

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Lutyens - Det (ASHP+PV)			Issued on Date	15/12/2022
Assessment Reference	Lutyens - Det (ASHP+PV)	Prop Type Ref			
Property	Plot, 5 Bed, K, U, WC, B, 2ES				
SAP Rating	90 B	DER	9.78	TER	24.50
Environmental	91 B	% DER<TER	60.08		
CO ₂ Emissions (t/year)	1.09	DFEE	46.33	TFEE	58.18
General Requirements Compliance	Pass	% DFEE<TFEE	20.36		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Detached House, total floor area 140 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) 24.50 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.28 (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	0.13 (max. 0.20)	0.16 (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

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

Based on:

Overshading: Average
Windows facing South East: 9.47 m², No overhang
Windows facing South West: 1.62 m², No overhang
Windows facing North West: 8.25 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.12 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.12 W/m²K
Roof U-value 0.12 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.024 W/m²K
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	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (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)
											Air changes per hour	
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes	
Measured/design AP50											4.0100	
Infiltration rate											0.2005 (18)	
Number of sides sheltered											0 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =	1.0000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.2005 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:											0.5000 (23a)	
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)					
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)					
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)					
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)					
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)					
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)					
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)					
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)					
Total net area of external elements Aum(A, m2)			337.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	85.7458			(33)					
Timber GF			61.6600			9.0000	554.9400 (32c)					
Timber 1F			137.7600			9.0000	1239.8400 (32c)					
Timber 2F			16.1500			9.0000	145.3500 (32c)					
Masonry GF			44.0200			39.0000	1716.7800 (32c)					
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)					
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)					
Internal Ceiling			56.4200			9.0000	507.7800 (32e)					
Internal Ceiling			27.3600			9.0000	246.2400 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18795.9180 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.0650 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0826 (36)					
Total fabric heat loss							(33) + (36) = 93.8284 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.3246	Feb 57.7465	Mar 57.6744	Apr 57.6744	May 57.6744	Jun 57.6744	Jul 57.6744	Aug 57.6744	Sep 57.6744	Oct 57.6744	Nov 57.6744	Dec 57.6744 (38)
Heat transfer coeff	152.1530	151.5748	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	(39)
Average = Sum(39)m / 12 =												151.5629 (39)
HLP	Jan 1.0853	Feb 1.0811	Mar 1.0806	Apr 1.0806	May 1.0806	Jun 1.0806	Jul 1.0806	Aug 1.0806	Sep 1.0806	Oct 1.0806	Nov 1.0806	Dec 1.0806 (40)
HLP (average)												1.0810 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content (annual)	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3229	22.1476	22.8543	19.9250	19.1185	16.4978	15.2876	17.5428	17.7523	20.6886	22.5832	24.5239 (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 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	218.1964	192.2491	201.7391	180.6171	176.8334	157.7693	151.2944	166.3287	166.1327	187.3008	198.3388	212.8696 (62)
WWHRS	-53.3301	-46.9255	-47.8926	-39.3922	-36.5701	-30.1640	-25.5206	-30.9023	-31.8075	-39.3292	-45.5696	-51.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-478.9524
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	164.8663	145.3236	153.8465	141.2249	140.2633	127.6053	125.7737	135.4264	134.3252	147.9716	152.7692	161.3208 (64)
Heat gains from water heating, kWh/month	95.6340	84.7726	90.1619	82.3942	81.8807	74.7973	73.3890	78.3879	77.5781	85.3612	88.2867	93.8628 (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	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7103	26.3884	21.4605	16.2470	12.1448	10.2532	11.0789	14.4008	19.3287	24.5422	28.6444	30.5360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	309.6393	312.8524	304.7555	287.5182	265.7593	245.3089	231.6468	228.4337	236.5306	253.7679	275.5268	295.9772 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	121.1853	114.4364	110.0548	103.8852	98.6412	105.3601	107.7474	114.7327	122.6204	126.1597 (72)
Total internal gains	534.6518	532.1524	514.1633	484.9636	454.7208	426.2092	408.1288	414.9566	430.3686	459.8047	493.5535	519.4348 (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				9.4700	36.7938	0.4600		0.0000		0.7700		123.4166 (77)
Southwest				1.6200	36.7938	0.4600		0.0000		0.7700		21.1124 (79)
Northwest				5.1000	11.2829	0.4600		0.0000		0.7700		20.3817 (81)
Northwest				3.1500	11.2829	0.4300		0.0000		0.7700		11.7677 (81)
Solar gains	176.6785	311.6276	454.7471	610.9972	727.7633	741.5887	707.0270	616.9960	508.3977	352.0627	213.5648	149.9416 (83)
Total gains	711.3303	843.7800	968.9104	1095.9608	1182.4841	1167.7979	1115.1558	1031.9526	938.7663	811.8674	707.1183	669.3764 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.3147	34.4456	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2876	3.2964	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9890	0.9801	0.9613	0.9172	0.8295	0.6916	0.5483	0.6016	0.8067	0.9422	0.9817	0.9910 (86)
Tweekday	17.3474	17.6971	18.2402	18.9128	19.5037	19.8623	19.9805	19.9628	19.7117	18.9504	18.0162	17.2759
Tweekend	19.7199	19.8746	20.1172	20.4224	20.7014	20.8870	20.9615	20.9469	20.7991	20.4345	20.0152	19.6872
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	19.0244	19.2592	19.6376	20.0981	20.5391	20.8265	20.9406	20.9181	20.6863	20.1272	19.4622	18.9738 (87)
Th 2	20.0129	20.0163	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9869	0.9762	0.9535	0.8994	0.7910	0.6191	0.4436	0.4979	0.7493	0.9263	0.9775	0.9892 (89)
Tweekday	17.3474	17.6971	18.2402	18.9128	19.5037	19.8623	19.9805	19.9628	19.7117	18.9504	18.0162	17.2759
Tweekend	17.3474	17.6971	18.2402	18.9128	19.5037	19.8623	19.9805	19.9628	19.7117	18.9504	18.0162	17.2759

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MIT 2	17.3474	17.6971	18.2402	18.9128	19.5037	19.8623	19.9805	19.9628	19.7117	18.9504	18.0162	17.2759 (90)
Living area fraction									fLA = Living area / (4) =			0.1166 (91)
MIT	17.5429	17.8793	18.4032	19.0510	19.6244	19.9748	20.0924	20.0742	19.8253	19.0877	18.1848	17.4739 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5429	17.8793	18.4032	19.0510	19.6244	19.9748	20.0924	20.0742	19.8253	19.0877	18.1848	17.4739 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Utilisation	0.9787	0.9640	0.9359	0.8774	0.7731	0.6157	0.4522	0.5045	0.7361	0.9061	0.9658	0.9821	(94)		
Useful gains	696.1482	813.3975	906.8057	961.5696	914.1712	718.9815	504.3115	520.6200	691.0332	735.6088	682.9027	657.3982	(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															
	2014.9535	1967.3353	1803.3603	1537.9023	1200.5692	814.2912	529.1121	556.6482	867.4014	1285.9063	1679.3770	2011.0292	(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															
	981.1912	775.4462	667.0367	414.9596	213.0802	0.0000	0.0000	0.0000	0.0000	409.4214	717.4615	1007.1015	(98)		
Space heating													5185.6982	(98)	
Space heating per m2													(98) / (4) =	36.9879	(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 %)													263.7656 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1966.0250 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	981.1912	775.4462	667.0367	414.9596	213.0802	0.0000	0.0000	0.0000	0.0000	409.4214	717.4615	1007.1015 (98)	
Space heating efficiency (main heating system 1)	263.7656	263.7656	263.7656	263.7656	263.7656	0.0000	0.0000	0.0000	0.0000	263.7656	263.7656	263.7656 (210)	
Space heating fuel (main heating system)	371.9936	293.9906	252.8899	157.3213	80.7839	0.0000	0.0000	0.0000	0.0000	155.2217	272.0072	381.8168 (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	164.8663	145.3236	153.8465	141.2249	140.2633	127.6053	125.7737	135.4264	134.3252	147.9716	152.7692	161.3208 (64)	
Efficiency of water heater (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 (216)	
Fuel for water heating, kWh/month	96.8207	85.3439	90.3491	82.9369	82.3721	74.9385	73.8629	79.5316	78.8849	86.8990	89.7164	94.7386 (219)	
Water heating fuel used												1016.3946 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1966.0250 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													98.4274 (230a)
Total electricity for the above, kWh/year													98.4274 (231)
Electricity for lighting (calculated in Appendix L)													524.6926 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1004 * 1.00) =									-963.8364			-963.8364 (233)	
Total delivered energy for all uses												2641.7032 (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	1966.0250	0.5190	1020.3670 (261)	
Space heating - secondary	0.0000	0.5190	0.0000 (263)	
Water heating (other fuel)	1016.3946	0.5190	527.5088 (264)	
Space and water heating			1547.8758 (265)	
Pumps and fans	98.4274	0.5190	51.0838 (267)	
Energy for lighting	524.6926	0.5190	272.3155 (268)	
Energy saving/generation technologies				
PV Unit	-963.8364	0.5190	-500.2311 (269)	
Total CO2, kg/year			1371.0440 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			9.7800 (273)	

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

DER			9.7800 ZC1
Total Floor Area		TFA	140.2000
Assumed number of occupants		N	2.9175
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.0874 ZC2
CO2 emissions from cooking, equation (L16)			1.3482 ZC3
Total CO2 emissions			24.2156 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	24.2156	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1144 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3644 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3644 (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	0.4647	0.4555	0.4464	0.4009	0.3918	0.3462	0.3462	0.3371	0.3644	0.3918	0.4100	0.4282 (22b)
Effective ac	0.6080	0.6038	0.5997	0.5804	0.5767	0.5599	0.5599	0.5568	0.5664	0.5767	0.5840	0.5917 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			19.3400	1.3258	25.6402		(27)
FP McCann System			56.4200	0.1300	7.3346		(28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.1800	27.8460		(29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.1800	0.7272		(29a)
Wall to Void	37.9900		37.9900	0.1800	6.8382		(29a)
Sloping Ceiling	20.5900		20.5900	0.1300	2.6767		(30)
Dormer Flat Roof	2.6300		2.6300	0.1300	0.3419		(30)
Ceiling to Void	29.0600		29.0600	0.1300	3.7778		(30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.1300	1.1687		(30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7073		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5553 (36)
Total fabric heat loss						(33) + (36) =	94.2626 (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	70.1265	69.6430	69.1690	66.9429	66.5264	64.5874	64.5874	64.2284	65.3343	66.5264	67.3690	68.2498 (38)
Heat transfer coeff	164.3891	163.9055	163.4316	161.2054	160.7889	158.8500	158.8500	158.4909	159.5968	160.7889	161.6315	162.5124 (39)
Average = Sum(39)m / 12 =												161.2034 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1725	1.1691	1.1657	1.1498	1.1469	1.1330	1.1330	1.1305	1.1384	1.1469	1.1529	1.1591 (40)
HLP (average)												1.1498 (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												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy conte	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1628.2972 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.3229	22.1476	22.8543	19.9250	19.1185	16.4978	15.2876	17.5428	17.7523	20.6886	22.5832	24.5239	(46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss												
27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
219.7457	193.6484	203.2884	182.1164	178.3826	159.2686	152.8436	167.8780	167.6320	188.8500	199.8381	214.4188	(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												
219.7457	193.6484	203.2884	182.1164	178.3826	159.2686	152.8436	167.8780	167.6320	188.8500	199.8381	214.4188	(64)
Total per year (kWh/year) = Sum(64)m =												2227.9106 (64)
Heat gains from water heating, kWh/month												
96.8734	85.8920	91.4013	83.5937	83.1202	75.9968	74.6284	79.6274	78.7776	86.6006	89.4861	95.1022	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
29.7103	26.3884	21.4605	16.2470	12.1448	10.2532	11.0789	14.4008	19.3287	24.5422	28.6444	30.5360	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
309.6393	312.8524	304.7555	287.5182	265.7593	245.3089	231.6468	228.4337	236.5306	253.7679	275.5268	295.9772	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	(71)
Water heating gains (Table 5)												
130.2061	127.8155	122.8512	116.1023	111.7206	105.5510	100.3071	107.0260	109.4133	116.3986	124.2863	127.8255	(72)
Total internal gains	539.3177	536.8183	518.8292	489.6295	459.3867	430.8750	412.7947	419.6224	435.0345	464.4706	498.2194	524.1007 (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	9.4700	36.7938	0.6300	0.7000	0.7700	106.4871 (77)
Southwest	1.6200	36.7938	0.6300	0.7000	0.7700	18.2164 (79)
Northwest	8.2500	11.2829	0.6300	0.7000	0.7700	28.4478 (81)

Solar gains	153.1512	270.3223	394.9656	531.4508	633.6682	645.9762	615.7610	536.9200	441.8244	305.5310	185.1606	129.9520 (83)
Total gains	692.4689	807.1406	913.7948	1021.0803	1093.0549	1076.8513	1028.5557	956.5425	876.8589	770.0017	683.3800	654.0527 (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	
59.2260	59.4007	59.5730	60.3957	60.5521	61.2912	61.2912	61.4301	61.0044	60.5521	60.2365	59.9100	
4.9484	4.9600	4.9715	5.0264	5.0368	5.0861	5.0861	5.0953	5.0670	5.0368	5.0158	4.9940	
util living area	0.9992	0.9981	0.9946	0.9812	0.9346	0.8107	0.6458	0.7060	0.9142	0.9890	0.9982	0.9994 (86)
MIT	19.6301	19.7762	20.0242	20.3645	20.6825	20.9035	20.9767	20.9639	20.7989	20.3896	19.9525	19.6113 (87)
Th 2	19.9420	19.9448	19.9475	19.9604	19.9628	19.9740	19.9740	19.9760	19.9696	19.9628	19.9579	19.9528 (88)
util rest of house	0.9989	0.9974	0.9925	0.9731	0.9041	0.7261	0.5118	0.5750	0.8615	0.9830	0.9975	0.9992 (89)
MIT 2	18.1054	18.3209	18.6847	19.1859	19.6287	19.9033	19.9646	19.9596	19.7913	19.2280	18.5884	18.0854 (90)
Living area fraction												0.1166 (91)
MIT	18.2832	18.4906	18.8409	19.3233	19.7516	20.0200	20.0826	20.0767	19.9088	19.3634	18.7475	18.2634 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2832	18.4906	18.8409	19.3233	19.7516	20.0200	20.0826	20.0767	19.9088	19.3634	18.7475	18.2634 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9982	0.9958	0.9892	0.9662	0.8963	0.7305	0.5270	0.5892	0.8575	0.9778	0.9960	0.9986 (94)
Useful gains	691.1908	803.7851	903.9489	986.6054	979.6749	786.5948	542.0497	563.5608	751.9233	752.9129	680.6738	653.1493 (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												
	2298.6834	2227.5743	2016.8965	1680.2965	1294.6061	860.9640	553.2159	582.7204	927.0688	1409.0628	1882.5964	2285.4694 (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	1195.9745	956.7864	828.0330	499.4576	234.3088	0.0000	0.0000	0.0000	0.0000	488.1755	865.3843	1214.4461 (98)
Space heating												6282.5662 (98)
Space heating per m2											(98) / (4) =	44.8115 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6719.3221 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1195.9745	956.7864	828.0330	499.4576	234.3088	0.0000	0.0000	0.0000	0.0000	488.1755	865.3843	1214.4461	(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)	1279.1171	1023.3009	885.5968	534.1793	250.5976	0.0000	0.0000	0.0000	0.0000	522.1128	925.5447	1298.8729	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	219.7457	193.6484	203.2884	182.1164	178.3826	159.2686	152.8436	167.8780	167.6320	188.8500	199.8381	214.4188	(64)
Efficiency of water heater (217)m	88.6549	88.5025	88.1697	87.3698	85.5422	79.8000	79.8000	79.8000	79.8000	87.2372	88.2794	88.7150	(216)
Fuel for water heating, kWh/month	247.8664	218.8056	230.5650	208.4433	208.5317	199.5847	191.5334	210.3734	210.0651	216.4789	226.3701	241.6941	(219)
Water heating fuel used												2610.3118	(219)
Annual totals kWh/year													
Space heating fuel - main system												6719.3221	(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)												524.6926	(232)
Total delivered energy for all uses												9929.3265	(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	6719.3221	0.2160	1451.3736 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2610.3118	0.2160	563.8273 (264)
Space and water heating			2015.2009 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	524.6926	0.5190	272.3155 (268)
Total CO2, kg/m2/year			2326.4414 (272)
Emissions per m2 for space and water heating			14.3738 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.9423 (272b)
Emissions per m2 for pumps and fans			0.2776 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3738 * 1.55) + 1.9423 + 0.2776, rounded to 2 d.p.			24.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1144 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3149 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3149 (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	0.4015	0.3937	0.3858	0.3464	0.3386	0.2992	0.2992	0.2913	0.3149	0.3386	0.3543	0.3700 (22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685 (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)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.7458		(33)
Timber GF			61.6600			9.0000	554.9400 (32c)
Timber 1F			137.7600			9.0000	1239.8400 (32c)
Timber 2F			16.1500			9.0000	145.3500 (32c)
Masonry GF			44.0200			39.0000	1716.7800 (32c)
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)
Internal Ceiling			56.4200			9.0000	507.7800 (32e)
Internal Ceiling			27.3600			9.0000	246.2400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18795.9180 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K 134.0650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.0826 (36)
Total fabric heat loss (33) + (36) = 93.8284 (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	66.9736	66.6125	66.2585	64.5960	64.2850	62.8370	62.8370	62.5689	63.3948	64.2850	64.9142	65.5721 (38)
Heat transfer coeff	160.8019	160.4408	160.0869	158.4244	158.1134	156.6654	156.6654	156.3972	157.2231	158.1134	158.7426	159.4004 (39)
Average = Sum(39)m / 12 =												158.4229 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1469	1.1444	1.1418	1.1300	1.1278	1.1174	1.1174	1.1155	1.1214	1.1278	1.1323	1.1370 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9175 (42)											
Average daily hot water use (litres/day)	103.4898 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Energy content (annual)	Total = Sum(45)m =											1628.2972 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.8742	31.3758	32.3770	28.2270	27.0845	23.3719	21.6575	24.8523	25.1491	29.3088	31.9929	34.7422 (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	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7103	26.3884	21.4605	16.2470	12.1448	10.2532	11.0789	14.4008	19.3287	24.5422	28.6444	30.5360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	309.6393	312.8524	304.7555	287.5182	265.7593	245.3089	231.6468	228.4337	236.5306	253.7679	275.5268	295.9772 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	48.2180	46.6901	43.5175	39.2042	36.4039	32.4609	29.1095	33.4036	34.9293	39.3936	44.4346	46.6965 (72)
Total internal gains	454.3295	452.6929	436.4954	409.7314	381.0699	354.7849	338.5971	343.0000	357.5505	384.4656	415.3677	439.9717 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Southeast	9.4700	36.7938	0.4600	0.0000	0.7700	123.4166 (77)
Southwest	1.6200	36.7938	0.4600	0.0000	0.7700	21.1124 (79)
Northwest	5.1000	11.2829	0.4600	0.0000	0.7700	20.3817 (81)
Northwest	3.1500	11.2829	0.4300	0.0000	0.7700	11.7677 (81)

Solar gains	176.6785	311.6276	454.7471	610.9972	727.7633	741.5887	707.0270	616.9960	508.3977	352.0627	213.5648	149.9416 (83)
Total gains	631.0080	764.3205	891.2425	1020.7286	1108.8332	1096.3737	1045.6242	959.9960	865.9482	736.5283	628.9325	589.9133 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.4691	32.5421	32.6141	32.9563	33.0212	33.3264	33.3264	33.3835	33.2081	33.0212	32.8903	32.7545
alpha	3.1646	3.1695	3.1743	3.1971	3.2014	3.2218	3.2218	3.2256	3.2139	3.2014	3.1927	3.1836
util living area	0.9922	0.9851	0.9699	0.9329	0.8566	0.7280	0.5884	0.6443	0.8405	0.9563	0.9869	0.9937 (86)
MIT	18.8202	19.0613	19.4557	19.9738	20.4458	20.7817	20.9209	20.8922	20.6193	19.9994	19.3143	18.7795 (87)
Th 2	19.9627	19.9648	19.9668	19.9764	19.9782	19.9866	19.9866	19.9882	19.9834	19.9782	19.9746	19.9708 (88)
util rest of house	0.9906	0.9821	0.9636	0.9175	0.8209	0.6557	0.4776	0.5366	0.7872	0.9434	0.9838	0.9924 (89)
MIT 2	17.9584	18.1995	18.5918	19.1061	19.5539	19.8531	19.9534	19.9390	19.7239	19.1395	18.4598	17.9236 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0589	18.3000	18.6925	19.2073	19.6579	19.9614	20.0662	20.0502	19.8283	19.2398	18.5594	18.0234 (91)
Temperature adjustment	0.0000											
adjusted MIT	18.0589	18.3000	18.6925	19.2073	19.6579	19.9614	20.0662	20.0502	19.8283	19.2398	18.5594	18.0234 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9864	0.9754	0.9531	0.9030	0.8077	0.6536	0.4871	0.5439	0.7774	0.9311	0.9777	0.9889 (94)
Ext temp.	622.4502	745.4928	849.4401	921.7509	895.6346	716.6377	509.2928	522.1845	673.2222	685.7669	614.9106	583.3794 (95)
Heat loss rate W	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)
Month fracti	2212.4506	2149.9138	1951.8646	1632.9204	1258.2554	839.9471	543.0316	570.8771	900.6259	1366.0696	1819.1010	2203.4574 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1182.9603	943.7709	820.2039	512.0420	269.7899	0.0000	0.0000	0.0000	0.0000	506.1451	867.0171	1205.3380 (98)
Space heating per m ²	(98) / (4) = 44.9876 (99)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1472.6546	1159.3238	1188.6190	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7448	0.8158	0.7808	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1096.8723	945.8092	928.0787	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1404.7900	1342.7150	1245.2870	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	221.7008	295.2979	236.0030	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													
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	55.4252	73.8245	59.0007	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													
Energy for space heating													
Energy for space cooling													
Total													
Dwelling Fabric Energy Efficiency (DFEE)													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1144 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3644 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3644 (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	0.4647	0.4555	0.4464	0.4009	0.3918	0.3462	0.3462	0.3371	0.3644	0.3918	0.4100	0.4282 (22b)
Effective ac	0.6080	0.6038	0.5997	0.5804	0.5767	0.5599	0.5599	0.5568	0.5664	0.5767	0.5840	0.5917 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			19.3400	1.3258	25.6402		(27)
FP McCann System			56.4200	0.1300	7.3346		(28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.1800	27.8460		(29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.1800	0.7272		(29a)
Wall to Void	37.9900		37.9900	0.1800	6.8382		(29a)
Sloping Ceiling	20.5900		20.5900	0.1300	2.6767		(30)
Dormer Flat Roof	2.6300		2.6300	0.1300	0.3419		(30)
Ceiling to Void	29.0600		29.0600	0.1300	3.7778		(30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.1300	1.1687		(30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.7073		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5553 (36)
Total fabric heat loss						(33) + (36) =	94.2626 (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	70.1265	69.6430	69.1690	66.9429	66.5264	64.5874	64.5874	64.2284	65.3343	66.5264	67.3690	68.2498 (38)
Heat transfer coeff	164.3891	163.9055	163.4316	161.2054	160.7889	158.8500	158.8500	158.4909	159.5968	160.7889	161.6315	162.5124 (39)
Average = Sum(39)m / 12 =												161.2034 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1725	1.1691	1.1657	1.1498	1.1469	1.1330	1.1330	1.1305	1.1384	1.1469	1.1529	1.1591 (40)
HLP (average)												1.1498 (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												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy conte	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1628.2972 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.8742	31.3758	32.3770	28.2270	27.0845	23.3719	21.6575	24.8523	25.1491	29.3088	31.9929	34.7422 (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	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	145.8732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.7103	26.3884	21.4605	16.2470	12.1448	10.2532	11.0789	14.4008	19.3287	24.5422	28.6444	30.5360	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	309.6393	312.8524	304.7555	287.5182	265.7593	245.3089	231.6468	228.4337	236.5306	253.7679	275.5268	295.9772	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	37.5873	(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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	(71)
Water heating gains (Table 5)	48.2180	46.6901	43.5175	39.2042	36.4039	32.4609	29.1095	33.4036	34.9293	39.3936	44.4346	46.6965	(72)
Total internal gains	454.3295	452.6929	436.4954	409.7314	381.0699	354.7849	338.5971	343.0000	357.5505	384.4656	415.3677	439.9717	(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			9.4700		36.7938		0.6300		0.7000		0.7700		106.4871 (77)
Southwest			1.6200		36.7938		0.6300		0.7000		0.7700		18.2164 (79)
Northwest			8.2500		11.2829		0.6300		0.7000		0.7700		28.4478 (81)
Solar gains	153.1512	270.3223	394.9656	531.4508	633.6682	645.9762	615.7610	536.9200	441.8244	305.5310	185.1606	129.9520	(83)
Total gains	607.4807	723.0152	831.4610	941.1822	1014.7381	1000.7612	954.3582	879.9201	799.3749	689.9966	600.5283	569.9237	(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	59.2260	59.4007	59.5730	60.3957	60.5521	61.2912	61.2912	61.4301	61.0044	60.5521	60.2365	59.9100
alpha	4.9484	4.9600	4.9715	5.0264	5.0368	5.0861	5.0861	5.0953	5.0670	5.0368	5.0158	4.9940
util living area	0.9996	0.9988	0.9964	0.9866	0.9495	0.8422	0.6851	0.7487	0.9369	0.9932	0.9990	0.9997 (86)
MIT	19.5736	19.7205	19.9705	20.3153	20.6436	20.8832	20.9697	20.9528	20.7635	20.3385	19.8975	19.5552 (87)
Th 2	19.9420	19.9448	19.9475	19.9604	19.9628	19.9740	19.9740	19.9760	19.9696	19.9628	19.9579	19.9528 (88)
util rest of house	0.9994	0.9984	0.9950	0.9806	0.9243	0.7629	0.5481	0.6180	0.8937	0.9893	0.9986	0.9996 (89)
MIT 2	18.6316	18.7806	19.0321	19.3842	19.7009	19.9134	19.9653	19.9606	19.8204	19.4112	18.9680	18.6218 (90)
Living area fraction	fLA = Living area / (4) = 0.1166 (91)											
MIT	18.7415	18.8902	19.1416	19.4928	19.8109	20.0265	20.0824	20.0763	19.9304	19.5194	19.0764	18.7306 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7415	18.8902	19.1416	19.4928	19.8109	20.0265	20.0824	20.0763	19.9304	19.5194	19.0764	18.7306 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9978	0.9935	0.9769	0.9196	0.7677	0.5639	0.6324	0.8916	0.9868	0.9981	0.9994	(94)
Useful gains	606.9485	721.3980	826.0548	919.4297	933.1731	768.2645	538.1215	556.4373	712.7182	680.9023	599.3588	569.5666	(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	2374.0188	2293.0659	2066.0329	1707.6109	1304.1387	861.9957	553.1842	582.6548	930.5085	1434.1366	1935.7580	2361.4049	(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	1314.7003	1056.1608	922.5437	567.4905	275.9983	0.0000	0.0000	0.0000	0.0000	560.4063	962.2074	1333.1277	(98)
Space heating	6992.6352 (98)												
Space heating per m2	(98) / (4) = 49.8761 (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	1493.1900	1175.4900	1204.5311	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7703	0.8559	0.8166	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1150.1789	1006.1483	983.6606	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1293.0352	1236.0404	1151.6917	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	102.8565	171.0397	125.0151	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												398.9114 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.7141	42.7599	31.2538	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.7278 (107)
Space cooling per m2												0.7113 (108)
Energy for space heating												49.8761 (99)
Energy for space cooling												0.7113 (108)
Total												50.5875 (109)
Target Fabric Energy Efficiency (TFEE)												58.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (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)	
												Air changes per hour		
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =		0.0000 (8)
Pressure test												Yes		
Measured/design AP50														4.0100
Infiltration rate														0.2005 (18)
Number of sides sheltered														0 (19)
Shelter factor						(20) = 1 - [0.075 x (19)] =								1.0000 (20)
Infiltration rate adjusted to include shelter factor						(21) = (18) x (20) =								0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)	
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)	
Adj infilt rate														
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905	(22b)	
Mechanical extract ventilation - decentralised														
If mechanical ventilation:												0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)					
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)					
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)					
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)					
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)					
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)					
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)					
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)					
Total net area of external elements Aum(A, m2)			337.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =	85.7458			(33)					
Timber GF			61.6600			9.0000	554.9400 (32c)					
Timber 1F			137.7600			9.0000	1239.8400 (32c)					
Timber 2F			16.1500			9.0000	145.3500 (32c)					
Masonry GF			44.0200			39.0000	1716.7800 (32c)					
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)					
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)					
Internal Ceiling			56.4200			9.0000	507.7800 (32e)					
Internal Ceiling			27.3600			9.0000	246.2400 (32e)					
Heat capacity Cm = Sum(A x k)				(28) ... (30) + (32) + (32a) ... (32e) =	18795.9180		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.0650 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0826 (36)					
Total fabric heat loss				(33) + (36) =	93.8284		(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.6744	Feb 57.6744	Mar 57.6744	Apr 57.6744	May 57.6744	Jun 57.6744	Jul 57.6744	Aug 57.6744	Sep 57.6744	Oct 57.6744	Nov 57.6744	Dec 57.6744 (38)
Heat transfer coeff	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	(39)
Average = Sum(39)m / 12 =												151.5027 (39)
HLP	Jan 1.0806	Feb 1.0806	Mar 1.0806	Apr 1.0806	May 1.0806	Jun 1.0806	Jul 1.0806	Aug 1.0806	Sep 1.0806	Oct 1.0806	Nov 1.0806	Dec 1.0806 (40)
HLP (average)												1.0806 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content (annual)	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3229	22.1476	22.8543	19.9250	19.1185	16.4978	15.2876	17.5428	17.7523	20.6886	22.5832	24.5239 (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	218.1964	192.2491	201.7391	180.6171	176.8334	157.7693	151.2944	166.3287	166.1327	187.3008	198.3388	212.8696 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	218.1964	192.2491	201.7391	180.6171	176.8334	157.7693	151.2944	166.3287	166.1327	187.3008	198.3388	212.8696 (64)
RHI water heating demand	95.6340	84.7726	90.1619	82.3942	81.8807	74.7973	73.3890	78.3879	77.5781	85.3612	88.2867	93.8628 (65)
Heat gains from water heating, kWh/month	95.6340	84.7726	90.1619	82.3942	81.8807	74.7973	73.3890	78.3879	77.5781	85.3612	88.2867	93.8628 (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	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2757	65.9710	53.6512	40.6174	30.3620	25.6329	27.6972	36.0019	48.3217	61.3555	71.6109	76.3400 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.1482	466.9439	454.8590	429.1317	396.6556	366.1327	345.7415	340.9458	353.0307	378.7580	411.2341	441.7570 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	121.1853	114.4364	110.0548	103.8852	98.6412	105.3601	107.7474	114.7327	122.6204	126.1597 (72)
Total internal gains	778.7357	772.8361	743.4671	697.9571	650.8439	609.4222	585.8514	596.0794	622.8713	668.6177	719.2369	758.0282 (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					9.4700	40.4699	0.4600	0.0000	0.7700	135.7472	(77)	
Southwest					1.6200	40.4699	0.4600	0.0000	0.7700	23.2218	(79)	
Northwest					5.1000	12.9236	0.4600	0.0000	0.7700	23.3454	(81)	
Northwest					3.1500	12.9236	0.4300	0.0000	0.7700	13.4788	(81)	

Solar gains	195.7932	311.3988	450.8785	627.8602	731.3370	798.5569	752.7126	669.8663	547.6356	376.1740	242.5845	164.4904 (83)
Total gains	974.5289	1084.2348	1194.3456	1325.8173	1382.1809	1407.9791	1338.5640	1265.9457	1170.5069	1044.7917	961.8214	922.5186 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9693	0.9556	0.9230	0.8491	0.7146	0.5034	0.3436	0.3728	0.6481	0.8696	0.9495	0.9735 (86)
Tweekday	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570
Tweekend	19.9785	20.0952	20.3316	20.6121	20.8435	20.9660	20.9932	20.9910	20.9162	20.6404	20.2631	19.9460
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	19.4234	19.6003	19.9685	20.3944	20.7585	20.9478	20.9895	20.9862	20.8691	20.4450	19.8494	19.3734 (87)
Th 2	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9635	0.9474	0.9083	0.8196	0.6586	0.4163	0.2379	0.2628	0.5665	0.8372	0.9385	0.9685 (89)
Tweekday	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570
Tweekend	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570
MIT 2	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Living area fraction									fLA = Living area / (4) =	0.1166 (91)		
MIT	18.1032	18.3528	18.8569	19.4379	19.8900	20.0941	20.1271	20.1254	20.0231	19.5075	18.7156	18.0338 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1032	18.3528	18.8569	19.4379	19.8900	20.0941	20.1271	20.1254	20.0231	19.5075	18.7156	18.0338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9479	0.9287	0.8863	0.7992	0.6507	0.4235	0.2501	0.2753	0.5671	0.8168	0.9189	0.9541	(94)
Useful gains	923.7094	1006.9757	1058.5076	1059.5677	899.3767	596.3093	334.7180	348.5439	663.8254	853.3973	883.8384	880.1387	(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													
Month fracti	1970.0167	1932.0775	1735.7462	1445.0117	1043.8559	620.2644	337.4077	352.3052	730.7158	1198.0114	1623.4471	1959.5061	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	778.4526	621.6684	503.8655	277.5197	107.4925	0.0000	0.0000	0.0000	0.0000	256.3929	532.5183	803.0493	(98)
RHI space heating demand												3880.9592	(98)
												3881	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	85.7458	(33)
Timber GF			61.6600			9.0000	554.9400 (32c)
Timber 1F			137.7600			9.0000	1239.8400 (32c)
Timber 2F			16.1500			9.0000	145.3500 (32c)
Masonry GF			44.0200			39.0000	1716.7800 (32c)
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)
Internal Ceiling			56.4200			9.0000	507.7800 (32e)
Internal Ceiling			27.3600			9.0000	246.2400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18795.9180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		134.0650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0826 (36)
Total fabric heat loss	(33) + (36) =	93.8284 (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	58.3246	57.7465	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744 (38)
Heat transfer coeff	152.1530	151.5748	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027 (39)
Average = Sum(39)m / 12 =												151.5629 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0853	1.0811	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806 (40)
HLP (average)												1.0810 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Distribution loss (46)m = 0.15 x (45)m	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Total = Sum(45)m =												1628.2972 (45)
Water storage loss:	25.3229	22.1476	22.8543	19.9250	19.1185	16.4978	15.2876	17.5428	17.7523	20.6886	22.5832	24.5239 (46)
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	218.1964	192.2491	201.7391	180.6171	176.8334	157.7693	151.2944	166.3287	166.1327	187.3008	198.3388	212.8696 (62)
WWHRS	-53.3301	-46.9255	-47.8926	-39.3922	-36.5701	-30.1640	-25.5206	-30.9023	-31.8075	-39.3292	-45.5696	-51.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-478.9524
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	164.8663	145.3236	153.8465	141.2249	140.2633	127.6053	125.7737	135.4264	134.3252	147.9716	152.7692	161.3208 (64)
Heat gains from water heating, kWh/month	95.6340	84.7726	90.1619	82.3942	81.8807	74.7973	73.3890	78.3879	77.5781	85.3612	88.2867	93.8628 (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	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2757	65.9710	53.6512	40.6174	30.3620	25.6329	27.6972	36.0019	48.3217	61.3555	71.6109	76.3400 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.1482	466.9439	454.8590	429.1317	396.6556	366.1327	345.7415	340.9458	353.0307	378.7580	411.2341	441.7570 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	121.1853	114.4364	110.0548	103.8852	98.6412	105.3601	107.7474	114.7327	122.6204	126.1597 (72)
Total internal gains	778.7357	772.8361	743.4671	697.9571	650.8439	609.4222	585.8514	596.0794	622.8713	668.6177	719.2369	758.0282 (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					9.4700	36.7938	0.4600	0.0000	0.7700		123.4166 (77)	
Southwest					1.6200	36.7938	0.4600	0.0000	0.7700		21.1124 (79)	
Northwest					5.1000	11.2829	0.4600	0.0000	0.7700		20.3817 (81)	
Northwest					3.1500	11.2829	0.4300	0.0000	0.7700		11.7677 (81)	

Solar gains	176.6785	311.6276	454.7471	610.9972	727.7633	741.5887	707.0270	616.9960	508.3977	352.0627	213.5648	149.9416 (83)
Total gains	955.4142	1084.4636	1198.2142	1308.9543	1378.6072	1351.0110	1292.8784	1213.0754	1131.2690	1020.6804	932.8017	907.9698 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.3147	34.4456	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2876	3.2964	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9746	0.9604	0.9335	0.8769	0.7756	0.6284	0.4858	0.5312	0.7361	0.9005	0.9608	0.9782 (86)
Tweekday	17.7021	18.0293	18.5248	19.1201	19.6195	19.9052	19.9922	19.9810	19.8007	19.1756	18.3281	17.6275
Tweekend	19.8785	20.0243	20.2478	20.5219	20.7630	20.9158	20.9731	20.9634	20.8517	20.5420	20.1561	19.8440
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	19.2691	19.4908	19.8391	20.2534	20.6342	20.8707	20.9585	20.9434	20.7684	20.2931	19.6824	19.2160 (87)
Th 2	20.0129	20.0163	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9700	0.9534	0.9213	0.8533	0.7317	0.5552	0.3884	0.4331	0.6716	0.8764	0.9526	0.9743 (89)
Tweekday	17.7021	18.0293	18.5248	19.1201	19.6195	19.9052	19.9922	19.9810	19.8007	19.1756	18.3281	17.6275
Tweekend	17.7021	18.0293	18.5248	19.1201	19.6195	19.9052	19.9922	19.9810	19.8007	19.1756	18.3281	17.6275

MIT 2	17.7021	18.0293	18.5248	19.1201	19.6195	19.9052	19.9922	19.9810	19.8007	19.1756	18.3281	17.6275 (90)
Living area fraction									fIA =	Living area /	(4) =	0.1166 (91)
MIT	17.8848	18.1998	18.6780	19.2523	19.7378	20.0178	20.1049	20.0932	19.9135	19.3059	18.4861	17.8127 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8848	18.1998	18.6780	19.2523	19.7378	20.0178	20.1049	20.0932	19.9135	19.3059	18.4861	17.8127 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9558	0.9357	0.8999	0.8313	0.7177	0.5553	0.3976	0.4412	0.6639	0.8546	0.9349	0.9614 (94)
Useful gains	913.2317	1014.6876	1078.2541	1088.1776	989.3745	750.2331	513.9952	535.1561	751.1034	872.2439	872.0603	872.9620 (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	2066.9747	2015.9076	1845.0072	1568.3965	1217.7553	820.8125	531.0040	559.5319	880.7663	1318.9667	1725.0182	2062.3667 (97a)
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	858.3847	672.8198	570.4643	345.7576	169.9153	0.0000	0.0000	0.0000	0.0000	332.3617	614.1297	884.9171 (98)
Space heating												4448.7503 (98)
Space heating per m2												31.7315 (99)
										(98) / (4) =		

Not applicable

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 %)	263.7656	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	1686.6300	(211)

[illegible]

Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)		
mechanical ventilation fans (SFP = 0.2308)		98.4274 (230a)
Total electricity for the above, kWh/year		98.4274 (231)
Electricity for lighting (calculated in Appendix L)		524.6926 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.20 * 1004 * 1.00) =	-963.8364	-963.8364 (233)
Total delivered energy for all uses		2362.3082 (238)

	Fuel kWh/year	Fuel price p/kWh £/year	Fuel cost £/year
Space heating - main system 1	1686.6300	13.1900	222.4665 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1016.3946	13.1900	134.0625 (247)
Mechanical ventilation fans	98.4274	13.1900	12.9826 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	524.6926	13.1900	69.2070 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-963.8364	13.1900	-127.1300 (252)
Total energy cost			311.5885 (255)

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7066 (257)
SAP value		90.1426
SAP rating (Section 12)		90 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP band

B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1686.6300	0.5190	875.3610 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1016.3946	0.5190	527.5088 (264)
Space and water heating			1402.8698 (265)
Pumps and fans	98.4274	0.5190	51.0838 (267)
Energy for lighting	524.6926	0.5190	272.3155 (268)
Energy saving/generation technologies			
PV Unit	-963.8364	0.5190	-500.2311 (269)
Total kg/year			1226.0380 (272)
CO2 emissions per m2			8.7400 (273)
EI value			91.1291
EI rating			91 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.6377 = 5.001$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.6377 = 0.1968$, 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	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (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)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.0100	
Infiltration rate											0.2005 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)					
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)					
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)					
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)					
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)					
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)					
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)					
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)					
Total net area of external elements Aum(A, m2)			337.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	85.7458			(33)					
Timber GF			61.6600			9.0000	554.9400 (32c)					
Timber 1F			137.7600			9.0000	1239.8400 (32c)					
Timber 2F			16.1500			9.0000	145.3500 (32c)					
Masonry GF			44.0200			39.0000	1716.7800 (32c)					
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)					
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)					
Internal Ceiling			56.4200			9.0000	507.7800 (32e)					
Internal Ceiling			27.3600			9.0000	246.2400 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18795.9180 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.0650 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0826 (36)					
Total fabric heat loss							(33) + (36) = 93.8284 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.6744	Feb 57.6744	Mar 57.6744	Apr 57.6744	May 57.6744	Jun 57.6744	Jul 57.6744	Aug 57.6744	Sep 57.6744	Oct 57.6744	Nov 57.6744	Dec 57.6744 (38)
Heat transfer coeff	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027 (39)
Average = Sum(39)m / 12 =												151.5027 (39)
HLP	Jan 1.0806	Feb 1.0806	Mar 1.0806	Apr 1.0806	May 1.0806	Jun 1.0806	Jul 1.0806	Aug 1.0806	Sep 1.0806	Oct 1.0806	Nov 1.0806	Dec 1.0806 (40)
HLP (average)												1.0806 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content (annual)	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3229	22.1476	22.8543	19.9250	19.1185	16.4978	15.2876	17.5428	17.7523	20.6886	22.5832	24.5239 (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	218.1964	192.2491	201.7391	180.6171	176.8334	157.7693	151.2944	166.3287	166.1327	187.3008	198.3388	212.8696 (62)
WWHRS	-53.3301	-46.9255	-47.8926	-39.3922	-36.5701	-30.1640	-25.5206	-30.9023	-31.8075	-39.3292	-45.5696	-51.5487 eq. (G10)
Total of WWHRS savings	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-478.9524
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	164.8663	145.3236	153.8465	141.2249	140.2633	127.6053	125.7737	135.4264	134.3252	147.9716	152.7692	161.3208 (64)
Heat gains from water heating, kWh/month	95.6340	84.7726	90.1619	82.3942	81.8807	74.7973	73.3890	78.3879	77.5781	85.3612	88.2867	93.8628 (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	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2757	65.9710	53.6512	40.6174	30.3620	25.6329	27.6972	36.0019	48.3217	61.3555	71.6109	76.3400 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.1482	466.9439	454.8590	429.1317	396.6556	366.1327	345.7415	340.9458	353.0307	378.7580	411.2341	441.7570 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	121.1853	114.4364	110.0548	103.8852	98.6412	105.3601	107.7474	114.7327	122.6204	126.1597 (72)
Total internal gains	778.7357	772.8361	743.4671	697.9571	650.8439	609.4222	585.8514	596.0794	622.8713	668.6177	719.2369	758.0282 (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				9.4700	40.4699	0.4600	0.0000	0.7700	135.7472 (77)			
Southwest				1.6200	40.4699	0.4600	0.0000	0.7700	23.2218 (79)			
Northwest				5.1000	12.9236	0.4600	0.0000	0.7700	23.3454 (81)			
Northwest				3.1500	12.9236	0.4300	0.0000	0.7700	13.4788 (81)			
Solar gains	195.7932	311.3988	450.8785	627.8602	731.3370	798.5569	752.7126	669.8663	547.6356	376.1740	242.5845	164.4904 (83)
Total gains	974.5289	1084.2348	1194.3456	1325.8173	1382.1809	1407.9791	1338.5640	1265.9457	1170.5069	1044.7917	961.8214	922.5186 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9693	0.9556	0.9230	0.8491	0.7146	0.5034	0.3436	0.3728	0.6481	0.8696	0.9495	0.9735 (86)
Tweekday	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570
Tweekend	19.9785	20.0952	20.3316	20.6121	20.8435	20.9660	20.9932	20.9910	20.9162	20.6404	20.2631	19.9460
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	19.4234	19.6003	19.9685	20.3944	20.7585	20.9478	20.9895	20.9862	20.8691	20.4450	19.8494	19.3734 (87)
Th 2	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9635	0.9474	0.9083	0.8196	0.6586	0.4163	0.2379	0.2628	0.5665	0.8372	0.9385	0.9685 (89)
Tweekday	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570
Tweekend	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570

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MIT 2	17.9289	18.1881	18.7101	19.3116	19.7754	19.9814	20.0132	20.0118	19.9114	19.3838	18.5660	17.8570 (90)
Living area fraction									fLA = Living area / (4) =			0.1166 (91)
MIT	18.1032	18.3528	18.8569	19.4379	19.8900	20.0941	20.1271	20.1254	20.0231	19.5075	18.7156	18.0338 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1032	18.3528	18.8569	19.4379	19.8900	20.0941	20.1271	20.1254	20.0231	19.5075	18.7156	18.0338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9479	0.9287	0.8863	0.7992	0.6507	0.4235	0.2501	0.2753	0.5671	0.8168	0.9189	0.9541	(94)	
Useful gains	923.7094	1006.9757	1058.5076	1059.5677	899.3767	596.3093	334.7180	348.5439	663.8254	853.3973	883.8384	880.1387	(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														
	1970.0167	1932.0775	1735.7462	1445.0117	1043.8559	620.2644	337.4077	352.3052	730.7158	1198.0114	1623.4471	1959.5061	(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														
	778.4526	621.6684	503.8655	277.5197	107.4925	0.0000	0.0000	0.0000	0.0000	256.3929	532.5183	803.0493	(98)	
Space heating													3880.9592	(98)
Space heating per m2													27.6816	(99)
										(98) / (4) =				

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													263.7658 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1471.3656 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	778.4526	621.6684	503.8655	277.5197	107.4925	0.0000	0.0000	0.0000	0.0000	256.3929	532.5183	803.0493 (98)	
Space heating efficiency (main heating system 1)	263.7658	263.7658	263.7658	263.7658	263.7658	0.0000	0.0000	0.0000	0.0000	263.7658	263.7658	263.7658 (210)	
Space heating fuel (main heating system)	295.1302	235.6895	191.0276	105.2144	40.7530	0.0000	0.0000	0.0000	0.0000	97.2048	201.8906	304.4554 (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	164.8663	145.3236	153.8465	141.2249	140.2633	127.6053	125.7737	135.4264	134.3252	147.9716	152.7692	161.3208 (64)	
Efficiency of water heater (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 (216)	
Fuel for water heating, kWh/month	96.8207	85.3439	90.3491	82.9369	82.3721	74.9385	73.8629	79.5316	78.8849	86.8990	89.7164	94.7386 (219)	
Water heating fuel used												1016.3946 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1471.3656 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													98.4274 (230a)
Total electricity for the above, kWh/year													98.4274 (231)
Electricity for lighting (calculated in Appendix L)													524.6926 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 1059 * 1.00) =									-1016.6283			-1016.6283 (233)	
Total delivered energy for all uses												2094.2518 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1471.3656	16.9600	249.5436 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1016.3946	16.9600	172.3805 (247)	
Mechanical ventilation fans	98.4274	16.9600	16.6933 (249)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Energy for lighting	524.6926	16.9600	88.9879 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1016.6283	16.9600	-172.4202 (252)	
Total energy cost			355.1851 (255)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1471.3656	0.5190	763.6387 (261)	
Space heating - secondary	0.0000	0.5190	0.0000 (263)	

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Water heating (other fuel)	1016.3946	0.5190	527.5088 (264)
Space and water heating			1291.1475 (265)
Pumps and fans	98.4274	0.5190	51.0838 (267)
Energy for lighting	524.6926	0.5190	272.3155 (268)
Energy saving/generation technologies			
PV Unit	-1016.6283	0.5190	-527.6301 (269)
Total kg/year			1086.9167 (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	1471.3656	3.0700	4517.0923 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1016.3946	3.0700	3120.3315 (264)
Space and water heating			7637.4238 (265)
Pumps and fans	98.4274	3.0700	302.1720 (267)
Energy for lighting	524.6926	3.0700	1610.8063 (268)
Energy saving/generation technologies			
PV Unit	-1016.6283	3.0700	-3121.0490 (269)
Primary energy kWh/year			6429.3531 (272)
Primary energy kWh/m2/year			45.8584 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 69	-210 kg (19.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£69 1.50 kg/m²	A 92	A 93
Total Savings	£69 1.50 kg/m²		

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

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

Typical heating and lighting costs of this home (per year, Thames Valley):	Current	Potential	Saving
Electricity	£528	£459	£69
Space heating	£266	£267	-£0
Water heating	£172	£104	£69
Lighting	£89	£89	£0

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Generated (PV)	-£172	-£172	£0
Total cost of fuels	£356	£287	£69
Total cost of uses	£355	£288	£69
Delivered energy	15 kWh/m ²	12 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m ²	8 kg/m ²	6 kg/m ²	1 kg/m ²
Primary energy	46 kWh/m ²	37 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	85.7458	(33)
Timber GF			61.6600			9.0000	554.9400 (32c)
Timber 1F			137.7600			9.0000	1239.8400 (32c)
Timber 2F			16.1500			9.0000	145.3500 (32c)
Masonry GF			44.0200			39.0000	1716.7800 (32c)
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)
Internal Ceiling			56.4200			9.0000	507.7800 (32e)
Internal Ceiling			27.3600			9.0000	246.2400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18795.9180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		134.0650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0826 (36)
Total fabric heat loss	(33) + (36) =	93.8284 (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	58.3246	57.7465	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744 (38)
Heat transfer coeff	152.1530	151.5748	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027 (39)
Average = Sum(39)m / 12 =												151.5629 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0853	1.0811	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806 (40)
HLP (average)												1.0810 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content (annual)	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Distribution loss (46)m = 0.15 x (45)m												24.5239 (46)
Water storage loss:												200.0000 (47)
Store volume												1.5600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8424 (55)
Enter (49) or (54) in (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 (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	218.1964	192.2491	200.3433	173.8635	164.0390	145.1626	138.2674	154.2322	160.7298	185.9050	198.3388	212.8696 (62)
WWHRS	-53.3301	-46.9255	-47.8926	-39.3922	-36.5701	-30.1640	-25.5206	-30.9023	-31.8075	-39.3292	-45.5696	-51.5487 eq. (G10)
Total of WWHRS savings												-478.9524
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												1.5779 (H8)
Utilisation factor												0.4694 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												103.4898 (H14)
Volume ratio Veff/V												0.7247 (H15)
Solar storage volume factor												0.9356 (H16)
Solar input												-700.3339 (H17)
Solar input	-20.3083	-33.8887	-57.7163	-77.3512	-95.5609	-93.9516	-92.7100	-81.0012	-63.4402	-43.3222	-24.0886	-16.9946 (63)
Output from w/h	144.5580	111.4349	94.7345	57.1201	31.9080	21.0469	20.0368	42.3287	65.4821	103.2537	128.6806	144.3263 (64)
Heat gains from water heating, kWh/month	95.6340	84.7726	89.0453	76.9913	71.6453	64.7119	62.9675	68.7108	73.2558	84.2446	88.2867	93.8628 (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	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2757	65.9710	53.6512	40.6174	30.3620	25.6329	27.6972	36.0019	48.3217	61.3555	71.6109	76.3400 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.1482	466.9439	454.8590	429.1317	396.6556	366.1327	345.7415	340.9458	353.0307	378.7580	411.2341	441.7570 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	119.6845	106.9324	96.2974	89.8777	84.6337	92.3532	101.7442	113.2319	122.6204	126.1597 (72)
Total internal gains	778.7357	772.8361	741.9663	690.4531	637.0866	595.4148	571.8439	583.0724	616.8681	667.1169	719.2369	758.0282 (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					9.4700	36.7938	0.4600	0.0000	0.7700			123.4166 (77)
Southwest					1.6200	36.7938	0.4600	0.0000	0.7700			21.1124 (79)
Northwest					5.1000	11.2829	0.4600	0.0000	0.7700			20.3817 (81)
Northwest					3.1500	11.2829	0.4300	0.0000	0.7700			11.7677 (81)

Solar gains	176.6785	311.6276	454.7471	610.9972	727.7633	741.5887	707.0270	616.9960	508.3977	352.0627	213.5648	149.9416 (83)
Total gains	955.4142	1084.4636	1196.7134	1301.4503	1364.8499	1337.0035	1278.8709	1200.0685	1125.2658	1019.1796	932.8017	907.9698 (84)

7. Mean internal temperature (heating season)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.3147	34.4456	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2876	3.2964	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9746	0.9604	0.9337	0.8784	0.7794	0.6329	0.4902	0.5358	0.7383	0.9008	0.9608	0.9782 (86)
Tweekday	17.7021	18.0293	18.5230	19.1135	19.6124	19.9025	19.9915	19.9800	19.7984	19.1741	18.3281	17.6275
Tweekend	19.8785	20.0243	20.2470	20.5186	20.7591	20.9139	20.9723	20.9624	20.8503	20.5413	20.1561	19.8440
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	19.2691	19.4908	19.8378	20.2483	20.6283	20.8678	20.9573	20.9420	20.7662	20.2920	19.6824	19.2160 (87)
Th 2	20.0129	20.0163	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9700	0.9534	0.9215	0.8550	0.7358	0.5598	0.3923	0.4372	0.6739	0.8767	0.9526	0.9743 (89)
Tweekday	17.7021	18.0293	18.5230	19.1135	19.6124	19.9025	19.9915	19.9800	19.7984	19.1741	18.3281	17.6275
Tweekend	17.7021	18.0293	18.5230	19.1135	19.6124	19.9025	19.9915	19.9800	19.7984	19.1741	18.3281	17.6275
MIT 2	17.7021	18.0293	18.5230	19.1135	19.6124	19.9025	19.9915	19.9800	19.7984	19.1741	18.3281	17.6275 (90)
Living area fraction									fLA = Living area / (4) =			0.1166 (91)
MIT	17.8848	18.1998	18.6764	19.2458	19.7309	20.0151	20.1041	20.0921	19.9113	19.3045	18.4861	17.8127 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8848	18.1998	18.6764	19.2458	19.7309	20.0151	20.1041	20.0921	19.9113	19.3045	18.4861	17.8127 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9558	0.9357	0.9001	0.8330	0.7215	0.5596	0.4014	0.4452	0.6661	0.8550	0.9349	0.9614 (94)
Useful gains	913.2317	1014.6876	1077.2027	1084.0806	984.6748	748.2150	513.3850	534.3276	749.5239	871.3518	872.0603	872.9620 (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	2066.9747	2015.9076	1844.7517	1567.4174	1216.6969	820.3973	530.8856	559.3692	880.4220	1318.7522	1725.0182	2062.3667 (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	858.3847	672.8198	571.0564	348.0025	172.6245	0.0000	0.0000	0.0000	0.0000	332.8659	614.1297	884.9171 (98)
Space heating												4454.8006 (98)
Space heating per m2										(98) / (4) =		31.7746 (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 %)												263.7656 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1688.9238 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	858.3847	672.8198	571.0564	348.0025	172.6245	0.0000	0.0000	0.0000	0.0000	332.8659	614.1297	884.9171 (98)
Space heating efficiency (main heating system 1)	263.7656	263.7656	263.7656	263.7656	263.7656	0.0000	0.0000	0.0000	0.0000	263.7656	263.7656	263.7656 (210)
Space heating fuel (main heating system)	325.4346	255.0824	216.5015	131.9362	65.4462	0.0000	0.0000	0.0000	0.0000	126.1976	232.8316	335.4937 (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	144.5580	111.4349	94.7345	57.1201	31.9080	21.0469	20.0368	42.3287	65.4821	103.2537	128.6806	144.3263 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	84.8943	65.4422	55.6345	33.5448	18.7385	12.3602	11.7670	24.8583	38.4555	60.6376	75.5700	84.7582 (219)
Water heating fuel used												566.6611 (219)
Annual totals kWh/year												
Space heating fuel - main system												1688.9238 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												98.4274 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												148.4274 (231)
Electricity for lighting (calculated in Appendix L)												524.6926 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.20 * 1004 * 1.00) =									-963.8364			-963.8364 (233)
Total delivered energy for all uses												1964.8685 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1688.9238	13.1900	222.7691 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water heating (other fuel)	566.6611	13.1900	74.7426 (247)
Mechanical ventilation fans	98.4274	13.1900	12.9826 (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	524.6926	13.1900	69.2070 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-963.8364	13.1900	-127.1300 (252)
Total energy cost			259.1662 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5877 (257)
SAP value		91.8010
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1688.9238	0.5190	876.5515 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	566.6611	0.5190	294.0971 (264)
Space and water heating			1170.6486 (265)
Pumps and fans	148.4274	0.5190	77.0338 (267)
Energy for lighting	524.6926	0.5190	272.3155 (268)
Energy saving/generation technologies			
PV Unit	-963.8364	0.5190	-500.2311 (269)
Total kg/year			1019.7668 (272)
CO2 emissions per m2			7.2700 (273)
EI value			92.6216
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.4200 (1b)	x 2.3900 (2b)	= 134.8438 (1b) - (3b)
First floor	56.4200 (1c)	x 2.6900 (2c)	= 151.7698 (1c) - (3c)
Second floor	27.3600 (1d)	x 2.3000 (2d)	= 62.9280 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 349.5416 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			16.1900	1.1450	18.5382		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			56.4200	0.1100	6.2062	75.0000	4231.5000 (28a)
100mm Knauf Supafil 34	176.0800	21.3800	154.7000	0.2500	38.6750	52.8000	8168.1600 (29a)
Dormer Cheek	5.9600	1.9200	4.0400	0.2800	1.1312	9.0000	36.3600 (29a)
Wall to Void	37.9900		37.9900	0.1200	4.5588	9.0000	341.9100 (29a)
Sloping Ceiling	20.5900		20.5900	0.1600	3.2944	9.0000	185.3100 (30)
Dormer Flat Roof	2.6300		2.6300	0.1200	0.3156	9.0000	23.6700 (30)
Ceiling to Void	29.0600		29.0600	0.1200	3.4872	9.0000	261.5400 (30)
Plane Ceiling-500mm Loft Roll	8.9900		8.9900	0.0900	0.8091	9.0000	80.9100 (30)
Total net area of external elements Aum(A, m ²)			337.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	85.7458	(33)
Timber GF			61.6600			9.0000	554.9400 (32c)
Timber 1F			137.7600			9.0000	1239.8400 (32c)
Timber 2F			16.1500			9.0000	145.3500 (32c)
Masonry GF			44.0200			39.0000	1716.7800 (32c)
Internal Floor 2F			27.3600			12.6000	344.7360 (32d)
Internal Floor 1F			56.4200			12.6000	710.8920 (32d)
Internal Ceiling			56.4200			9.0000	507.7800 (32e)
Internal Ceiling			27.3600			9.0000	246.2400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18795.9180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		134.0650 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.0826 (36)
Total fabric heat loss	(33) + (36) =	93.8284 (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	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744	57.6744 (38)
Heat transfer coeff	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027	151.5027 (39)
Average = Sum(39)m / 12 =												151.5027 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806	1.0806 (40)
HLP (average)												1.0806 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9175 (42)
Average daily hot water use (litres/day)												103.4898 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.8388	109.6992	105.5596	101.4200	97.2804	93.1408	93.1408	97.2804	101.4200	105.5596	109.6992	113.8388 (44)
Energy content (annual)	168.8196	147.6507	152.3623	132.8331	127.4566	109.9853	101.9176	116.9519	118.3487	137.9240	150.5548	163.4928 (45)
Distribution loss (46)m = 0.15 x (45)m												24.5239 (46)
Water storage loss:												200.0000 (47)
Store volume												1.5600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8424 (55)
Enter (49) or (54) in (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	218.1964	192.2491	200.3433	173.8635	164.0390	145.1626	138.2674	154.2322	160.7298	185.9050	198.3388	212.8696 (62)
WWHRS	-53.3301	-46.9255	-47.8926	-39.3922	-36.5701	-30.1640	-25.5206	-30.9023	-31.8075	-39.3292	-45.5696	-51.5487 eq. (G10)
Total of WWHRS savings												-478.9524
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												1.6665 (H8)
Utilisation factor												0.4512 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												103.4898 (H14)
Volume ratio Veff/V												0.7247 (H15)
Solar storage volume factor												0.9356 (H16)
Solar input												-711.0002 (H17)
Solar input	-21.8842	-32.8920	-55.3942	-76.5718	-92.2182	-97.0556	-94.7251	-84.5901	-66.0229	-44.9141	-26.6009	-18.1312 (63)
Output from w/h	142.9820	112.4316	97.0566	57.8995	35.2508	17.9430	18.0217	38.7398	62.8994	101.6617	126.1683	143.1896 (64)
Heat gains from water heating, kWh/month	95.6340	84.7726	89.0453	76.9913	71.6453	64.7119	62.9675	68.7108	73.2558	84.2446	88.2867	93.8628 (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	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479	175.0479 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2757	65.9710	53.6512	40.6174	30.3620	25.6329	27.6972	36.0019	48.3217	61.3555	71.6109	76.3400 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	462.1482	466.9439	454.8590	429.1317	396.6556	366.1327	345.7415	340.9458	353.0307	378.7580	411.2341	441.7570 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223	55.4223 (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)	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986	-116.6986 (71)
Water heating gains (Table 5)	128.5403	126.1497	119.6845	106.9324	96.2974	89.8777	84.6337	92.3532	101.7442	113.2319	122.6204	126.1597 (72)
Total internal gains	778.7357	772.8361	741.9663	690.4531	637.0866	595.4148	571.8439	583.0724	616.8681	667.1169	719.2369	758.0282 (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					9.4700	40.4699	0.4600	0.0000			0.7700	135.7472 (77)
Southwest					1.6200	40.4699	0.4600	0.0000			0.7700	23.2218 (79)
Northwest					5.1000	12.9236	0.4600	0.0000			0.7700	23.3454 (81)
Northwest					3.1500	12.9236	0.4300	0.0000			0.7700	13.4788 (81)

Solar gains	195.7932	311.3988	450.8785	627.8602	731.3370	798.5569	752.7126	669.8663	547.6356	376.1740	242.5845	164.4904 (83)
Total gains	974.5289	1084.2348	1192.8448	1318.3133	1368.4235	1393.9717	1324.5565	1252.9388	1164.5037	1043.2909	961.8214	922.5186 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620	34.4620
alpha	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975	3.2975
util living area	0.9693	0.9556	0.9232	0.8507	0.7188	0.5076	0.3470	0.3764	0.6503	0.8700	0.9495	0.9735 (86)
Tweekday	17.9289	18.1881	18.7085	19.3058	19.7704	19.9804	20.0131	20.0116	19.9102	19.3825	18.5660	17.8570
Tweekend	19.9785	20.0952	20.3309	20.6092	20.8406	20.9652	20.9930	20.9908	20.9153	20.6397	20.2631	19.9460
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	19.4234	19.6003	19.9673	20.3899	20.7541	20.9465	20.9892	20.9858	20.8677	20.4440	19.8494	19.3734 (87)
Th 2	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167	20.0167 (88)
util rest of house	0.9635	0.9474	0.9085	0.8215	0.6630	0.4201	0.2404	0.2655	0.5688	0.8377	0.9385	0.9685 (89)
Tweekday	17.9289	18.1881	18.7085	19.3058	19.7704	19.9804	20.0131	20.0116	19.9102	19.3825	18.5660	17.8570
Tweekend	17.9289	18.1881	18.7085	19.3058	19.7704	19.9804	20.0131	20.0116	19.9102	19.3825	18.5660	17.8570
MIT 2	17.9289	18.1881	18.7085	19.3058	19.7704	19.9804	20.0131	20.0116	19.9102	19.3825	18.5660	17.8570 (90)
Living area fraction									fLA = Living area / (4) =			0.1166 (91)
MIT	18.1032	18.3528	18.8553	19.4322	19.8852	20.0931	20.1269	20.1252	20.0219	19.5063	18.7156	18.0338 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1032	18.3528	18.8553	19.4322	19.8852	20.0931	20.1269	20.1252	20.0219	19.5063	18.7156	18.0338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9479	0.9287	0.8865	0.8010	0.6548	0.4272	0.2526	0.2781	0.5693	0.8172	0.9189	0.9541 (94)
Useful gains	923.7094	1006.9757	1057.5061	1055.9535	895.9761	595.5411	334.6129	348.4023	662.9012	852.6246	883.8384	880.1387 (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	1970.0167	1932.0775	1735.5032	1444.1604	1043.1191	620.1145	337.3873	352.2778	730.5246	1197.8284	1623.4471	1959.5061 (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	778.4526	621.6684	504.4299	279.5090	109.4744	0.0000	0.0000	0.0000	0.0000	256.8317	532.5183	803.0493 (98)
Space heating												3885.9335 (98)
Space heating per m2										(98) / (4) =		27.7171 (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 %)												263.7658 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1473.2515 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	778.4526	621.6684	504.4299	279.5090	109.4744	0.0000	0.0000	0.0000	0.0000	256.8317	532.5183	803.0493 (98)
Space heating efficiency (main heating system 1)	263.7658	263.7658	263.7658	263.7658	263.7658	0.0000	0.0000	0.0000	0.0000	263.7658	263.7658	263.7658 (210)
Space heating fuel (main heating system)	295.1302	235.6895	191.2416	105.9686	41.5044	0.0000	0.0000	0.0000	0.0000	97.3711	201.8906	304.4554 (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	142.9820	112.4316	97.0566	57.8995	35.2508	17.9430	18.0217	38.7398	62.8994	101.6617	126.1683	143.1896 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	83.9688	66.0275	56.9982	34.0025	20.7017	10.5373	10.5836	22.7507	36.9388	59.7027	74.0946	84.0907 (219)
Water heating fuel used												560.3971 (219)
Annual totals kWh/year												
Space heating fuel - main system												1473.2515 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												98.4274 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												148.4274 (231)
Electricity for lighting (calculated in Appendix L)												524.6926 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.20 * 1059 * 1.00) =									-1016.6283			-1016.6283 (233)
Total delivered energy for all uses												1690.1401 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1473.2515	16.9600	249.8634 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)

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Water heating (other fuel)	560.3971	16.9600	95.0433 (247)
Mechanical ventilation fans	98.4274	16.9600	16.6933 (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	524.6926	16.9600	88.9879 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1016.6283	16.9600	-172.4202 (252)
Total energy cost			286.6478 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1473.2515	0.5190	764.6175 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	560.3971	0.5190	290.8461 (264)
Space and water heating			1055.4636 (265)
Pumps and fans	148.4274	0.5190	77.0338 (267)
Energy for lighting	524.6926	0.5190	272.3155 (268)
Energy saving/generation technologies			
PV Unit	-1016.6283	0.5190	-527.6301 (269)
Total kg/year			877.1827 (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	1473.2515	3.0700	4522.8820 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	560.3971	3.0700	1720.4190 (264)
Space and water heating			6243.3010 (265)
Pumps and fans	148.4274	3.0700	455.6720 (267)
Energy for lighting	524.6926	3.0700	1610.8063 (268)
Energy saving/generation technologies			
PV Unit	-1016.6283	3.0700	-3121.0490 (269)
Primary energy kWh/year			5188.7302 (272)
Primary energy kWh/m2/year			37.0095 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	134.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	461.39 (P1)
Transmission heat loss coefficient	93.83 (P7)
Summer heat loss coefficient	555.22 (P2)

Overhangs				
Orientation	Ratio	Z_overhangs		Overhang type
South East	0.000	1.000		None
South West	0.000	1.000		None
North West	0.000	1.000		None
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	1.000	0.90	1.000	0.900
South West	1.000	0.90	1.000	0.900
North West	1.000	0.90	1.000	0.900

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	9.4700	119.9223	0.4600	0.0000	0.9000	470.1652
South West	1.6200	119.9223	0.4600	0.0000	0.9000	80.4295
North West	5.1000	98.8453	0.4600	0.0000	0.9000	208.7019
North West	3.1500	98.8453	0.4300	0.0000	0.9000	120.4973

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

total:				879.7939
	Jun	Jul	Aug	
Solar gains	933	880	783	(P3/P4)
Internal gains	609	586	596	
Total summer gains	1543	1466	1379	(P5)
Summer gain/loss ratio	2.78	2.64	2.48	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 134.1)	1.06	1.06	1.06	
Threshold temperature	19.84	21.60	21.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight			
