	82.2886	75.1493	73.7152	78.7622	77.9569	85.8025	88.7685	94.3860	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
(66)m	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	121.8407	115.0268	110.6030	104.3740	99.0795	105.8632	108.2734	115.3260	123.2895	126.8629	(72)
Total internal gains	825.9180	820.3068	789.5231	741.2692	690.8407	646.3693	620.8417	630.8229	659.0047	707.4973	761.4655	803.2813	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				12.3500	12.9236		0.4600		0.0000		0.7700		56.5324 (75)
Southeast				5.9000	40.4699		0.4600		0.0000		0.7700		84.5732 (77)
Southwest				9.2300	40.4699		0.4600		0.0000		0.7700		132.3069 (79)
Northwest				2.8300	12.9236		0.4600		0.0000		0.7700		12.9544 (81)
Southwest				7.3500	40.4699		0.4300		0.0000		0.7700		98.4870 (79)
Solar gains	384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418	(83)
Total gains	1210.7719	1431.5021	1672.2597	1967.0115	2115.8215	2201.1243	2086.8192	1937.4083	1729.9274	1445.1775	1238.1068	1126.7231	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9699	0.9483	0.8972	0.7843	0.6145	0.4016	0.2682	0.2973	0.5610	0.8344	0.9450	0.9755	(86)
Tweekday	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555	
Tweekend	20.0368	20.1903	20.4536	20.7321	20.9124	20.9851	20.9974	20.9962	20.9521	20.7169	20.3299	19.9947	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.6324	19.7475	20.1568	20.5818	20.8648	20.9772	20.9959	20.9942	20.9251	20.5631	19.9537	19.4484	(87)
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)
util rest of house	0.9641	0.9387	0.8783	0.7477	0.5559	0.3268	0.1838	0.2071	0.4809	0.7958	0.9327	0.9706	(89)
Tweekday	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555	
Tweekend	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555	
MIT 2	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555	(90)
Living area fraction	fLA = Living area / (4) =												0.0997 (91)
MIT	18.2069	18.5238	19.0814	19.6458	19.9822	20.0955	20.1091	20.1084	20.0525	19.6313	18.8275	18.1044	(92)
Temperature adjustment													0.0000
adjusted MIT	18.2069	18.5238	19.0814	19.6458	19.9822	20.0955	20.1091	20.1084	20.0525	19.6313	18.8275	18.1044	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9492	0.9196	0.8567	0.7325	0.5540	0.3332	0.1922	0.2160	0.4843	0.7784	0.9132	0.9571	(94)
Useful gains	1149.2257	1316.4066	1432.5697	1440.8647	1172.1745	733.5129	401.1074	418.5741	837.8875	1124.9826	1130.6500	1078.4132	(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													
	2386.6918	2353.3439	2127.1206	1774.6467	1271.4140	745.7602	402.2693	420.3399	883.6156	1462.4616	1971.6247	2368.0310	(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													
	920.6748	696.8219	516.7459	240.3230	73.8342	0.0000	0.0000	0.0000	0.0000	251.0844	605.5018	959.4756	(98)
Space heating												4264.4616	(98)
RHI space heating demand												4264	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			30.3100	1.1450	34.7061			(27)					
French Door (Uw = 1.40)			7.3500	1.3258	9.7443			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			84.4100	0.1100	9.2851		6330.7500	(28a)					
100mm Knauf Supafil 34	199.3300	39.8100	159.5200	0.2500	39.8800	52.8000	8422.6560	(29a)					
Plane Ceiling-500mm Loft Roll	81.4100		81.4100	0.0900	7.3269	9.0000	732.6900	(30)					
Bay Plane	1.1800		1.1800	0.1400	0.1652	9.0000	10.6200	(30)					
Sloping Ceiling	1.8200		1.8200	0.1600	0.2912	9.0000	16.3800	(30)					
Total net area of external elements Aum(A, m2)			368.1500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.5488			(33)					
1F Timber			224.2900			9.0000	2018.6100	(32c)					
GF Masonry			93.7300			39.0000	3655.4700	(32c)					
GF Timber			81.2800			9.0000	731.5200	(32c)					
Internal Floor			83.2300			13.8000	1148.5740	(32d)					
Internal Ceiling			83.2300			9.0000	749.0700	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23816.3400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.0684	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3261	(36)					
Total fabric heat loss						(33) + (36) =	110.8749	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 72.0222	Feb 71.3083	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192	(38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	(39)
Average = Sum(39)m / 12 =												182.1685	(39)
HLP	Jan 1.0910	Feb 1.0868	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862	(40)
HLP (average)												1.0867	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
WWHRS	219.8211	193.6701	203.2055	181.8956	178.0600	158.8278	152.2752	167.4543	167.2717	188.6282	199.7878	214.4431	(62)
Total of WWHRS savings	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
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	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)
Heat gains from water heating, kWh/month	96.1742	85.2451	90.6495	82.8193	82.2886	75.1493	73.7152	78.7622	77.9569	85.8025	88.7685	94.3860	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	121.8407	115.0268	110.6030	104.3740	99.0795	105.8632	108.2734	115.3260	123.2895	126.8629	(72)
Total internal gains	825.9180	820.3068	789.5231	741.2692	690.8407	646.3693	620.8417	630.8229	659.0047	707.4973	761.4655	803.2813	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829	0.4600	0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938	0.4600	0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938	0.4600	0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829	0.4600	0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938	0.4300	0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains	1173.3043	1432.1849	1680.2453	1934.6312	2109.3925	2090.6821	1998.3238	1834.7967	1653.6656	1398.1844	1181.2240	1098.1971 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309		
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221		
util living area	0.9761	0.9540	0.9104	0.8213	0.6827	0.5213	0.3902	0.4390	0.6584	0.8745	0.9593	0.9805	(86)	
Tweekday	17.8136	18.2383	18.7980	19.3865	19.7859	19.9599	20.0021	19.9959	19.8831	19.3376	18.4543	17.7213		
Tweekend	19.9329	20.1232	20.3784	20.6561	20.8581	20.9577	20.9880	20.9820	20.9062	20.6244	20.2176	19.8905		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0		
MIT	19.4849	19.6437	20.0407	20.4631	20.7811	20.9351	20.9815	20.9723	20.8535	20.4204	19.7783	19.2877	(87)	
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)	
util rest of house	0.9716	0.9457	0.8945	0.7909	0.6330	0.4517	0.3070	0.3515	0.5895	0.8454	0.9505	0.9768	(89)	
Tweekday	17.8136	18.2383	18.7980	19.3865	19.7859	19.9599	20.0021	19.9959	19.8831	19.3376	18.4543	17.7213		
Tweekend	17.8136	18.2383	18.7980	19.3865	19.7859	19.9599	20.0021	19.9959	19.8831	19.3376	18.4543	17.7213		
MIT 2	17.8136	18.2383	18.7980	19.3865	19.7859	19.9599	20.0021	19.9959	19.8831	19.3376	18.4543	17.7213	(90)	
Living area fraction									fLA = Living area / (4) =			0.0997	(91)	
MIT	17.9803	18.3785	18.9219	19.4939	19.8851	20.0571	20.0998	20.0933	19.9799	19.4456	18.5863	17.8776	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.9803	18.3785	18.9219	19.4939	19.8851	20.0571	20.0998	20.0933	19.9799	19.4456	18.5863	17.8776	(93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9584	0.9274	0.8729	0.7727	0.6261	0.4550	0.3145	0.3590	0.5871	0.8252	0.9331	0.9651	(94)
Useful gains	1124.5257	1328.2159	1466.6473	1494.9853	1320.6720	951.2234	628.5398	658.6320	970.8026	1153.7977	1102.1414	1059.9189	(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	2502.0856	2455.5535	2261.9547	1929.0874	1490.4642	993.7094	637.2865	672.5316	1070.6933	1610.7378	2091.5957	2490.6024	(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	1024.9046	757.5709	591.7087	312.5535	126.3254	0.0000	0.0000	0.0000	0.0000	339.9634	712.4071	1064.4285	(98)
Space heating												4929.8621	(98)
Space heating per m2												29.4074	(99)
												(98) / (4) =	

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 %)													266.4343 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1850.3108 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1024.9046	757.5709	591.7087	312.5535	126.3254	0.0000	0.0000	0.0000	0.0000	339.9634	712.4071	1064.4285	(98)
Space heating efficiency (main heating system 1)	266.4343	266.4343	266.4343	266.4343	266.4343	0.0000	0.0000	0.0000	0.0000	266.4343	266.4343	266.4343	(210)
Space heating fuel (main heating system)	384.6744	284.3369	222.0843	117.3098	47.4133	0.0000	0.0000	0.0000	0.0000	127.5975	267.3857	399.5089	(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	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	107.9530	95.1341	100.3506	91.2065	90.0731	81.3182	79.3111	86.0920	85.6258	95.1859	99.2651	105.5007	(219)
Water heating fuel used												1117.0161	(219)
Annual totals kWh/year													
Space heating fuel - main system												1850.3108	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													121.5431 (230a)
Total electricity for the above, kWh/year													121.5431 (231)
Electricity for lighting (calculated in Appendix L)													533.8788 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)
Total delivered energy for all uses												2634.7296	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1850.3108	13.1900	244.0560	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1117.0161	13.1900	147.3344	(247)
Mechanical ventilation fans	121.5431	13.1900	16.0315	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	533.8788	13.1900	70.4186	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			347.5208	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.6864 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	90.4245
SAP rating (Section 12)		90 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1850.3108	0.5190	960.3113 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1117.0161	0.5190	579.7314 (264)
Space and water heating			1540.0427 (265)
Pumps and fans	121.5431	0.5190	63.0809 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			1367.4247 (272)
CO2 emissions per m2			8.1600 (273)
EI value			91.3829
EI rating			91 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.6643 = 4.951$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.6643 = 0.1948$, stars = 5
Water heating energy efficiency	$13.19 / 1.7028 = 7.746$, stars = 3
Water heating environmental impact	$0.519 / 1.7028 = 0.3048$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2005 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2005 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

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

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192	71.2192 (38)
Average = Sum(39)m / 12 =	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
HLP	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862	1.0862 (40)
HLP (average)												1.0862 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
WWHRS	219.8211	193.6701	203.2055	181.8956	178.0600	158.8278	152.2752	167.4543	167.2717	188.6282	199.7878	214.4431	(62)
Total of WWHRS savings	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
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	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)
Heat gains from water heating, kWh/month	96.1742	85.2451	90.6495	82.8193	82.2886	75.1493	73.7152	78.7622	77.9569	85.8025	88.7685	94.3860	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	121.8407	115.0268	110.6030	104.3740	99.0795	105.8632	108.2734	115.3260	123.2895	126.8629	(72)
Total internal gains	825.9180	820.3068	789.5231	741.2692	690.8407	646.3693	620.8417	630.8229	659.0047	707.4973	761.4655	803.2813	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					12.3500	12.9236		0.4600	0.0000	0.7700		56.5324 (75)				
Southeast					5.9000	40.4699		0.4600	0.0000	0.7700		84.5732 (77)				
Southwest					9.2300	40.4699		0.4600	0.0000	0.7700		132.3069 (79)				
Northwest					2.8300	12.9236		0.4600	0.0000	0.7700		12.9544 (81)				
Southwest					7.3500	40.4699		0.4300	0.0000	0.7700		98.4870 (79)				
Solar gains					384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418 (83)
Total gains					1210.7719	1431.5021	1672.2597	1967.0115	2115.8215	2201.1243	2086.8192	1937.4083	1729.9274	1445.1775	1238.1068	1126.7231 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309		
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221		
util living area	0.9699	0.9483	0.8972	0.7843	0.6145	0.4016	0.2682	0.2973	0.5610	0.8344	0.9450	0.9755	(86)	
Tweekday	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555		
Tweekend	20.0368	20.1903	20.4536	20.7321	20.9124	20.9851	20.9974	20.9962	20.9521	20.7169	20.3299	19.9947		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0		
MIT	19.6324	19.7475	20.1568	20.5818	20.8648	20.9772	20.9959	20.9942	20.9251	20.5631	19.9537	19.4484	(87)	
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	(88)	
util rest of house	0.9641	0.9387	0.8783	0.7477	0.5559	0.3268	0.1838	0.2071	0.4809	0.7958	0.9327	0.9706	(89)	
Tweekday	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555		
Tweekend	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555		
MIT 2	18.0490	18.3882	18.9623	19.5421	19.8844	19.9978	20.0109	20.0102	19.9558	19.5281	18.7027	17.9555	(90)	
Living area fraction														
MIT	18.2069	18.5238	19.0814	19.6458	19.9822	20.0955	20.1091	20.1084	20.0525	19.6313	18.8275	18.1044	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.2069	18.5238	19.0814	19.6458	19.9822	20.0955	20.1091	20.1084	20.0525	19.6313	18.8275	18.1044	(93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9492	0.9196	0.8567	0.7325	0.5540	0.3332	0.1922	0.2160	0.4843	0.7784	0.9132	0.9571	(94)
Useful gains	1149.2257	1316.4066	1432.5697	1440.8647	1172.1745	733.5129	401.1074	418.5741	837.8875	1124.9826	1130.6500	1078.4132	(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	2386.6918	2353.3439	2127.1206	1774.6467	1271.4140	745.7602	402.2693	420.3399	883.6156	1462.4616	1971.6247	2368.0310	(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	920.6748	696.8219	516.7459	240.3230	73.8342	0.0000	0.0000	0.0000	0.0000	251.0844	605.5018	959.4756	(98)
Space heating												4264.4616	(98)
Space heating per m2												25.4382	(99)
												(98) / (4) =	

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 %)													266.4190 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1600.6600 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.6748	696.8219	516.7459	240.3230	73.8342	0.0000	0.0000	0.0000	0.0000	251.0844	605.5018	959.4756	(98)
Space heating efficiency (main heating system 1)	266.4190	266.4190	266.4190	266.4190	266.4190	0.0000	0.0000	0.0000	0.0000	266.4190	266.4190	266.4190	(210)
Space heating fuel (main heating system)	345.5741	261.5512	193.9599	90.2049	27.7136	0.0000	0.0000	0.0000	0.0000	94.2442	227.2743	360.1379	(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	183.8224	161.9944	170.8771	155.3064	153.3764	138.4686	135.0510	146.5975	145.8036	162.0825	169.0287	179.6465	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	107.9530	95.1341	100.3506	91.2065	90.0731	81.3182	79.3111	86.0920	85.6258	95.1859	99.2651	105.5007	(219)
Water heating fuel used												1117.0161	(219)
Annual totals kWh/year													
Space heating fuel - main system												1600.6600	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													121.5431 (230a)
Total electricity for the above, kWh/year													121.5431 (231)
Electricity for lighting (calculated in Appendix L)													533.8788 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =										-1046.8728		-1046.8728	(233)
Total delivered energy for all uses												2326.2253	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1600.6600	16.9600	271.4719 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1117.0161	16.9600	189.4459 (247)
Mechanical ventilation fans	121.5431	16.9600	20.6137 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	533.8788	16.9600	90.5459 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			394.5278 (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	1600.6600	0.5190	830.7425 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1117.0161	0.5190	579.7314 (264)
Space and water heating			1410.4739 (265)
Pumps and fans	121.5431	0.5190	63.0809 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year 1207.3109 (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	1600.6600	3.0700	4914.0262 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1117.0161	3.0700	3429.2395 (264)
Space and water heating			8343.2656 (265)
Pumps and fans	121.5431	3.0700	373.1373 (267)
Energy for lighting	533.8788	3.0700	1639.0080 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			7141.5116 (272)
Primary energy kWh/m2/year			42.6003 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 90
Current environmental impact rating: B 91

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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
N Solar water heating	+ 1.6	-£ 76	-232 kg (19.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76 1.38 kg/m²	A 92	A 93
Total Savings	£76 1.38 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£572	£496	£76
Space heating	£292	£292	-£0
Water heating	£189	£113	£76
Lighting	£91	£91	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£394	£318	£76
Total cost of uses	£394	£318	£76
Delivered energy	14 kWh/m²	11 kWh/m²	3 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	7 kg/m²	6 kg/m²	1 kg/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Primary energy	43 kWh/m ²	34 kWh/m ²	8 kWh/m ²
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

(38)m	Jan 72.0222	Feb 71.3083	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192 (38)
Heat transfer coeff	182.8972	182.1832	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.1685 (39)
HLP	Jan 1.0910	Feb 1.0868	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862 (40)
HLP (average)												1.0867 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)	Total = Sum (45)m =												1643.9683 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.8211	193.6701	201.8097	175.1420	165.2657	146.2211	139.2483	155.3578	161.8688	187.2324	199.7878	214.4431	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings													-323.2853
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1079.5246 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1813.6014 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.3732 (H8)
Utilisation factor													0.5172 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													104.4858 (H14)
Volume ratio Veff/V													0.7178 (H15)
Solar storage volume factor													0.9337 (H16)
Solar input													-770.1210 (H17)
Solar input	-22.3320	-37.2656	-63.4677	-85.0592	-105.0834	-103.3138	-101.9484	-89.0729	-69.7619	-47.6392	-26.4889	-18.6880	(63)
Output from w/h	161.4904	124.7288	106.0137	63.4936	35.4987	22.5481	20.0756	45.4282	70.6388	113.0476	142.5398	160.9585	(64)
Heat gains from water heating, kWh/month	96.1742	85.2451	89.5329	77.4164	72.0532	65.0639	63.2936	69.0850	73.6346	84.6859	88.7685	94.3860	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	120.3399	107.5228	96.8456	90.3665	85.0721	92.8562	102.2702	113.8252	123.2895	126.8629	(72)
Total internal gains	825.9180	820.3068	788.0223	733.7652	677.0834	632.3618	606.8342	617.8160	653.0015	705.9965	761.4655	803.2813	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				12.3500	11.2829	0.4600	0.0000		0.7700		49.3558 (75)	
Southeast				5.9000	36.7938	0.4600	0.0000		0.7700		76.8910 (77)	
Southwest				9.2300	36.7938	0.4600	0.0000		0.7700		120.2888 (79)	
Northwest				2.8300	11.2829	0.4600	0.0000		0.7700		11.3099 (81)	
Southwest				7.3500	36.7938	0.4300	0.0000		0.7700		89.5409 (79)	
Solar gains	347.3864	611.8782	890.7222	1193.3620	1418.5518	1444.3128	1377.4821	1203.9738	994.6609	690.6871	419.7584	294.9158 (83)
Total gains	1173.3043	1432.1849	1678.7445	1927.1272	2095.6351	2076.6746	1984.3163	1821.7898	1647.6624	1396.6836	1181.2240	1098.1971 (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	36.1714	36.3132	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4114	3.4209	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9761	0.9540	0.9106	0.8226	0.6855	0.5242	0.3928	0.4418	0.6600	0.8748	0.9593	0.9805	(86)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	17.8136	18.2383	18.7967	19.3825	19.7826	19.9589	20.0019	19.9956	19.8820	19.3366	18.4543	17.7213
Tweekend	19.9329	20.1232	20.3778	20.6541	20.8562	20.9570	20.9878	20.9817	20.9054	20.6239	20.2176	19.8905
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0
MIT	19.4849	19.6437	20.0397	20.4599	20.7781	20.9340	20.9811	20.9717	20.8524	20.4196	19.7783	19.2877 (87)
Th 2	20.0082	20.0117	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121 (88)
util rest of house	0.9716	0.9457	0.8947	0.7923	0.6359	0.4544	0.3090	0.3539	0.5911	0.8457	0.9505	0.9768 (89)
Tweekday	17.8136	18.2383	18.7967	19.3825	19.7826	19.9589	20.0019	19.9956	19.8820	19.3366	18.4543	17.7213
Tweekend	17.8136	18.2383	18.7967	19.3825	19.7826	19.9589	20.0019	19.9956	19.8820	19.3366	18.4543	17.7213
MIT 2	17.8136	18.2383	18.7967	19.3825	19.7826	19.9589	20.0019	19.9956	19.8820	19.3366	18.4543	17.7213 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	17.9803	18.3785	18.9207	19.4900	19.8819	20.0561	20.0995	20.0930	19.9788	19.4446	18.5863	17.8776 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9803	18.3785	18.9207	19.4900	19.8819	20.0561	20.0995	20.0930	19.9788	19.4446	18.5863	17.8776 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9584	0.9274	0.8731	0.7741	0.6288	0.4576	0.3166	0.3613	0.5886	0.8255	0.9331	0.9651 (94)
Useful gains	1124.5257	1328.2159	1465.7035	1491.8114	1317.8132	950.3015	628.3151	658.2830	969.8108	1153.0118	1102.1414	1059.9189 (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	2502.0856	2455.5535	2261.7339	1928.3749	1489.8727	993.5328	637.2448	672.4663	1070.4925	1610.5573	2091.5957	2490.6024 (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	1024.9046	757.5709	592.2466	314.3257	128.0123	0.0000	0.0000	0.0000	0.0000	340.4138	712.4071	1064.4285 (98)
Space heating												4934.3096 (98)
Space heating per m2												(98) / (4) = 29.4340 (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 %)												266.4343 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1851.9801 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1024.9046	757.5709	592.2466	314.3257	128.0123	0.0000	0.0000	0.0000	0.0000	340.4138	712.4071	1064.4285 (98)
Space heating efficiency (main heating system 1)	266.4343	266.4343	266.4343	266.4343	266.4343	0.0000	0.0000	0.0000	0.0000	266.4343	266.4343	266.4343 (210)
Space heating fuel (main heating system)	384.6744	284.3369	222.2862	117.9750	48.0465	0.0000	0.0000	0.0000	0.0000	127.7665	267.3857	399.5089 (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	161.4904	124.7288	106.0137	63.4936	35.4987	22.5481	20.0756	45.4282	70.6388	113.0476	142.5398	160.9585 (64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (217)
Fuel for water heating, kWh/month	94.8382	73.2492	62.2584	37.2878	20.8472	13.2418	11.7897	26.6785	41.4839	66.3892	83.7090	94.5258 (219)
Water heating fuel used												626.2988 (219)
Annual totals kWh/year												
Space heating fuel - main system												1851.9801 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												121.5431 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												171.5431 (231)
Electricity for lighting (calculated in Appendix L)												533.8788 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =									-988.0192			-988.0192 (233)
Total delivered energy for all uses												2195.6816 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1851.9801	13.1900	244.2762 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	626.2988	13.1900	82.6088 (247)
Mechanical ventilation fans	121.5431	13.1900	16.0315 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	533.8788	13.1900	70.4186 (250)
Additional standing charges			0.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-988.0192	13.1900	-130.3197 (252)
Total energy cost			289.6104 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		$[(255) \times (256)] / [(4) + 45.0] =$	0.5720 (257)
SAP value			92.0202
SAP rating (Section 12)			92 (258)
SAP band			A

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	1851.9801	0.5190	961.1776 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	626.2988	0.5190	325.0491 (264)
Space and water heating			1286.2267 (265)
Pumps and fans	171.5431	0.5190	89.0309 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			1139.5587 (272)
CO ₂ emissions per m ²			6.8000 (273)
EI value			92.8188
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

3. Heat losses and heat loss parameter

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

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

(38)m	Jan 71.2192	Feb 71.2192	Mar 71.2192	Apr 71.2192	May 71.2192	Jun 71.2192	Jul 71.2192	Aug 71.2192	Sep 71.2192	Oct 71.2192	Nov 71.2192	Dec 71.2192 (38)
Heat transfer coeff	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942	182.0942 (39)
Average = Sum(39)m / 12 =												182.0942 (39)
HLP	Jan 1.0862	Feb 1.0862	Mar 1.0862	Apr 1.0862	May 1.0862	Jun 1.0862	Jul 1.0862	Aug 1.0862	Sep 1.0862	Oct 1.0862	Nov 1.0862	Dec 1.0862 (40)
HLP (average)												1.0862 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9594 (42)
Average daily hot water use (litres/day)	104.4858 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.9344	110.7549	106.5755	102.3961	98.2166	94.0372	94.0372	98.2166	102.3961	106.5755	110.7549	114.9344	(44)
Energy conte	170.4443	149.0717	153.8287	134.1116	128.6832	111.0438	102.8984	118.0775	119.4877	139.2514	152.0038	165.0663	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	25.5667	22.3608	23.0743	20.1167	19.3025	16.6566	15.4348	17.7116	17.9232	20.8877	22.8006	24.7599	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.8211	193.6701	201.8097	175.1420	165.2657	146.2211	139.2483	155.3578	161.8688	187.2324	199.7878	214.4431	(62)
WWHRS	-35.9987	-31.6757	-32.3284	-26.5892	-24.6836	-20.3592	-17.2243	-20.8568	-21.4681	-26.5457	-30.7591	-34.7965	eq. (G10)
Total of WWHRS savings												-323.2853	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1140.0998	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1915.3676	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.4503	(H8)
Utilisation factor												0.4982	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												104.4858	(H14)
Volume ratio Veff/V												0.7178	(H15)
Solar storage volume factor												0.9337	(H16)
Solar input												-783.3867	(H17)
Solar input	-24.1123	-36.2407	-61.0339	-84.3675	-101.6068	-106.9368	-104.3690	-93.2022	-72.7446	-49.4868	-29.3091	-19.9772	(63)
Output from w/h	159.7102	125.7538	108.4475	64.1853	38.9753	18.9251	17.6550	41.2989	67.6561	111.1999	139.7196	159.6694	(64)
Heat gains from water heating, kWh/month	96.1742	85.2451	89.5329	77.4164	72.0532	65.0639	63.2936	69.0850	73.6346	84.6859	88.7685	94.3860	(65)
Total per year (kWh/year) = Sum(64)m =												1053.1959	(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	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	177.5641	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5761	67.1260	54.5905	41.3285	30.8936	26.0817	28.1821	36.6322	49.1677	62.4297	72.8647	77.6766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	506.1717	511.4241	498.1881	470.0100	434.4403	401.0098	378.6762	373.4237	386.6598	414.8378	450.4075	483.8380	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	55.7158	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	-118.3761	(71)
Water heating gains (Table 5)	129.2664	126.8528	120.3399	107.5228	96.8456	90.3665	85.0721	92.8562	102.2702	113.8252	123.2895	126.8629	(72)
Total internal gains	825.9180	820.3068	788.0223	733.7652	677.0834	632.3618	606.8342	617.8160	653.0015	705.9965	761.4655	803.2813	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					12.3500	12.9236	0.4600	0.0000			0.7700			56.5324 (75)		
Southeast					5.9000	40.4699	0.4600	0.0000			0.7700			84.5732 (77)		
Southwest					9.2300	40.4699	0.4600	0.0000			0.7700			132.3069 (79)		
Northwest					2.8300	12.9236	0.4600	0.0000			0.7700			12.9544 (81)		
Southwest					7.3500	40.4699	0.4300	0.0000			0.7700			98.4870 (79)		
Solar gains					384.8539	611.1953	882.7366	1225.7423	1424.9808	1554.7550	1465.9775	1306.5854	1070.9227	737.6802	476.6413	323.4418 (83)
Total gains					1210.7719	1431.5021	1670.7589	1959.5075	2102.0641	2187.1168	2072.8117	1924.4014	1723.9242	1443.6767	1238.1068	1126.7231 (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	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	36.3309	
alpha	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	3.4221	
util living area	0.9699	0.9483	0.8974	0.7857	0.6174	0.4039	0.2700	0.2992	0.5625	0.8347	0.9450	0.9755	(86)	

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Tweekday	18.0490	18.3882	18.9611	19.5388	19.8824	19.9975	20.0109	20.0102	19.9553	19.5273	18.7027	17.9555
Tweekend	20.0368	20.1903	20.4531	20.7304	20.9111	20.9849	20.9973	20.9962	20.9516	20.7165	20.3299	19.9947
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	5	0	0	0	0	0	0	0	0	0	0	0
MIT	19.6324	19.7475	20.1559	20.5791	20.8627	20.9767	20.9958	20.9941	20.9245	20.5624	19.9537	19.4484 (87)
Th 2	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121	20.0121 (88)
util rest of house												
	0.9641	0.9387	0.8785	0.7492	0.5588	0.3288	0.1851	0.2085	0.4823	0.7962	0.9327	0.9706 (89)
Tweekday	18.0490	18.3882	18.9611	19.5388	19.8824	19.9975	20.0109	20.0102	19.9553	19.5273	18.7027	17.9555
Tweekend	18.0490	18.3882	18.9611	19.5388	19.8824	19.9975	20.0109	20.0102	19.9553	19.5273	18.7027	17.9555
MIT 2	18.0490	18.3882	18.9611	19.5388	19.8824	19.9975	20.0109	20.0102	19.9553	19.5273	18.7027	17.9555 (90)
Living area fraction									fLA = Living area / (4) =			0.0997 (91)
MIT	18.2069	18.5238	19.0803	19.6426	19.9801	20.0952	20.1091	20.1083	20.0520	19.6305	18.8275	18.1044 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2069	18.5238	19.0803	19.6426	19.9801	20.0952	20.1091	20.1083	20.0520	19.6305	18.8275	18.1044 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9492	0.9196	0.8569	0.7340	0.5567	0.3353	0.1935	0.2175	0.4857	0.7788	0.9132	0.9571 (94)
Useful gains	1149.2257	1316.4066	1431.6818	1438.2077	1170.3176	733.2317	401.0764	418.5276	837.3920	1124.3338	1130.6500	1078.4132 (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	2386.6918	2353.3439	2126.9139	1774.0633	1271.0435	745.7080	402.2634	420.3311	883.5197	1462.3160	1971.6247	2368.0310 (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	920.6748	696.8219	517.2527	241.8160	74.9401	0.0000	0.0000	0.0000	0.0000	251.4587	605.5018	959.4756 (98)
Space heating												4267.9415 (98)
Space heating per m2												(98) / (4) = 25.4590 (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 %)												266.4190 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1601.9662 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.6748	696.8219	517.2527	241.8160	74.9401	0.0000	0.0000	0.0000	0.0000	251.4587	605.5018	959.4756 (98)
Space heating efficiency (main heating system 1)	266.4190	266.4190	266.4190	266.4190	266.4190	0.0000	0.0000	0.0000	0.0000	266.4190	266.4190	266.4190 (210)
Space heating fuel (main heating system)	345.5741	261.5512	194.1501	90.7653	28.1287	0.0000	0.0000	0.0000	0.0000	94.3847	227.2743	360.1379 (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	159.7102	125.7538	108.4475	64.1853	38.9753	18.9251	17.6550	41.2989	67.6561	111.1999	139.7196	159.6694 (64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800 (217)
Fuel for water heating, kWh/month	93.7927	73.8512	63.6877	37.6940	22.8889	11.1141	10.3682	24.2535	39.7323	65.3042	82.0529	93.7687 (219)
Water heating fuel used												618.5083 (219)
Annual totals kWh/year												
Space heating fuel - main system												1601.9662 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												121.5431 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												171.5431 (231)
Electricity for lighting (calculated in Appendix L)												533.8788 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728 (233)
Total delivered energy for all uses												1879.0237 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1601.9662	16.9600	271.6935 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	618.5083	16.9600	104.8990 (247)
Mechanical ventilation fans	121.5431	16.9600	20.6137 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	16.9600	8.4800 (249)
Energy for lighting	533.8788	16.9600	90.5459 (250)
Additional standing charges			0.0000 (251)

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Energy saving/generation technologies			
PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			318.6824 (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	1601.9662	0.5190	831.4205 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	618.5083	0.5190	321.0058 (264)
Space and water heating			1152.4263 (265)
Pumps and fans	171.5431	0.5190	89.0309 (267)
Energy for lighting	533.8788	0.5190	277.0831 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			975.2133 (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	1601.9662	3.0700	4918.0362 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	618.5083	3.0700	1898.8205 (264)
Space and water heating			6816.8567 (265)
Pumps and fans	171.5431	3.0700	526.6373 (267)
Energy for lighting	533.8788	3.0700	1639.0080 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			5768.6026 (272)
Primary energy kWh/m2/year			34.4107 (273)

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

Overheating Calculation Input Data

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

Overheating Calculation

Summer ventilation heat loss coefficient	569.75 (P1)
Transmission heat loss coefficient	110.87 (P7)
Summer heat loss coefficient	680.63 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs
North East	1.000	0.90	1.000
South East	1.000	0.90	1.000
South West	1.000	0.90	1.000
North West	1.000	0.90	1.000

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
North East	12.3500	98.8453	0.4600	0.0000	0.9000	505.3860
South East	5.9000	119.9223	0.4600	0.0000	0.9000	292.9223
South West	9.2300	119.9223	0.4600	0.0000	0.9000	458.2497
North West	2.8300	98.8453	0.4600	0.0000	0.9000	115.8091
South West	7.3500	119.9223	0.4300	0.0000	0.9000	341.1131
total:						1713.4802

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Calculation Type: New Build (As Designed)



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

Solar gains	1817	1713	1527	(P4)
Internal gains	646	621	631	
Total summer gains	2464	2334	2158	(P5)
Summer gain/loss ratio	3.62	3.43	3.17	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 142.1)	1.01	1.01	1.01	
Threshold temperature	20.63	22.34	21.98	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			