

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Elmslie - End/Semi (ASHP+PV)			Issued on Date	15/12/2022
Assessment Reference	Elmslie - End/Semi (ASHP+PV)	Prop Type Ref			
Property	Plot, 3 Bed, K, WC, B, ES				
SAP Rating	92 A	DER	9.03	TER	25.82
Environmental	93 A	% DER<TER	65.02		
CO ₂ Emissions (t/year)	0.57	DFEE	39.35	TFEE	50.96
General Requirements Compliance	Pass	% DFEE<TFEE	22.78		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 87 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 25.82 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.03 kgCO₂/m²OK

1b TFEE and DFEE

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

Dwelling Fabric Energy Efficiency (DFEE)39.3 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: 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):	Slight	OK
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Based on:

Overshading:	Average
Windows facing South East:	4.40 m ² , No overhang
Windows facing South West:	0.66 m ² , No overhang
Windows facing North West:	6.95 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
Window U-value	0.90 W/m ² K
Thermal bridging y-value	0.027 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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total = Sum(45)m =		1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)
Water storage loss:												
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	205.0727	180.7711	189.8948	170.2910	166.9252	149.2193	143.3715	157.2371	156.9325	176.5789	186.6350	200.1600 (62)
WWHRS	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq.(G10)
Total of WWHRS savings												-430.6864
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	157.1381	138.5954	146.8487	134.8691	134.0327	122.0829	120.4019	129.4273	128.3128	141.2027	145.6613	153.8301 (64)
								Total per year (kWh/year) = Sum(64)m =				1652.4028 (64)
Heat gains from water heating, kWh/month	91.2703	80.9561	86.2237	78.9608	78.5863	71.9544	70.7547	75.3650	74.5191	81.7961	84.3952	89.6369 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	122.6752	120.4704	115.8920	109.6677	105.6267	99.9367	95.1004	101.2970	103.4987	109.9410	117.2155	120.4796	(72)
Total internal gains	439.6837	437.3990	423.0229	399.9084	376.4104	353.9102	339.4146	345.6912	357.6906	381.0231	407.7546	427.8290	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				4.4000	36.7938	0.4600	0.0000	0.7700	57.3425 (77)			
Southwest				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (79)			
Northwest				3.8000	11.2829	0.4600	0.0000	0.7700	15.1864 (81)			
Northwest				3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)			
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)
Total gains	532.5817	604.5916	675.5641	752.6796	807.9264	798.3092	761.2028	706.2856	644.5560	572.2185	520.6553	506.2752 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	
util living area	0.9813	0.9695	0.9441	0.8845	0.7722	0.6133	0.4691	0.5199	0.7423	0.9139	0.9697	0.9843	(86)
Tweekday	17.9897	18.2821	18.7574	19.3320	19.7916	20.0262	20.0888	20.0800	19.9275	19.3458	18.5537	17.9056	
Tweekend	19.9819	20.1127	20.3267	20.5910	20.8141	20.9411	20.9829	20.9752	20.8799	20.5921	20.2326	19.9444	
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	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.4287	19.6275	19.9608	20.3614	20.7130	20.9095	20.9736	20.9617	20.8125	20.3705	19.8018	19.3708	(87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	(88)
util rest of house	0.9779	0.9640	0.9337	0.8628	0.7301	0.5451	0.3812	0.4300	0.6816	0.8930	0.9633	0.9814	(89)
Tweekday	17.9897	18.2821	18.7574	19.3320	19.7916	20.0262	20.0888	20.0800	19.9275	19.3458	18.5537	17.9056	
Tweekend	17.9897	18.2821	18.7574	19.3320	19.7916	20.0262	20.0888	20.0800	19.9275	19.3458	18.5537	17.9056	
MIT 2	17.9897	18.2821	18.7574	19.3320	19.7916	20.0262	20.0888	20.0800	19.9275	19.3458	18.5537	17.9056	(90)
Living area fraction									fLA = Living area / (4) =			0.2363	(91)
MIT	18.3297	18.6000	19.0418	19.5753	20.0094	20.2350	20.2979	20.2883	20.1366	19.5879	18.8486	18.2518	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3297	18.6000	19.0418	19.5753	20.0094	20.2350	20.2979	20.2883	20.1366	19.5879	18.8486	18.2518	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9685	0.9518	0.9184	0.8478	0.7252	0.5556	0.4008	0.4492	0.6840	0.8783	0.9512	0.9730 (94)
Useful gains	515.8198	575.4255	620.4216	638.1191	585.9247	443.5034	305.0719	317.2555	440.8696	502.5514	495.2464	492.6049 (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	1186.1278	1158.2568	1060.3351	902.5306	702.5075	476.4026	312.6365	328.7357	510.3569	759.8740	993.2786	1187.9992 (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	498.7091	391.6627	327.2956	190.3763	86.7376	0.0000	0.0000	0.0000	0.0000	191.4480	358.5832	517.3734 (98)
Space heating												2562.1860 (98)
Space heating per m2												29.5319 (99)
										(98) / (4) =		

Not applicable

[illegible]

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	1072.0798	0.5190	556.4094 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	970.4033	0.5190	503.6393 (264)
Space and water heating			1060.0488 (265)
Pumps and fans	59.7406	0.5190	31.0054 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total CO ₂ , kg/year			783.0206 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0300 (273)

PER		9.0300	ZC1
Total Floor Area	TFA	86.7600	
Assumed number of occupants	N	2.5787	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9134	ZC2
CO2 emissions from cooking, equation (L16)		2.0849	ZC3
Total CO2 emissions		27.0283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.0283	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
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Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1406 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3906 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3613 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4606	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4064	0.4245	(22b)				
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			12.0100	1.3258	15.9223		(27)					
FP McCann System			43.3800	0.1300	5.6394		(28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.1800	14.0418		(29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.1300	5.6394		(30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)	(26) ... (30) + (32) =				43.2229		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5117 (36)					
Total fabric heat loss	(33) + (36) =						52.7346 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.6876	42.3975	42.1131	40.7773	40.5274	39.3640	39.3640	39.1485	39.8121	40.5274	41.0330	41.5615 (38)
Heat transfer coeff	95.4223	95.1321	94.8477	93.5120	93.2620	92.0986	92.0986	91.8832	92.5468	93.2620	93.7676	94.2962 (39)
Average = Sum(39)m / 12 =												93.5108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0998	1.0965	1.0932	1.0778	1.0749	1.0615	1.0615	1.0590	1.0667	1.0749	1.0808	1.0869 (40)
HLP (average)												1.0778 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Daily hot water use	Jan 104.9892	Feb 101.1714	Mar 97.3536	Apr 93.5358	May 89.7180	Jun 85.9003	Jul 85.9003	Aug 89.7180	Sep 93.5358	Oct 97.3536	Nov 101.1714	Dec 104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)	Total = Sum(45)m =											1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)
Water storage loss:												200.0000 (47)
Store volume												1.6525 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

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	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	27.6637	26.7713	27.6637	26.7713	27.6637 (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	206.6220	182.1704	191.4441	171.7903	168.4744	150.7186	144.9208	158.7864	158.4318	178.1281	188.1343	201.7093 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	206.6220	182.1704	191.4441	171.7903	168.4744	150.7186	144.9208	158.7864	158.4318	178.1281	188.1343	201.7093 (64)
								Total per year (kWh/year) =	Sum (64)m =			2101.3306 (64)
Heat gains from water heating, kWh/month	92.5098	82.0756	87.4631	80.1602	79.8257	73.1539	71.9941	76.6044	75.7185	83.0355	85.5946	90.8763 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	124.3411	122.1363	117.5579	111.3336	107.2926	101.6026	96.7663	102.9629	105.1646	111.6069	118.8814	122.1455 (72)
Total internal gains	444.3496	442.0649	427.6888	404.5743	381.0763	358.5761	344.0805	350.3571	362.3565	385.6890	412.4205	432.4948 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				4.4000	36.7938		0.6300		0.7000		0.7700		49.4766 (77)
Southwest				0.6600	36.7938		0.6300		0.7000		0.7700		7.4215 (79)
Northwest				6.9500	11.2829		0.6300		0.7000		0.7700		23.9651 (81)
Solar gains	80.8631	145.7000	220.4970	308.6467	378.0582	389.5532	369.6494	315.6900	250.6805	166.7305	98.3050	68.2640	88.2640 (83)
Total gains	525.2128	587.7650	648.1858	713.2210	759.1346	748.1293	713.7300	666.0471	613.0370	552.4195	510.7255	500.7588	84.3434 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.1404	63.3330	63.5229	64.4303	64.6029	65.4190	65.4190	65.5724	65.1022	64.6029	64.2546	63.8944
alpha	5.2094	5.2222	5.2349	5.2954	5.3069	5.3613	5.3613	5.3715	5.3401	5.3069	5.2836	5.2596
util living area	0.9979	0.9958	0.9896	0.9660	0.8918	0.7282	0.5556	0.6133	0.8589	0.9777	0.9957	0.9984 (86)
MIT	19.8317	19.9656	20.1973	20.5146	20.7911	20.9509	20.9905	20.9844	20.8769	20.5282	20.1286	19.8127 (87)
Th 2	20.0010	20.0037	20.0064	20.0190	20.0213	20.0324	20.0324	20.0344	20.0281	20.0213	20.0166	20.0116 (88)
util rest of house	0.9972	0.9944	0.9858	0.9529	0.8506	0.6410	0.4398	0.4952	0.7921	0.9666	0.9939	0.9979 (89)
MIT 2	18.4418	18.6390	18.9778	19.4405	19.8118	19.9989	20.0287	20.0278	19.9266	19.4673	18.8869	18.4217 (90)
Living area fraction									fLA = Living area / (4) =			0.2363 (91)
MIT	18.7702	18.9525	19.2660	19.6943	20.0432	20.2238	20.2560	20.2538	20.1511	19.7180	19.1803	18.7503 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7702	18.9525	19.2660	19.6943	20.0432	20.2238	20.2560	20.2538	20.1511	19.7180	19.1803	18.7503 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9923	0.9820	0.9475	0.8516	0.6595	0.4673	0.5231	0.8018	0.9620	0.9918	0.9968 (94)
Useful gains	523.0909	583.2298	636.5144	675.7481	646.5087	493.3856	333.5162	348.4266	491.5579	531.4194	506.5285	499.1707 (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												
Month fracti	1380.7771	1336.8410	1210.8224	1009.3936	778.1029	517.9479	336.7114	354.0979	560.0133	850.3600	1132.7417	1372.0417 (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)
	638.1185	506.4268	427.2852	240.2247	97.9061	0.0000	0.0000	0.0000	0.0000	237.2917	450.8735	649.4160 (98)
Space heating												3247.5425 (98)
Space heating per m2												37.4313 (99)
										(98) / (4) =		37.4313 (99)

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3473.3075 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	638.1185	506.4268	427.2852	240.2247	97.9061	0.0000	0.0000	0.0000	0.0000	237.2917	450.8735	649.4160 (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)	682.4797	541.6329	456.9895	256.9248	104.7124	0.0000	0.0000	0.0000	0.0000	253.7880	482.2177	694.5625 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	206.6220	182.1704	191.4441	171.7903	168.4744	150.7186	144.9208	158.7864	158.4318	178.1281	188.1343	201.7093 (64)
Efficiency of water heater (217)m	87.6261	87.3997	86.8949	85.7083	83.4253	79.8000	79.8000	79.8000	79.8000	85.5796	87.0630	79.8000 (216)
Fuel for water heating, kWh/month	235.7996	208.4337	220.3168	200.4360	201.9466	188.8704	181.6050	198.9804	198.5361	208.1431	216.0898	229.9657 (219)
Water heating fuel used												2489.1232 (219)
Annual totals kWh/year												
Space heating fuel - main system												3473.3075 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												394.5058 (232)
Total delivered energy for all uses												6431.9365 (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	3473.3075	0.2160	750.2344 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.1232	0.2160	537.6506 (264)
Space and water heating			1287.8850 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Total CO2, kg/m2/year			1531.5585 (272)
Emissions per m2 for space and water heating			14.8442 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3599 (272b)
Emissions per m2 for pumps and fans			0.4487 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8442 * 1.55) + 2.3599 + 0.4487, rounded to 2 d.p.			25.8200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1406 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3155 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4022	0.3944	0.3865	0.3470	0.3391	0.2997	0.2997	0.2918	0.3155	0.3391	0.3549	0.3707 (22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)
Total net area of external elements Aum(A, m ²)			178.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)
Timber GF			54.6000			9.0000	491.4000 (32c)
Timber FF			91.4300			9.0000	822.8700 (32c)
Internal Floor			43.3800			12.6000	546.5880 (32d)
Internal Ceiling			43.3800			9.0000	390.4200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11900.5260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							137.1660 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)
Total fabric heat loss							(33) + (36) = 49.3283 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.9137	40.6924	40.4756	39.4569	39.2663	38.3791	38.3791	38.2148	38.7209	39.2663	39.6519	40.0550 (38)
Heat transfer coeff	90.2420	90.0208	89.8039	88.7853	88.5947	87.7075	87.7075	87.5432	88.0492	88.5947	88.9802	89.3833 (39)
Average = Sum(39)m / 12 =												88.7843 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0401	1.0376	1.0351	1.0233	1.0211	1.0109	1.0109	1.0090	1.0149	1.0211	1.0256	1.0302 (40)
HLP (average)												1.0233 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	44.4696	43.0606	40.1345	36.1566	33.5740	29.9375	26.8466	30.8069	32.2140	36.3312	40.9803	43.0664	(72)
Total internal gains	361.4782	359.9892	347.2654	326.3973	304.3577	283.9110	271.1609	275.2011	286.4059	307.4133	331.5194	350.4158	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

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

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	446.1107	511.2447	566.5116	601.6133	570.7160	443.0660	309.8596	319.7176	426.9851	457.2174	431.5381	422.3601	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1285.9017	1248.2020	1133.5636	948.9924	732.8610	491.3666	321.9009	337.8993	527.9085	797.1653	1058.4916	1279.6046	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	624.8045	495.2353	421.8867	250.1129	120.6359	0.0000	0.0000	0.0000	0.0000	252.9212	451.4065	637.7899	(98)
Space heating												3254.7931	(98)
Space heating per m2												37.5149	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	824.4502	649.0353	665.3281	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8296	0.8869	0.8595	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	683.9360	575.6226	571.8703	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	948.7611	905.4506	840.5213	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	190.6741	245.3920	199.8763	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			635.9424 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	47.6685	61.3480	49.9691	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												158.9856 (107)
Energy for space heating												1.8325 (108)
Energy for space cooling												37.5149 (99)
Total												1.8325 (108)
Dwelling Fabric Energy Efficiency (DFEE)												39.3474 (109)
												39.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1406 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3906 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3613 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4606	0.4516	0.4426	0.3974	0.3884	0.3432	0.3432	0.3342	0.3613	0.3884	0.4064	0.4245	(22b)				
Effective ac	0.6061	0.6020	0.5979	0.5790	0.5754	0.5589	0.5589	0.5558	0.5653	0.5754	0.5826	0.5901	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			12.0100	1.3258	15.9223		(27)					
FP McCann System			43.3800	0.1300	5.6394		(28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.1800	14.0418		(29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.1300	5.6394		(30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	43.2229		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5117 (36)					
Total fabric heat loss						(33) + (36) =	52.7346 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.6876	Feb 42.3975	Mar 42.1131	Apr 40.7773	May 40.5274	Jun 39.3640	Jul 39.3640	Aug 39.1485	Sep 39.8121	Oct 40.5274	Nov 41.0330	Dec 41.5615 (38)
Heat transfer coeff	95.4223	95.1321	94.8477	93.5120	93.2620	92.0986	92.0986	91.8832	92.5468	93.2620	93.7676	94.2962 (39)
Average = Sum(39)m / 12 =												93.5108 (39)
HLP	Jan 1.0998	Feb 1.0965	Mar 1.0932	Apr 1.0778	May 1.0749	Jun 1.0615	Jul 1.0615	Aug 1.0590	Sep 1.0667	Oct 1.0749	Nov 1.0808	Dec 1.0869 (40)
HLP (average)												1.0778 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy content (annual)	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Distribution loss	Total = Sum(45)m = 1501.7171 (45)											
	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.0854	28.9367	29.8601	26.0327	24.9790	21.5550	19.9739	22.9203	23.1941	27.0304	29.5058	32.0414 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	128.9363	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3385	19.8409	16.1357	12.2158	9.1314	7.7091	8.3300	10.8276	14.5328	18.4528	21.5371	22.9594	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.9891	235.4068	229.3143	216.3440	199.9714	184.5835	174.3034	171.8857	177.9782	190.9485	207.3211	222.7090	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	35.8936	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	44.4696	43.0606	40.1345	36.1566	33.5740	29.9375	26.8466	30.8069	32.2140	36.3312	40.9803	43.0664	(72)
Total internal gains	361.4782	359.9892	347.2654	326.3973	304.3577	283.9110	271.1609	275.2011	286.4059	307.4133	331.5194	350.4158	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
Southeast				4.4000	36.7938	0.6300	0.7000	0.7700	49.4766 (77)				
Southwest				0.6600	36.7938	0.6300	0.7000	0.7700	7.4215 (79)				
Northwest				6.9500	11.2829	0.6300	0.7000	0.7700	23.9651 (81)				
Solar gains	80.8631	145.7000	220.4970	308.6467	378.0582	389.5532	369.6494	315.6900	250.6805	166.7305	98.3050	68.2640	(83)
Total gains	442.3413	505.6892	567.7624	635.0440	682.4159	673.4642	640.8103	590.8911	537.0864	474.1439	429.8244	418.6797	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	63.1404	63.3330	63.5229	64.4303	64.6029	65.4190	65.4190	65.5724	65.1022	64.6029	64.2546	63.8944		
alpha	5.2094	5.2222	5.2349	5.2954	5.3069	5.3613	5.3613	5.3715	5.3401	5.3069	5.2836	5.2596		
util living area	0.9991	0.9979	0.9943	0.9788	0.9234	0.7817	0.6113	0.6771	0.9053	0.9884	0.9981	0.9993	(86)	
MIT	19.7419	19.8774	20.1132	20.4407	20.7397	20.9307	20.9851	20.9752	20.8326	20.4499	20.0414	19.7234	(87)	
Th 2	20.0010	20.0037	20.0064	20.0190	20.0213	20.0324	20.0324	20.0344	20.0281	20.0213	20.0166	20.0116	(88)	
util rest of house	0.9988	0.9972	0.9921	0.9701	0.8902	0.6972	0.4876	0.5534	0.8511	0.9822	0.9973	0.9991	(89)	
MIT 2	18.8469	18.9843	19.2213	19.5542	19.8364	19.9985	20.0283	20.0268	19.9275	19.5681	19.1587	18.8369	(90)	
Living area fraction									fLA = Living area / (4) =			0.2363	(91)	
MIT	19.0583	19.1953	19.4320	19.7637	20.0498	20.2188	20.2544	20.2509	20.1414	19.7765	19.3673	19.0464	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0583	19.1953	19.4320	19.7637	20.0498	20.2188	20.2544	20.2509	20.1414	19.7765	19.3673	19.0464	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9984	0.9964	0.9904	0.9671	0.8914	0.7151	0.5172	0.5829	0.8587	0.9801	0.9965	0.9988	(94)	
Ext temp.	441.6128	503.8728	562.3096	614.1797	608.2930	481.5719	331.4201	344.4375	461.1938	464.7082	428.3379	418.1662	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	1408.2750	1359.9427	1226.5720	1015.8826	778.7196	517.4804	336.5668	353.8285	559.1096	855.8173	1150.2742	1399.9572	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(98)	
Space heating kWh	719.1966	575.2790	494.2112	289.2261	126.7974	0.0000	0.0000	0.0000	0.0000	290.9851	519.7942	730.4525	(98)	
Space heating												3745.9422	(98)	
Space heating per m2												43.1759	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	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	865.7271	681.5298	698.3121	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8518	0.9179	0.8892	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	737.3984	625.5546	620.9729	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	884.6556	844.5093	788.0356	0.0000	0.0000	0.0000	0.0000	(103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	106.0251	162.9023	124.2947	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												393.2221	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)												1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)	
Water storage loss:												
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 (59)	
Total heat required for water heating calculated for each month												
205.0727	180.7711	189.8948	170.2910	166.9252	149.2193	143.3715	157.2371	156.9325	176.5789	186.6350	200.1600 (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 (63)	
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	205.0727	180.7711	189.8948	170.2910	166.9252	149.2193	143.3715	157.2371	156.9325	176.5789	186.6350	200.1600 (64)
RHI water heating demand												2083.0891 (64)
Heat gains from water heating, kWh/month	91.2703	80.9561	86.2237	78.9608	78.5863	71.9544	70.7547	75.3650	74.5191	81.7961	84.3952	89.6369 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (69)	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)												
-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)	
Water heating gains (Table 5)												
122.6752	120.4704	115.8920	109.6677	105.6267	99.9367	95.1004	101.2970	103.4987	109.9410	117.2155	120.4796 (72)	
Total internal gains	630.8921	626.0517	603.1170	567.7343	531.5457	499.3329	480.7052	489.5375	510.0955	545.6963	585.1183	614.9053 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				4.4000	40.4699	0.4600	0.0000	0.7700	63.0716 (77)			
Southwest				0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (79)			
Northwest				3.8000	12.9236	0.4600	0.0000	0.7700	17.3946 (81)			
Northwest				3.1500	12.9236	0.4300	0.0000	0.7700	13.4788 (81)			
Solar gains	103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)
Total gains	734.2978	794.0433	855.1197	932.4339	967.2986	979.8769	931.7702	883.2279	821.0960	751.2057	713.9718	701.3170 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
Feb	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9454	0.9270	0.8817	0.7854	0.6276	0.4193	0.2792	0.3033	0.5559	0.8044	0.9143	0.9518 (86)
Tweekday	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307
Tweekend	20.2558	20.3521	20.5468	20.7641	20.9206	20.9865	20.9978	20.9970	20.9612	20.7820	20.4891	20.2252
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	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8514	19.9977	20.3005	20.6316	20.8775	20.9792	20.9966	20.9953	20.9393	20.6635	20.2022	19.8043 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house												
0.9362	0.9150	0.8622	0.7515	0.5735	0.3487	0.1996	0.2199	0.4828	0.7655	0.8981	0.9436 (89)	
Tweekday	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307
Tweekend	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307
MIT 2	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307 (90)
Living area fraction												
MIT	18.8937	19.0894	19.4837	19.9083	20.1963	20.3007	20.3145	20.3138	20.2657	19.9515	19.3706	18.8316 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8937	19.0894	19.4837	19.9083	20.1963	20.3007	20.3145	20.3138	20.2657	19.9515	19.3706	18.8316 (93)

8. Space heating requirement

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	
Utilisation	0.9208	0.8986	0.8466	0.7434	0.5793	0.3645	0.2184	0.2396	0.4965	0.7580	0.8820	0.9287	(94)
Useful gains	676.1138	713.4940	723.9592	693.1912	560.3280	357.1300	203.4657	211.5807	407.6608	569.4453	629.7428	651.3289	(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													
	1166.1783	1140.4540	1021.6093	846.1439	608.4029	363.6002	204.1335	212.5295	428.2789	706.0672	961.3195	1160.9288	(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													
	364.6080	286.9171	221.4517	110.1260	35.7677	0.0000	0.0000	0.0000	0.0000	101.6467	238.7352	379.1423	(98)
Space heating												1738.3946	(98)
RHI space heating demand												1738	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)										Total = Sum (45)m =		1501.7171 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)
Water storage loss:												
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	205.0727	180.7711	189.8948	170.2910	166.9252	149.2193	143.3715	157.2371	156.9325	176.5789	186.6350	200.1600 (62)
WWHRS	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
Total of WWHRS savings												-430.6864
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	157.1381	138.5954	146.8487	134.8691	134.0327	122.0829	120.4019	129.4273	128.3128	141.2027	145.6613	153.8301 (64)
Total per year (kWh/year) = Sum (64)m =												1652.4028 (64)
Heat gains from water heating, kWh/month	91.2703	80.9561	86.2237	78.9608	78.5863	71.9544	70.7547	75.3650	74.5191	81.7961	84.3952	89.6369 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	122.6752	120.4704	115.8920	109.6677	105.6267	99.9367	95.1004	101.2970	103.4987	109.9410	117.2155	120.4796 (72)
Total internal gains	630.8921	626.0517	603.1170	567.7343	531.5457	499.3329	480.7052	489.5375	510.0955	545.6963	585.1183	614.9053 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Southeast					4.4000	36.7938	0.4600	0.0000			0.7700			57.3425 (77)
Southwest					0.6600	36.7938	0.4600	0.0000			0.7700			8.6014 (79)
Northwest					3.8000	11.2829	0.4600	0.0000			0.7700			15.1864 (81)
Northwest					3.1500	11.2829	0.4300	0.0000			0.7700			11.7677 (81)
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)		
Total gains	723.7900	793.2443	855.6582	920.5055	963.0616	943.7319	902.4934	850.1319	796.9609	736.8916	698.0190	693.3515 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9541	0.9351	0.8980	0.8222	0.6976	0.5377	0.4021	0.4423	0.6485	0.8462	0.9318	0.9600 (86)
Tweekday	18.4159	18.6730	19.0779	19.5434	19.8905	20.0550	20.0953	20.0905	19.9972	19.5790	18.9169	18.3314
Tweekend	20.1742	20.2909	20.4762	20.6953	20.8690	20.9615	20.9896	20.9852	20.9238	20.7073	20.3992	20.1359
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	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.7255	19.9030	20.1915	20.5243	20.7979	20.9408	20.9839	20.9772	20.8810	20.5482	20.0619	19.6664 (87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)
util rest of house	0.9466	0.9247	0.8816	0.7940	0.6521	0.4728	0.3243	0.3620	0.5850	0.8155	0.9191	0.9534 (89)
Tweekday	18.4159	18.6730	19.0779	19.5434	19.8905	20.0550	20.0953	20.0905	19.9972	19.5790	18.9169	18.3314
Tweekend	18.4159	18.6730	19.0779	19.5434	19.8905	20.0550	20.0953	20.0905	19.9972	19.5790	18.9169	18.3314
MIT 2	18.4159	18.6730	19.0779	19.5434	19.8905	20.0550	20.0953	20.0905	19.9972	19.5790	18.9169	18.3314 (90)
Living area fraction									fLA = Living area / (4) =			0.2363 (91)
MIT	18.7254	18.9637	19.3410	19.7751	20.1049	20.2643	20.3053	20.3000	20.2061	19.8080	19.1874	18.6469 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7254	18.9637	19.3410	19.7751	20.1049	20.2643	20.3053	20.3000	20.2061	19.8080	19.1874	18.6469 (93)

8. Space heating requirement

AES
Sustainability
Consultants

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	970.4033	0.5190	503.6393 (264)
Space and water heating			943.7098 (265)
Pumps and fans	59.7406	0.5190	31.0054 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			666.6816 (272)
CO2 emissions per m2			7.6800 (273)
EI value			93.2198
EI rating			93 (274)
EI band			A

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.3899 = 5.519$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.3899 = 0.2172$, 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	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)
Water storage loss:												
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	205.0727	180.7711	189.8948	170.2910	166.9252	149.2193	143.3715	157.2371	156.9325	176.5789	186.6350	200.1600 (62)
WWHRS	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
Total of WWHRS savings												-430.6864
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	157.1381	138.5954	146.8487	134.8691	134.0327	122.0829	120.4019	129.4273	128.3128	141.2027	145.6613	153.8301 (64)
Total per year (kWh/year) = Sum(64)m =												1652.4028 (64)
Heat gains from water heating, kWh/month	91.2703	80.9561	86.2237	78.9608	78.5863	71.9544	70.7547	75.3650	74.5191	81.7961	84.3952	89.6369 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	(71)
Water heating gains (Table 5)	122.6752	120.4704	115.8920	109.6677	105.6267	99.9367	95.1004	101.2970	103.4987	109.9410	117.2155	120.4796	(72)
Total internal gains	630.8921	626.0517	603.1170	567.7343	531.5457	499.3329	480.7052	489.5375	510.0955	545.6963	585.1183	614.9053	(73)

6. Solar gains

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

Southeast					4.4000	40.4699	0.4600	0.0000			0.7700			63.0716 (77)
Southwest					0.6600	40.4699	0.4600	0.0000			0.7700			9.4607 (79)
Northwest					3.8000	12.9236	0.4600	0.0000			0.7700			17.3946 (81)
Northwest					3.1500	12.9236	0.4300	0.0000			0.7700			13.4788 (81)

Solar gains		103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)	
Total gains		734.2978	794.0433	855.1197	932.4339	967.2986	979.8769	931.7702	883.2279	821.0960	751.2057	713.9718	701.3170 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	
util living area	0.9454	0.9270	0.8817	0.7854	0.6276	0.4193	0.2792	0.3033	0.5559	0.8044	0.9143	0.9518 (86)	
Tweekday	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307	
Tweekend	20.2558	20.3521	20.5468	20.7641	20.9206	20.9865	20.9978	20.9970	20.9612	20.7820	20.4891	20.2252	
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	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8514	19.9977	20.3005	20.6316	20.8775	20.9792	20.9966	20.9953	20.9393	20.6635	20.2022	19.8043 (87)	
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047 (88)	
util rest of house	0.9362	0.9150	0.8622	0.7515	0.5735	0.3487	0.1996	0.2199	0.4828	0.7655	0.8981	0.9436 (89)	
Tweekday	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307	
Tweekend	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307	
MIT 2	18.5974	18.8084	19.2310	19.6845	19.9855	20.0908	20.1035	20.1030	20.0573	19.7312	19.1133	18.5307 (90)	
Living area fraction													
MIT	18.8937	19.0894	19.4837	19.9083	20.1963	20.3007	20.3145	20.3138	20.2657	19.9515	19.3706	18.8316 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8937	19.0894	19.4837	19.9083	20.1963	20.3007	20.3145	20.3138	20.2657	19.9515	19.3706	18.8316 (93)	

8. Space heating requirement

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	727.3858	3.0700	2233.0746	(261)
Space heating - secondary	0.0000	3.0700	0.0000	(263)
Water heating (other fuel)	970.4033	3.0700	2979.1382	(264)
Space and water heating			5212.2128	(265)
Pumps and fans	59.7406	3.0700	183.4035	(267)
Energy for lighting	394.5058	3.0700	1211.1327	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	3.0700	-3213.8994	(269)
Primary energy kWh/year			3392.8496	(272)
Primary energy kWh/m2/year			39.1062	(273)

SAP 2012 EPC IMPROVEMENTS

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

(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	+ 2.3	-£ 66	-202 kg (35.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66	2.33 kg/m²	A 95
Total Savings	£66	2.33 kg/m²	A 95

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

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 £365	Potential £299	Saving £66
Electricity			
Space heating	£133	£134	-£0
Water heating	£165	£98	£66
Lighting	£67	£67	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£187	£121	£66
Total cost of uses	£187	£121	£66
Delivered energy	13 kWh/m²	8 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	7 kg/m²	4 kg/m²	2 kg/m²
Primary energy	39 kWh/m²	25 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1501.7171 (45)
	23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)
Water storage loss:												
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												
	205.0727	180.7711	188.4991	163.5374	154.1309	136.6126	130.3446	145.1407	151.5296	175.1831	186.6350	200.1600 (62)
WWHRS	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
Total of WWHRS savings												-430.6864
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												1.6933 (H8)
Utilisation factor												0.4460 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.4447 (H14)
Volume ratio Veff/V												0.7858 (H15)
Solar storage volume factor												0.9518 (H16)
Solar input												-676.9108 (H17)
Solar input	-19.6291	-32.7553	-55.7860	-74.7642	-92.3649	-90.8094	-89.6093	-78.2921	-61.3184	-41.8733	-23.2829	-16.4262 (63)
Output from w/h												
	137.5090	105.8401	89.6670	53.3513	28.8735	18.6668	17.7656	39.0387	61.5915	97.9337	122.3784	137.4039 (64)
Heat gains from water heating, kWh/month												
	91.2703	80.9561	85.1071	73.5579	68.3508	61.8691	60.3331	65.6878	70.1968	80.6795	84.3952	89.6369 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Water heating gains (Table 5)	122.6752	120.4704	114.3912	102.1637	91.8694	85.9293	81.0929	88.2901	97.4955	108.4402	117.2155	120.4796 (72)
Total internal gains	630.8921	626.0517	601.6162	560.2303	517.7883	485.3254	466.6978	476.5306	504.0923	544.1955	585.1183	614.9053 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				4.4000	36.7938	0.4600	0.0000	0.7700	57.3425 (77)			
Southwest				0.6600	36.7938	0.4600	0.0000	0.7700	8.6014 (79)			
Northwest				3.8000	11.2829	0.4600	0.0000	0.7700	15.1864 (81)			
Northwest				3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)			
Solar gains	92.8979	167.1926	252.5411	352.7712	431.5159	444.3990	421.7881	360.5943	286.8654	191.1954	112.9007	78.4462 (83)
Total gains	723.7900	793.2443	854.1574	913.0015	949.3043	929.7244	888.4859	837.1249	790.9577	735.3908	698.0190	693.3515 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
util living area	0.9541	0.9351	0.8984	0.8251	0.7040	0.5443	0.4080	0.4484	0.6519	0.8469	0.9318	0.9600 (86)
Tweekday	18.4159	18.6730	19.0755	19.5353	19.8833	20.0528	20.0948	20.0898	19.9952	19.5773	18.9169	18.3314
Tweekend	20.1742	20.2909	20.4750	20.6913	20.8650	20.9599	20.9891	20.9845	20.9225	20.7064	20.3992	20.1359

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

24 / 16	0	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	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7255	19.9030	20.1898	20.5179	20.7916	20.9385	20.9832	20.9761	20.8789	20.5468	20.0619	19.6664	(87)	
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	(88)	
util rest of house														
	0.9466	0.9247	0.8821	0.7971	0.6586	0.4791	0.3292	0.3673	0.5885	0.8162	0.9191	0.9534	(89)	
Tweekday	18.4159	18.6730	19.0755	19.5353	19.8833	20.0528	20.0948	20.0898	19.9952	19.5773	18.9169	18.3314		
Tweekend	18.4159	18.6730	19.0755	19.5353	19.8833	20.0528	20.0948	20.0898	19.9952	19.5773	18.9169	18.3314		
MIT 2	18.4159	18.6730	19.0755	19.5353	19.8833	20.0528	20.0948	20.0898	19.9952	19.5773	18.9169	18.3314	(90)	
Living area fraction									fLA = Living area / (4) =				0.2363	(91)
MIT	18.7254	18.9637	19.3388	19.7674	20.0979	20.2621	20.3047	20.2993	20.2040	19.8064	19.1874	18.6469	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7254	18.9637	19.3388	19.7674	20.0979	20.2621	20.3047	20.2993	20.2040	19.8064	19.1874	18.6469	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9319	0.9085	0.8657	0.7854	0.6583	0.4910	0.3472	0.3854	0.5959	0.8046	0.9031	0.9394	(94)
Useful gains	674.5204	720.6642	739.4255	717.0596	624.8883	456.4632	308.4557	322.6299	471.3618	591.6789	630.3909	651.3661	(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	1219.5810	1189.0002	1085.4434	918.7799	709.9969	478.6976	313.2145	329.6597	516.0579	778.3440	1021.9220	1221.3980	(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	405.5251	314.7218	257.4374	145.2386	63.3208	0.0000	0.0000	0.0000	0.0000	138.8788	281.9024	424.1037	(98)
Space heating												2031.1285	(98)
Space heating per m2										(98) / (4) =		23.4109	(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 %)													238.9921	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													849.8727	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	405.5251	314.7218	257.4374	145.2386	63.3208	0.0000	0.0000	0.0000	0.0000	138.8788	281.9024	424.1037	(98)	
Space heating efficiency (main heating system 1)	238.9921	238.9921	238.9921	238.9921	238.9921	0.0000	0.0000	0.0000	0.0000	238.9921	238.9921	238.9921	(210)	
Space heating fuel (main heating system)	169.6814	131.6871	107.7179	60.7713	26.4950	0.0000	0.0000	0.0000	0.0000	58.1102	117.9547	177.4551	(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	137.5090	105.8401	89.6670	53.3513	28.8735	18.6668	17.7656	39.0387	61.5915	97.9337	122.3784	137.4039	(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)	
Fuel for water heating, kWh/month	80.7546	62.1565	52.6585	31.3315	16.9565	10.9624	10.4332	22.9262	36.1707	57.5133	71.8689	80.6929	(219)	
Water heating fuel used												534.4254	(219)	
Annual totals kWh/year														
Space heating fuel - main system												849.8727	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)														
mechanical ventilation fans (SFP = 0.2294)													59.7406	(230a)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													109.7406	(231)
Electricity for lighting (calculated in Appendix L)													394.5058	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)	
Total delivered energy for all uses												900.5252	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	849.8727	13.1900	112.0982	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	534.4254	13.1900	70.4907	(247)
Mechanical ventilation fans	59.7406	13.1900	7.8798	(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	394.5058	13.1900	52.0353	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			118.7793	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.3786 (257)
SAP value 94.7182
SAP rating (Section 12) 95 (258)
SAP band A

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	849.8727	0.5190	441.0839 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	534.4254	0.5190	277.3668 (264)
Space and water heating			718.4507 (265)
Pumps and fans	109.7406	0.5190	56.9554 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			467.3726 (272)
CO ₂ emissions per m ²			5.3900 (273)
EI value			95.2468
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.3800 (1b)	x 2.3100 (2b)	= 100.2078 (1b) - (3b)
First floor	43.3800 (1c)	x 2.6100 (2c)	= 113.2218 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 213.4296 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Window (Uw = 1.20)			8.8600	1.1450	10.1450		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			43.3800	0.1100	4.7718	75.0000	3253.5000 (28a)					
100mm Knauf Supafil 34	92.0000	13.9900	78.0100	0.2500	19.5025	52.8000	4118.9280 (29a)					
Plane Ceiling-500mm Loft Roll	43.3800		43.3800	0.0900	3.9042	9.0000	390.4200 (30)					
Total net area of external elements Aum(A, m2)			178.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4797		(33)					
E-WM-30			41.9200	0.0000	0.0000	45.0000	1886.4000 (32)					
Timber GF			54.6000			9.0000	491.4000 (32c)					
Timber FF			91.4300			9.0000	822.8700 (32c)					
Internal Floor			43.3800			12.6000	546.5880 (32d)					
Internal Ceiling			43.3800			9.0000	390.4200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11900.5260 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							137.1660 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8487 (36)					
Total fabric heat loss						(33) + (36) =	49.3283 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.2159	Feb 35.2159	Mar 35.2159	Apr 35.2159	May 35.2159	Jun 35.2159	Jul 35.2159	Aug 35.2159	Sep 35.2159	Oct 35.2159	Nov 35.2159	Dec 35.2159 (38)
Heat transfer coeff	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442	84.5442 (39)
Average = Sum(39)m / 12 =												84.5442 (39)
HLP	Jan 0.9745	Feb 0.9745	Mar 0.9745	Apr 0.9745	May 0.9745	Jun 0.9745	Jul 0.9745	Aug 0.9745	Sep 0.9745	Oct 0.9745	Nov 0.9745	Dec 0.9745 (40)
HLP (average)												0.9745 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5787 (42)
Average daily hot water use (litres/day)												95.4447 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	104.9892	101.1714	97.3536	93.5358	89.7180	85.9003	85.9003	89.7180	93.5358	97.3536	101.1714	104.9892 (44)
Energy conte	155.6959	136.1727	140.5180	122.5070	117.5484	101.4353	93.9947	107.8603	109.1485	127.2021	138.8510	150.7832 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1501.7171 (45)
23.3544	20.4259	21.0777	18.3760	17.6323	15.2153	14.0992	16.1790	16.3723	19.0803	20.8277	22.6175 (46)	
Water storage loss:												
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												
205.0727	180.7711	188.4991	163.5374	154.1309	136.6126	130.3446	145.1407	151.5296	175.1831	186.6350	200.1600 (62)	
WWHRS	-47.9347	-42.1757	-43.0461	-35.4219	-32.8925	-27.1364	-22.9697	-27.8099	-28.6197	-35.3761	-40.9737	-46.3300 eq. (G10)
Total of WWHRS savings												-430.6864
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												1.7883 (H8)
Utilisation factor												0.4283 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.4447 (H14)
Volume ratio Veff/V												0.7858 (H15)
Solar storage volume factor												0.9518 (H16)
Solar input												-686.5871 (H17)
Solar input	-21.1328	-31.7626	-53.4922	-73.9426	-89.0517	-93.7231	-91.4726	-81.6856	-63.7559	-43.3719	-25.6875	-17.5087 (63)
Solar input (sum of months) = Sum(63)m =												-686.5871 (63)
Output from w/h												
136.0053	106.8328	91.9607	54.1729	32.1867	15.7531	15.9023		35.6452	59.1540	96.4350	119.9738	136.3214 (64)
Heat gains from water heating, kWh/month												
91.2703	80.9561	85.1071	73.5579	68.3508	61.8691	60.3331	65.6878	70.1968	80.6795	84.3952	89.6369 (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	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235	154.7235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8464	49.6023	40.3393	30.5394	22.8286	19.2728	20.8250	27.0691	36.3321	46.1319	53.8428	57.3985 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.7450	351.3535	342.2602	322.9016	298.4648	275.4977	260.1543	256.5458	265.6391	284.9977	309.4344	332.4015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511	53.0511 (69)
Pumps, fans	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)												
Water heating gains (Table 5)	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490	-103.1490 (71)
Total internal gains	122.6752	120.4704	114.3912	102.1637	91.8694	85.9293	81.0929	88.2901	97.4955	108.4402	117.2155	120.4796 (72)
	630.8921	626.0517	601.6162	560.2303	517.7883	485.3254	466.6978	476.5306	504.0923	544.1955	585.1183	614.9053 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast					4.4000	40.4699	0.4600	0.0000	0.7700	63.0716 (77)		
Southwest					0.6600	40.4699	0.4600	0.0000	0.7700	9.4607 (79)		
Northwest					3.8000	12.9236	0.4600	0.0000	0.7700	17.3946 (81)		
Northwest					3.1500	12.9236	0.4300	0.0000	0.7700	13.4788 (81)		
Solar gains	103.4057	167.9915	252.0026	364.6996	435.7529	480.5441	451.0650	393.6903	311.0005	205.5095	128.8535	86.4117 (83)
Total gains	734.2978	794.0433	853.6189	924.9299	953.5413	965.8695	917.7628	870.2209	815.0928	749.7049	713.9718	701.3170 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	39.1003	39.1003	39.1003	39.1003	39.1003	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	3.6067	3.6067	3.6067	3.6067	3.6067	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003	39.1003
util living area						3.6067	3.6067	3.6067	3.6067	3.6067	3.6067	3.6067
	0.9454	0.9270	0.8821	0.7886	0.6341	0.4249	0.2833	0.3077	0.5592	0.8051	0.9143	0.9518 (86)
Tweekday	18.5974	18.8084	19.2288	19.6779	19.9811	20.0902	20.1034	20.1029	20.0564	19.7298	19.1133	18.5307
Tweekend	20.2558	20.3521	20.5457	20.7606	20.9179	20.9859	20.9977	20.9968	20.9604	20.7812	20.4891	20.2252

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24 / 16	0	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	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8514	19.9977	20.2989	20.6262	20.8733	20.9783	20.9964	20.9951	20.9382	20.6623	20.2022	19.8043	(87)
Th 2	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	20.1047	(88)
util rest of house													
	0.9362	0.9150	0.8627	0.7549	0.5800	0.3535	0.2026	0.2231	0.4859	0.7663	0.8981	0.9436	(89)
Tweekday	18.5974	18.8084	19.2288	19.6779	19.9811	20.0902	20.1034	20.1029	20.0564	19.7298	19.1133	18.5307	
Tweekend	18.5974	18.8084	19.2288	19.6779	19.9811	20.0902	20.1034	20.1029	20.0564	19.7298	19.1133	18.5307	
MIT 2	18.5974	18.8084	19.2288	19.6779	19.9811	20.0902	20.1034	20.1029	20.0564	19.7298	19.1133	18.5307	(90)
Living area fraction									fLA = Living area / (4) =				0.2363 (91)
MIT	18.8937	19.0894	19.4817	19.9020	20.1919	20.3000	20.3144	20.3137	20.2647	19.9501	19.3706	18.8316	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8937	19.0894	19.4817	19.9020	20.1919	20.3000	20.3144	20.3137	20.2647	19.9501	19.3706	18.8316	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9208	0.8986	0.8471	0.7465	0.5855	0.3694	0.2217	0.2431	0.4995	0.7588	0.8820	0.9287	(94)
Useful gains	676.1138	713.4940	723.1243	690.5060	558.2986	356.7843	203.4239	211.5233	407.1693	568.8740	629.7428	651.3289	(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													
	1166.1783	1140.4540	1021.4356	845.6112	608.0338	363.5414	204.1262	212.5195	428.1924	705.9536	961.3195	1160.9288	(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													
	364.6080	286.9171	221.9436	111.6757	37.0029	0.0000	0.0000	0.0000	0.0000	101.9872	238.7352	379.1423	(98)
Space heating													1742.0120 (98)
Space heating per m2											(98) / (4) =		20.0785 (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 %)													238.9921 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													728.8995 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	364.6080	286.9171	221.9436	111.6757	37.0029	0.0000	0.0000	0.0000	0.0000	101.9872	238.7352	379.1423	(98)
Space heating efficiency (main heating system 1)	238.9921	238.9921	238.9921	238.9921	238.9921	0.0000	0.0000	0.0000	0.0000	238.9921	238.9921	238.9921	(210)
Space heating fuel (main heating system)	152.5607	120.0530	92.8665	46.7278	15.4829	0.0000	0.0000	0.0000	0.0000	42.6739	99.8925	158.6422	(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	136.0053	106.8328	91.9607	54.1729	32.1867	15.7531	15.9023	35.6452	59.1540	96.4350	119.9738	136.3214	(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	79.8715	62.7395	54.0056	31.8140	18.9022	9.2513	9.3389	20.9333	34.7393	56.6332	70.4568	80.0572	(219)
Water heating fuel used												528.7428	(219)
Annual totals kWh/year												728.8995	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													59.7406 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													109.7406 (231)
Electricity for lighting (calculated in Appendix L)													394.5058 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728	(233)
Total delivered energy for all uses												715.0158	(238)

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

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	728.8995	16.9600	123.6213	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	528.7428	16.9600	89.6748	(247)
Mechanical ventilation fans	59.7406	16.9600	10.1320	(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	394.5058	16.9600	66.9082	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			121.2667	(255)

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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	728.8995	0.5190	378.2988 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	528.7428	0.5190	274.4175 (264)
Space and water heating			652.7163 (265)
Pumps and fans	109.7406	0.5190	56.9554 (267)
Energy for lighting	394.5058	0.5190	204.7485 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			371.0932 (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	728.8995	3.0700	2237.7213 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	528.7428	3.0700	1623.2404 (264)
Space and water heating			3860.9618 (265)
Pumps and fans	109.7406	3.0700	336.9035 (267)
Energy for lighting	394.5058	3.0700	1211.1327 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			2195.0986 (272)
Primary energy kWh/m2/year			25.3008 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	137.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	281.73 (P1)
Transmission heat loss coefficient	49.33 (37)
Summer heat loss coefficient	331.06 (P2)

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

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

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

	Jun	Jul	Aug	
Solar gains	562	527	460	(P3/P4)
Internal gains	499	481	490	
Total summer gains	1061	1008	950	(P5)
Summer gain/loss ratio	3.20	3.04	2.87	(P6)
Summer external temperature	16.00	17.90	17.80	

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Thermal mass temperature increment (TMP = 137.2)	1.04	1.04	1.04	
Threshold temperature	20.24	21.98	21.71	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			