

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Flat 3 51LC			Issued on Date	15/05/2020
Assessment Reference	51 LC	Prop Type Ref	Penthouse		
Property	Flat 3, 51, Lambs Close, Cuffley, POTTERS BAR, Hertfordshire, EN6 4HD				
SAP Rating	84 B	DER	17.10	TER	17.15
Environmental	86 B	% DER<TER	0.30		
CO₂ Emissions (t/year)	1.47	DFEE	45.66	TFEE	50.99
General Requirements Compliance	Pass	% DFEE<TFEE	10.44		
Assessor Details	Mr. Dhiraj Karsan, Dhiraj Karsan, Tel: 07931 746910, dhirajk777@hotmail.com			Assessor ID	m078-0001
Client					

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

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DWELLING AS DESIGNED

Top-floor flat, total floor area 100 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.10 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.51 (max. 2.00)	1.60 (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:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas
Data from database	
Worcester Greenstar 28CDi Compact ErP	
Combi boiler	
Efficiency: 89.8% SEDBUK2009	
Minimum: 88.0%	OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

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

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing East:	8.40 m ² , No overhang
Windows facing South:	1.68 m ² , No overhang
Windows facing West:	6.60 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

External wall U-value	0.14 W/m ² K
Roof U-value	0.10 W/m ² K

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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	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1231 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =		0.3731 (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	0.4757	0.4663	0.4570	0.4104	0.4010	0.3544	0.3544	0.3451	0.3731	0.4010	0.4197	0.4384 (22b)
Effective ac	0.6131	0.6087	0.6044	0.5842	0.5804	0.5628	0.5628	0.5595	0.5696	0.5804	0.5881	0.5961 (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
Windows (Uw = 1.50)			16.6800	1.4151	23.6038		(27)
Door			1.6800	1.6000	2.6880		(26)
Roof Window (Uw = 1.50)			0.6400	1.4151	0.9057		(27a)
External Wall	52.9000	16.6800	36.2200	0.1400	5.0708		(29a)
Shelter Wall	31.4000	1.6800	29.7200	0.1974	5.8658		(29a)
Flat Roof	99.5000	0.6400	98.8600	0.1000	9.8860		(30)
Total net area of external elements Aum(A, m ²)			183.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.0200	(33)
Party Floor			99.5000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7730 (36)
Total fabric heat loss						(33) + (36) =	61.7930 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.3233	48.9699	48.6235	46.9966	46.6922	45.2752	45.2752	45.0127	45.8210	46.6922	47.3080	47.9517 (38)
Average = Sum(39)m / 12 =	111.1163	110.7629	110.4165	108.7896	108.4852	107.0682	107.0682	106.8058	107.6140	108.4852	109.1010	109.7448 (39)
HLP	1.1167	1.1132	1.1097	1.0934	1.0903	1.0761	1.0761	1.0734	1.0815	1.0903	1.0965	1.1030 (40)
HLP (average)												1.0933 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7348 (42)
Average daily hot water use (litres/day)												99.1527 (43)
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)												Total = Sum(45)m = 1560.0574 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2617	21.2194	21.8965	19.0899	18.3173	15.8064	14.6469	16.8076	17.0083	19.8216	21.6368	23.4961 (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)

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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	0.0000	0.0000	(57)
Combi loss	29.1653	26.3359	29.1417	28.1752	29.0934	28.1308	29.0534	29.0793	28.1550	29.1209	28.2061	29.1577	(61)		
Total heat required for water heating calculated for each month															
Solar input	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986	(62)		
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)		
Solar input (sum of months) = Sum(63)m =													0.0000	(63)	
Total per year (kWh/year) = Sum(64)m =													1902.8720	(64)	
Heat gains from water heating, kWh/month	61.0714	53.6204	55.8228	49.3598	47.8766	42.0702	39.7308	44.5267	44.7405	51.2180	55.0131	59.3725	(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	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9662	21.2866	17.3114	13.1058	9.7968	8.2708	8.9369	11.6166	15.5917	19.7973	23.1064	24.6323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.5169	258.1684	251.4868	237.2624	219.3067	202.4309	191.1568	188.5054	195.1870	209.4113	227.3670	244.2428	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)
Water heating gains (Table 5)	82.0852	79.7922	75.0306	68.5553	64.3503	58.4308	53.4016	59.8477	62.1396	68.8414	76.4070	79.8018	(72)
Total internal gains	428.5911	426.2699	410.8515	385.9463	360.4765	336.1553	320.5180	326.9923	339.9411	365.0728	393.9031	415.6997	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
East	8.4000	19.6403	0.5700	0.7000	0.7700	45.6176	(76)						
South	1.6800	46.7521	0.5700	0.7000	0.7700	21.7178	(78)						
West	6.6000	19.6403	0.5700	0.7000	0.7700	35.8424	(80)						
Horizontal	0.6400	26.0000	0.5700	0.7000	1.0000	5.9754	(82)						
Solar gains	109.1533	207.3318	329.8026	468.4223	566.5514	577.4881	550.7534	477.4872	378.9781	242.6180	134.8983	90.5813	(83)
Total gains	537.7444	633.6017	740.6541	854.3686	927.0278	913.6434	871.2715	804.4795	718.9191	607.6907	528.8015	506.2809	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)	62.1846	62.3830	62.5787	63.5145	63.6928	64.5357	64.5357	64.6943	64.2084	63.6928	63.3333	62.9617	21.0000	(85)
alpha	5.1456	5.1589	5.1719	5.2343	5.2462	5.3024	5.3024	5.3130	5.2806	5.2462	5.2222	5.1974		
util living area	0.9988	0.9969	0.9899	0.9608	0.8732	0.7013	0.5310	0.5926	0.8540	0.9817	0.9973	0.9991	(86)	
MIT	19.7479	19.9056	20.1748	20.5275	20.8097	20.9574	20.9919	20.9861	20.8771	20.4926	20.0572	19.7263	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0204	20.0204	20.0226	20.0159	20.0088	20.0037	19.9984	(88)	
util rest of house	0.9984	0.9958	0.9863	0.9460	0.8279	0.6131	0.4179	0.4758	0.7856	0.9723	0.9962	0.9988	(89)	
MIT 2	18.3095	18.5420	18.9354	19.4475	19.8216	19.9921	20.0174	20.0168	19.9154	19.4080	18.7738	18.2859	(90)	
Living area fraction	19.0048	19.2012	19.5345	19.9696	20.2993	20.4587	20.4885	20.4853	20.3803	19.9323	19.3942	18.9822	(91)	
MIT	19.0048	19.2012	19.5345	19.9696	20.2993	20.4587	20.4885	20.4853	20.3803	19.9323	19.3942	18.9822	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0048	19.2012	19.5345	19.9696	20.2993	20.4587	20.4885	20.4853	20.3803	19.9323	19.3942	18.9822	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9947	0.9841	0.9454	0.8425	0.6543	0.4728	0.5326	0.8137	0.9713	0.9953	0.9984	(94)
Ext temp.	536.5583	630.2246	728.8839	807.7112	781.0576	597.7517	411.9599	428.4322	584.9918	590.2799	526.3131	505.4611	(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	1633.9442	1584.0424	1439.2294	1204.2575	932.8942	627.2823	416.3337	436.3379	675.8492	1012.4165	1341.3108	1622.2729	(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	816.4551	640.9655	528.4970	285.5133	112.9665	0.0000	0.0000	0.0000	0.0000	314.0696	586.7983	830.9079	(98)
Space heating per m ²												4116.1733	(98)
										(98) / (4) =		41.3686	(99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4538.2285 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	816.4551	640.9655	528.4970	285.5133	112.9665	0.0000	0.0000	0.0000	0.0000	314.0696	586.7983	830.9079	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	900.1710	706.6875	582.6869	314.7887	124.5496	0.0000	0.0000	0.0000	0.0000	346.2730	646.9662	916.1058	(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	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986	(64)
Efficiency of water heater (217)m	89.9748	89.9067	89.7500	89.3603	88.5446	87.0000	87.0000	87.0000	87.0000	89.4099	89.8322	90.0000	(216)
Fuel for water heating, kWh/month	212.1815	186.6366	195.1182	173.9491	170.7709	153.4560	145.6319	162.2183	162.6940	180.3655	191.9704	206.4417	(219)
Water heating fuel used													2141.4341 (219)
Annual totals kWh/year													
Space heating fuel - main system													4538.2285 (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)													423.2507 (232)
Total delivered energy for all uses													7177.9133 (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	4538.2285	0.2160	980.2574 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2141.4341	0.2160	462.5498 (264)
Space and water heating			1442.8071 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.2507	0.5190	219.6671 (268)
Total CO2, kg/year			1701.3992 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1000 (273)

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

DER			17.1000 ZC1
Total Floor Area		TFA	99.5000
Assumed number of occupants		N	2.7348
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.2175 ZC2
CO2 emissions from cooking, equation (L16)			1.8556 ZC3
Total CO2 emissions			34.1731 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			34.1731 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1231 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =		0.3731 (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 infiltr rate												
Effective ac	0.4757	0.4663	0.4570	0.4104	0.4010	0.3544	0.3544	0.3451	0.3731	0.4010	0.4197	0.4384 (22b)
	0.6131	0.6087	0.6044	0.5842	0.5804	0.5628	0.5628	0.5595	0.5696	0.5804	0.5881	0.5961 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.6800	1.0000	1.6800		(26)					
TER Opening Type (Uw = 1.40)			16.6800	1.3258	22.1136		(27)					
TER Room Window (Uw = 1.70)			0.6400	1.5918	1.0187		(27a)					
External Wall	52.9000	16.6800	36.2200	0.1800	6.5196		(29a)					
Shelter Wall	31.4000	1.6800	29.7200	0.1800	5.3496		(29a)					
Flat Roof	99.5000	0.6400	98.8600	0.1300	12.8518		(30)					
Total net area of external elements Aum(A, m2)			183.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	49.5334	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4370 (36)					
Total fabric heat loss						(33) + (36) =	60.9704 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	49.3233	48.9699	48.6235	46.9966	46.6922	45.2752	45.2752	45.0127	45.8210	46.6922	47.3080	47.9517 (38)
Heat transfer coeff	110.2936	109.9403	109.5939	107.9669	107.6625	106.2455	106.2455	105.9831	106.7913	107.6625	108.2783	108.9221 (39)
Average = Sum(39)m / 12 =												107.9655 (39)
HLP	1.1085	1.1049	1.1014	1.0851	1.0820	1.0678	1.0678	1.0652	1.0733	1.0820	1.0882	1.0947 (40)
HLP (average)												1.0851 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7348 (42)
Average daily hot water use (litres/day)												99.1527 (43)
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)												Total = Sum(45)m = 1560.0574 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.2617	21.2194	21.8965	19.0899	18.3173	15.8064	14.6469	16.8076	17.0083	19.8216	21.6368	23.4961 (46)
Total storage loss:												
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	47.9193	47.4955	44.0075	45.4744	47.4955	47.9193	50.9589	49.3151	50.9589 (61)	
Solar input	212.7035	187.4902	196.9359	175.1855	169.6105	149.3835	143.1207	159.5461	161.3081	183.1027	193.5603	207.5999 (62)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
Heat gains from water heating, kWh/month	212.7035	187.4902	196.9359	175.1855	169.6105	149.3835	143.1207	159.5461	161.3081	183.1027	193.5603	207.5999 (64)	
	66.5198	58.5432	61.2771	54.2958	52.4771	46.0394	43.8360	49.1307	49.6816	56.6775	60.2903	64.8229 (65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3658	20.7533	16.8777	12.7775	9.5513	8.0636	8.7130	11.3255	15.2011	19.3013	22.5275	24.0152 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.5169	258.1684	251.4868	237.2624	219.3067	202.4309	191.1568	188.5054	195.1870	209.4113	227.3670	244.2428 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742 (69)	
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940 (71)	
Water heating gains (Table 5)	89.4083	87.1179	82.3617	75.4109	70.5338	63.9436	58.9194	66.0359	69.0022	76.1795	83.7365	87.1275 (72)	
Total internal gains	435.3138	433.0623	417.7489	392.4736	366.4145	341.4609	325.8120	332.8895	346.4130	371.9148	400.6538	422.4082 (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						
East	8.4000	19.6403	0.6300	0.7000	0.7700	50.4195 (76)						
South	1.6800	46.7521	0.6300	0.7000	0.7700	24.0039 (78)						
West	6.6000	19.6403	0.6300	0.7000	0.7700	39.6153 (80)						
Horizontal	0.6400	26.0000	0.6300	0.7000	1.0000	6.6044 (82)						
Solar gains	120.6431	229.1562	364.5187	517.7299	626.1883	638.2763	608.7275	527.7490	418.8705	268.1567	149.0982	100.1162 (83)
Total gains	555.9569	662.2185	782.2675	910.2035	992.6029	979.7372	934.5395	860.6385	765.2835	640.0715	549.7519	522.5244 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, n_{il} , m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6484	62.8498	63.0484	63.9985	64.1794	65.0354	65.0354	65.1964	64.7030	64.1794	63.8145	63.4373	
alpha	5.1766	5.1900	5.2032	5.2666	5.2786	5.3357	5.3357	5.3464	5.3135	5.2786	5.2543	5.2292	
util living area	0.9986	0.9962	0.9871	0.9495	0.8444	0.6605	0.4939	0.5544	0.8253	0.9769	0.9968	0.9990 (86)	
MIT	19.7762	19.9433	20.2221	20.5777	20.8441	20.9685	20.9944	20.9900	20.8992	20.5275	20.0864	19.7529 (87)	
Th 2	19.9939	19.9968	19.9997	20.0130	20.0155	20.0272	20.0272	20.0294	20.0227	20.0155	20.0105	20.0052 (88)	
util rest of house	0.9981	0.9949	0.9826	0.9315	0.7944	0.5737	0.3881	0.4436	0.7520	0.9655	0.9955	0.9986 (89)	
MIT 2	18.3557	18.6016	19.0082	19.5206	19.8661	20.0068	20.0252	20.0253	19.9428	19.4617	18.8211	18.3297 (90)	
Living area fraction	19.0424	19.2502	19.5950	20.0316	20.3389	20.4717	20.4937	20.4917	20.4052	19.9769	19.4327	19.0177 (92)	
Temperature adjustment	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (91)	
adjusted MIT	19.0424	19.2502	19.5950	20.0316	20.3389	20.4717	20.4937	20.4917	20.4052	19.9769	19.4327	19.0177 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9975	0.9936	0.9802	0.9319	0.8122	0.6147	0.4395	0.4974	0.7832	0.9650	0.9944	0.9981 (94)	
Ext temp.	554.5404	657.9533	766.7709	848.2502	806.1608	602.2197	410.6902	428.0665	599.4080	617.6507	546.6880	521.5530 (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	1625.9942	1577.6665	1435.1294	1201.8494	930.0821	623.8431	413.6884	433.6491	673.3363	1009.5418	1335.3688	1613.9792 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)	
Space heating	797.1617	618.0473	497.2587	254.5914	92.1975	0.0000	0.0000	0.0000	0.0000	291.5670	567.8502	812.7651 (98)	
Space heating per m2												3931.4388 (98)	
										(98) / (4) =		39.5119 (99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4209.2492 (211)
Space heating requirement	797.1617	618.0473	497.2587	254.5914	92.1975	0.0000	0.0000	0.0000	0.0000	291.5670	567.8502	812.7651	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	853.4921	661.7208	532.3969	272.5818	98.7125	0.0000	0.0000	0.0000	0.0000	312.1702	607.9766	870.1982	(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	212.7035	187.4902	196.9359	175.1855	169.6105	149.3835	143.1207	159.5461	161.3081	183.1027	193.5603	207.5999	(64)
Efficiency of water heater (217)m	88.0669	87.8288	87.2855	85.9913	83.5888	80.3000	80.3000	80.3000	80.3000	86.2169	87.5991	88.1443	(216)
Fuel for water heating, kWh/month	241.5248	213.4724	225.6227	203.7248	202.9106	186.0317	178.2325	198.6875	200.8818	212.3745	220.9616	235.5226	(219)
Water heating fuel used													2519.9477 (219)
Annual totals kWh/year													
Space heating fuel - main system													4209.2492 (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)													412.6470 (232)
Total delivered energy for all uses													7216.8439 (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	4209.2492	0.2160	909.1978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2519.9477	0.2160	544.3087 (264)
Space and water heating			1453.5065 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	412.6470	0.5190	214.1638 (268)
Total CO2, kg/m2/year			1706.5953 (272)
Emissions per m2 for space and water heating			14.6081 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1524 (272b)
Emissions per m2 for pumps and fans			0.3912 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6081 * 1.00) + 2.1524 + 0.3912, rounded to 2 d.p.			17.1500 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1231 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =		0.3731 (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	0.4757	0.4663	0.4570	0.4104	0.4010	0.3544	0.3544	0.3451	0.3731	0.4010	0.4197	0.4384 (22b)
Effective ac	0.6131	0.6087	0.6044	0.5842	0.5804	0.5628	0.5628	0.5595	0.5696	0.5804	0.5881	0.5961 (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
Windows (Uw = 1.50)			16.6800	1.4151	23.6038		(27)
Door			1.6800	1.6000	2.6880		(26)
Roof Window (Uw = 1.50)			0.6400	1.4151	0.9057		(27a)
External Wall	52.9000	16.6800	36.2200	0.1400	5.0708		(29a)
Shelter Wall	31.4000	1.6800	29.7200	0.1974	5.8658		(29a)
Flat Roof	99.5000	0.6400	98.8600	0.1000	9.8860		(30)
Total net area of external elements Aum(A, m2)			183.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.0200	(33)
Party Floor			99.5000				(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7730 (36)
Total fabric heat loss	(33) + (36) = 61.7930 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.3233	48.9699	48.6235	46.9966	46.6922	45.2752	45.2752	45.0127	45.8210	46.6922	47.3080	47.9517 (38)
Average = Sum(39)m / 12 =	111.1163	110.7629	110.4165	108.7896	108.4852	107.0682	107.0682	106.8058	107.6140	108.4852	109.1010	109.7448 (39)
												108.7881 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1167	1.1132	1.1097	1.0934	1.0903	1.0761	1.0761	1.0734	1.0815	1.0903	1.0965	1.1030 (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	2.7348 (42)
Average daily hot water use (litres/day)	99.1527 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy content (annual)	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1560.0574 (45)
Water 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 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	(59)
Heat gains from water heating, kWh/month	34.3707	30.0609	31.0201	27.0441	25.9494	22.3924	20.7498	23.8108	24.0951	28.0805	30.6521	33.2862	(65)	

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

Metabolic gains (Table 5), Watts														
(66)m	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9662	21.2866	17.3114	13.1058	9.7968	8.2708	8.9369	11.6166	15.5917	19.7973	23.1064	24.6323	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.5169	258.1684	251.4868	237.2624	219.3067	202.4309	191.1568	188.5054	195.1870	209.4113	227.3670	244.2428	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	(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)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)	
Water heating gains (Table 5)	46.1972	44.7334	41.6937	37.5612	34.8783	31.1005	27.8896	32.0037	33.4655	37.7427	42.5724	44.7395	(72)	
Total internal gains	389.7031	388.2111	374.5146	351.9522	328.0045	305.8250	292.0061	296.1484	308.2669	330.9740	357.0685	377.6374	(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						
East		8.4000	19.6403	0.5700	0.7000	0.7700	45.6176 (76)						
South		1.6800	46.7521	0.5700	0.7000	0.7700	21.7178 (78)						
West		6.6000	19.6403	0.5700	0.7000	0.7700	35.8424 (80)						
Horizontal		0.6400	26.0000	0.5700	0.7000	1.0000	5.9754 (82)						
Solar gains	109.1533	207.3318	329.8026	468.4223	566.5514	577.4881	550.7534	477.4872	378.9781	242.6180	134.8983	90.5813	(83)
Total gains	498.8564	595.5429	704.3172	820.3745	894.5559	883.3131	842.7595	773.6356	687.2450	573.5920	491.9668	468.2187	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)														21.0000 (85)
Utilisation factor for gains for living area, nil, m (see Table 9a)														
tau	62.1846	62.3830	62.5787	63.5145	63.6928	64.5357	64.5357	64.6943	64.2084	63.6928	63.3333	62.9617		
alpha	5.1456	5.1589	5.1719	5.2343	5.2462	5.3024	5.3024	5.3130	5.2806	5.2462	5.2222	5.1974		
util living area	0.9992	0.9977	0.9919	0.9665	0.8859	0.7190	0.5474	0.6130	0.8714	0.9857	0.9981	0.9994	(86)	
MIT	19.7112	19.8700	20.1419	20.5008	20.7934	20.9521	20.9907	20.9837	20.8627	20.4629	20.0226	19.6902	(87)	
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0204	20.0204	20.0226	20.0159	20.0088	20.0037	19.9984	(88)	
util rest of house	0.9989	0.9969	0.9889	0.9535	0.8431	0.6309	0.4316	0.4937	0.8070	0.9781	0.9973	0.9992	(89)	
MIT 2	18.8051	18.9659	19.2386	19.6000	19.8683	19.9983	20.0180	20.0179	19.9375	19.5701	19.1295	18.7932	(90)	
Living area fraction									flA = Living area / (4) =			0.4834	(91)	
MIT	19.2431	19.4030	19.6753	20.0355	20.3155	20.4594	20.4882	20.4848	20.3848	20.0017	19.5612	19.2268	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2431	19.4030	19.6753	20.0355	20.3155	20.4594	20.4882	20.4848	20.3848	20.0017	19.5612	19.2268	(93)	

8. Space heating requirement

Utilisation	0.9986	0.9962	0.9877	0.9540	0.8577	0.6723	0.4880	0.5519	0.8340	0.9780	0.9968	0.9990	(94)	
Useful gains	498.1389	593.2962	695.6879	782.6271	767.2893	593.8542	411.2388	426.9564	573.1423	560.9914	490.4099	467.7360	(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	1660.4202	1606.3941	1454.7694	1211.4211	934.6571	627.3538	416.3044	436.2766	676.3281	1019.9434	1359.5307	1649.1151	(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	864.7373	680.8018	564.7567	308.7317	124.5216	0.0000	0.0000	0.0000	0.0000	341.4603	625.7669	878.9460	(98)	
Space heating												4389.7223	(98)	
Space heating per m2												(98) / (4) =	44.1178	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b														
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1006.4409	792.3045	811.7239	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8858	0.9401	0.9160	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	891.4602	744.8350	743.5373	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1129.9801	1080.7859	1003.2474	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														

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	171.7343	249.9475	193.2244	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												614.9062 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	42.9336	62.4869	48.3061	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												153.7265 (107)
Energy for space heating												1.5450 (108)
Energy for space cooling												44.1178 (99)
Total												1.5450 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.6628 (109)
												45.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1231 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =		0.3731 (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												
Effective ac	0.4757	0.4663	0.4570	0.4104	0.4010	0.3544	0.3544	0.3451	0.3731	0.4010	0.4197	0.4384 (22b)
	0.6131	0.6087	0.6044	0.5842	0.5804	0.5628	0.5628	0.5595	0.5696	0.5804	0.5881	0.5961 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.6800	1.0000	1.6800		(26)					
TER Opening Type (Uw = 1.40)			16.6800	1.3258	22.1136		(27)					
TER Room Window (Uw = 1.70)			0.6400	1.5918	1.0187		(27a)					
External Wall	52.9000	16.6800	36.2200	0.1800	6.5196		(29a)					
Shelter Wall	31.4000	1.6800	29.7200	0.1800	5.3496		(29a)					
Flat Roof	99.5000	0.6400	98.8600	0.1300	12.8518		(30)					
Total net area of external elements Aum(A, m2)			183.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	49.5334	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4370 (36)					
Total fabric heat loss						(33) + (36) =	60.9704 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	49.3233	48.9699	48.6235	46.9966	46.6922	45.2752	45.2752	45.0127	45.8210	46.6922	47.3080	47.9517 (38)
Heat transfer coeff	110.2936	109.9403	109.5939	107.9669	107.6625	106.2455	106.2455	105.9831	106.7913	107.6625	108.2783	108.9221 (39)
Average = Sum(39)m / 12 =												107.9655 (39)
HLP	1.1085	1.1049	1.1014	1.0851	1.0820	1.0678	1.0678	1.0652	1.0733	1.0820	1.0882	1.0947 (40)
HLP (average)												1.0851 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7348 (42)
Average daily hot water use (litres/day)												99.1527 (43)
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)												Total = Sum(45)m = 1560.0574 (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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.3707	30.0609	31.0201	27.0441	25.9494	22.3924	20.7498	23.8108	24.0951	28.0805	30.6521	33.2862	(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	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	136.7424	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.3658	20.7533	16.8777	12.7775	9.5513	8.0636	8.7130	11.3255	15.2011	19.3013	22.5275	24.0152	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.5169	258.1684	251.4868	237.2624	219.3067	202.4309	191.1568	188.5054	195.1870	209.4113	227.3670	244.2428	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	36.6742	(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)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)
Water heating gains (Table 5)	46.1972	44.7334	41.6937	37.5612	34.8783	31.1005	27.8896	32.0037	33.4655	37.7427	42.5724	44.7395	(72)
Total internal gains	389.1026	387.6778	374.0809	351.6239	327.7591	305.6178	291.7822	295.8573	307.8763	330.4780	356.4896	377.0203	(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						
East		8.4000	19.6403	0.6300	0.7000	0.7700	50.4195 (76)						
South		1.6800	46.7521	0.6300	0.7000	0.7700	24.0039 (78)						
West		6.6000	19.6403	0.6300	0.7000	0.7700	39.6153 (80)						
Horizontal		0.6400	26.0000	0.6300	0.7000	1.0000	6.6044 (82)						
Solar gains	120.6431	229.1562	364.5187	517.7299	626.1883	638.2763	608.7275	527.7490	418.8705	268.1567	149.0982	100.1162	(83)
Total gains	509.7458	616.8340	738.5996	869.3538	953.9474	943.8941	900.5097	823.6064	726.7468	598.6347	505.5878	477.1364	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6484	62.8498	63.0484	63.9985	64.1794	65.0354	65.0354	65.1964	64.7030	64.1794	63.8145	63.4373	
alpha	5.1766	5.1900	5.2032	5.2666	5.2786	5.3357	5.3357	5.3464	5.3135	5.2786	5.2543	5.2292	
util living area	0.9991	0.9973	0.9900	0.9575	0.8604	0.6804	0.5115	0.5768	0.8474	0.9826	0.9978	0.9993	(86)
MIT	19.7326	19.9009	20.1830	20.5473	20.8275	20.9638	20.9934	20.9880	20.8841	20.4921	20.0448	19.7099	(87)
Th 2	19.9939	19.9968	19.9997	20.0130	20.0155	20.0272	20.0272	20.0294	20.0227	20.0155	20.0105	20.0052	(88)
util rest of house	0.9987	0.9963	0.9863	0.9418	0.8129	0.5930	0.4024	0.4628	0.7779	0.9736	0.9969	0.9991	(89)
MIT 2	18.8319	19.0021	19.2845	19.6490	19.9010	20.0110	20.0256	20.0260	19.9584	19.6038	19.1571	18.8183	(90)
Living area fraction									fLA = Living area / (4) =				0.4834 (91)
MIT	19.2673	19.4366	19.7189	20.0833	20.3489	20.4716	20.4934	20.4911	20.4059	20.0332	19.5863	19.2493	(92)
Temperature adjustment													0.0000
adjusted MIT	19.2673	19.4366	19.7189	20.0833	20.3489	20.4716	20.4934	20.4911	20.4059	20.0332	19.5863	19.2493	(93)

8. Space heating requirement

Utilisation	0.9984	0.9956	0.9850	0.9431	0.8304	0.6344	0.4554	0.5182	0.8079	0.9738	0.9964	0.9989	(94)
Useful gains	508.9414	614.1191	727.5552	819.8879	792.1521	598.8041	410.1097	426.8199	587.1206	582.9750	503.7814	476.6035	(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	1650.7957	1598.1572	1448.7054	1207.4215	931.1604	623.8318	413.6584	433.5830	673.4192	1015.6004	1351.9924	1639.1991	(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	849.5396	661.2736	536.5358	279.0242	103.4222	0.0000	0.0000	0.0000	0.0000	321.8733	610.7119	864.9711	(98)
Space heating												4227.3517	(98)
Space heating per m2												(98) / (4) =	42.4859 (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	998.7079	786.2169	805.4716	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9083	0.9539	0.9331	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	907.1594	749.9623	751.5760	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1199.6963	1147.2160	1060.6262	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	210.6266	295.5568	229.9334	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												736.1168 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	52.6567	73.8892	57.4833	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												184.0292 (107)
Space cooling per m2												1.8495 (108)
Energy for space heating												42.4859 (99)
Energy for space cooling												1.8495 (108)
Total												44.3355 (109)
Target Fabric Energy Efficiency (TFEE)												51.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1231 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =		0.3731 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	4.8000	4.9000	4.3000	4.3000	3.8000	3.9000	4.0000	4.2000	4.4000	4.4000	4.7000 (22)
Wind factor	1.2500	1.2000	1.2250	1.0750	1.0750	0.9500	0.9750	1.0000	1.0500	1.1000	1.1000	1.1750 (22a)
Adj infilt rate	0.4663	0.4477	0.4570	0.4010	0.4010	0.3544	0.3637	0.3731	0.3917	0.4104	0.4104	0.4384 (22b)
Effective ac	0.6087	0.6002	0.6044	0.5804	0.5804	0.5628	0.5662	0.5696	0.5767	0.5842	0.5842	0.5961 (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					
Windows (Uw = 1.50)			16.6800	1.4151	23.6038		(27)					
Door			1.6800	1.6000	2.6880		(26)					
Roof Window (Uw = 1.50)			0.6400	1.4151	0.9057		(27a)					
External Wall	52.9000	16.6800	36.2200	0.1400	5.0708		(29a)					
Shelter Wall	31.4000	1.6800	29.7200	0.1974	5.8658		(29a)					
Flat Roof	99.5000	0.6400	98.8600	0.1000	9.8860		(30)					
Total net area of external elements Aum(A, m2)			183.8000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.0200	(33)					
Party Floor			99.5000				(32d)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7730 (36)					
Total fabric heat loss						(33) + (36) =	61.7930 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.9699	48.2841	48.6235	46.6922	46.6922	45.2752	45.5446	45.8210	46.3948	46.9966	46.9966	47.9517 (38)
Average = Sum(39)m / 12 =	110.7629	110.0772	110.4165	108.4852	108.4852	107.0682	107.3376	107.6140	108.1878	108.7896	108.7896	109.7448 (39)
HLP	1.1132	1.1063	1.1097	1.0903	1.0903	1.0761	1.0788	1.0815	1.0873	1.0934	1.0934	1.1030 (40)
HLP (average)												1.0936 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.7348 (42)
Average daily hot water use (litres/day)												99.1527 (43)
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)												Total = Sum(45)m = 1560.0574 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2617	21.2194	21.8965	19.0899	18.3173	15.8064	14.6469	16.8076	17.0083	19.8216	21.6368	23.4961 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)		
Combi loss	29.1653	26.3359	29.1417	28.1752	29.0934	28.1308	29.0534	29.0793	28.1550	29.1209	28.2061	29.1577												(61)	
Total heat required for water heating calculated for each month	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986												(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																	(63)	
Output from w/h	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986												(64)	
RHI water heating demand																									(64)
Heat gains from water heating, kWh/month	61.0714	53.6204	55.8228	49.3598	47.8766	42.0702	39.7308	44.5267	44.7405	51.2180	55.0131	59.3725												(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	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9155	53.2164	43.2785	32.7646	24.4919	20.6771	22.3424	29.0414	38.9794	49.4933	57.7659	61.5808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.3685	385.3259	375.3534	354.1230	327.3235	302.1357	285.3087	281.3513	291.3238	312.5542	339.3537	364.5415	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)
Water heating gains (Table 5)	82.0852	79.7922	75.0306	68.5553	64.3503	58.4308	53.4016	59.8477	62.1396	68.8414	76.4070	79.8018	(72)
Total internal gains	635.2102	630.1755	605.5034	567.2839	528.0066	493.0845	472.8935	482.0813	504.2837	542.7298	585.3676	617.7650	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
East	8.4000	22.3485	0.5700	0.7000	0.7700	51.9079 (76)							
South	1.6800	51.1372	0.5700	0.7000	0.7700	23.7548 (78)							
West	6.6000	22.3485	0.5700	0.7000	0.7700	40.7848 (80)							
Horizontal	0.6400	30.0000	0.5700	0.7000	1.0000	6.8947 (82)							
Solar gains	123.3423	214.6514	331.2014	481.0766	564.1180	618.6650	586.4238	520.2739	412.3383	259.8581	156.1887	101.3481	(83)
Total gains	758.5525	844.8269	936.7048	1048.3604	1092.1246	1111.7495	1059.3173	1002.3552	916.6220	802.5879	741.5563	719.1131	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3830	62.7716	62.5787	63.6928	63.6928	64.5357	64.3737	64.2084	63.8678	63.5145	63.5145	62.9617	
alpha	5.1589	5.1848	5.1719	5.2462	5.2462	5.3024	5.2916	5.2806	5.2579	5.2343	5.2343	5.1974	
util living area	0.9937	0.9883	0.9707	0.9084	0.7786	0.5384	0.3736	0.3954	0.7043	0.9349	0.9864	0.9952	(86)
MIT	19.9796	20.1187	20.3737	20.6976	20.9004	20.9888	20.9987	20.9982	20.9553	20.6885	20.2866	19.9469	(87)
Th 2	19.9901	19.9957	19.9929	20.0088	20.0088	20.0204	20.0182	20.0159	20.0112	20.0063	20.0063	19.9984	(88)
util rest of house	0.9917	0.9846	0.9611	0.8797	0.7180	0.4508	0.2752	0.2913	0.6154	0.9073	0.9812	0.9936	(89)
MIT 2	18.6491	18.8546	19.2179	19.6741	19.9207	20.0145	20.0179	20.0155	19.9814	19.6700	19.1070	18.6077	(90)
Living area fraction									fLA = Living area / (4) =			0.4834	(91)
MIT	19.2923	19.4657	19.7767	20.1689	20.3943	20.4855	20.4920	20.4906	20.4522	20.1623	19.6772	19.2551	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2923	19.4657	19.7767	20.1689	20.3943	20.4855	20.4920	20.4906	20.4522	20.1623	19.6772	19.2551	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9898	0.9821	0.9586	0.8849	0.7429	0.4930	0.3229	0.3418	0.6569	0.9123	0.9790	0.9920	(94)
Ext temp.	750.8180	829.6965	897.8887	927.7057	811.3262	548.1128	342.0325	342.5613	602.0844	732.2314	725.9988	713.3671	(95)
Heat loss rate W	4.5000	5.0000	6.8000	9.3000	12.2000	15.3000	17.3000	17.3000	14.6000	11.1000	7.4000	4.4000	(96)
Month fracti	1638.4376	1592.3408	1432.8392	1179.1100	888.9591	555.1999	342.6234	343.3504	633.1353	985.8889	1335.6307	1630.2707	(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)
RHI space heating demand	660.3890	512.4970	398.0031	181.0111	57.7588	0.0000	0.0000	0.0000	0.0000	188.7212	438.9349	682.1762	(98)
												3119.4913	(98)
												3119	(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 (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1231 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =	0.3731 (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												
Effective ac	0.4757	0.4663	0.4570	0.4104	0.4010	0.3544	0.3544	0.3451	0.3731	0.4010	0.4197	0.4384 (22b)
	0.6131	0.6087	0.6044	0.5842	0.5804	0.5628	0.5628	0.5595	0.5696	0.5804	0.5881	0.5961 (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
Windows (Uw = 1.50)			16.6800	1.4151	23.6038		(27)
Door			1.6800	1.6000	2.6880		(26)
Roof Window (Uw = 1.50)			0.6400	1.4151	0.9057		(27a)
External Wall	52.9000	16.6800	36.2200	0.1400	5.0708		(29a)
Shelter Wall	31.4000	1.6800	29.7200	0.1974	5.8658		(29a)
Flat Roof	99.5000	0.6400	98.8600	0.1000	9.8860		(30)
Total net area of external elements Aum(A, m2)			183.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 48.0200		(33)
Party Floor			99.5000				(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7730 (36)
Total fabric heat loss						(33) + (36) =	61.7930 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.3233	48.9699	48.6235	46.9966	46.6922	45.2752	45.2752	45.0127	45.8210	46.6922	47.3080	47.9517 (38)
Average = Sum(39)m / 12 =	111.1163	110.7629	110.4165	108.7896	108.4852	107.0682	107.0682	106.8058	107.6140	108.4852	109.1010	109.7448 (39)
												108.7881 (39)

HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1167	1.1132	1.1097	1.0934	1.0903	1.0761	1.0761	1.0734	1.0815	1.0903	1.0965	1.1030 (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												2.7348 (42)
Average daily hot water use (litres/day)												99.1527 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)												Total = Sum(45)m = 1560.0574 (45)
Distribution loss (46)m = 0.15 x (45)m	24.2617	21.2194	21.8965	19.0899	18.3173	15.8064	14.6469	16.8076	17.0083	19.8216	21.6368	23.4961 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	29.1653	26.3359	29.1417	28.1752	29.0934	28.1308	29.0534	29.0793	28.1550	29.1209	28.2061	29.1577	29.1577	29.1577	29.1577	(61)
Total heat required for water heating calculated for each month	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986	185.7986	185.7986	185.7986	(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	0.0000	0.0000	0.0000	(63)
Output from w/h	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986	185.7986	185.7986	185.7986	(64)
Heat gains from water heating, kWh/month	61.0714	53.6204	55.8228	49.3598	47.8766	42.0702	39.7308	44.5267	44.7405	51.2180	55.0131	59.3725	59.3725	59.3725	59.3725	(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	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9155	53.2164	43.2785	32.7646	24.4919	20.6771	22.3424	29.0414	38.9794	49.4933	57.7659	61.5808	61.5808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.3685	385.3259	375.3534	354.1230	327.3235	302.1357	285.3087	281.3513	291.3238	312.5542	339.3537	364.5415	364.5415	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)
Water heating gains (Table 5)	82.0852	79.7922	75.0306	68.5553	64.3503	58.4308	53.4016	59.8477	62.1396	68.8414	76.4070	79.8018	79.8018	(72)
Total internal gains	635.2102	630.1755	605.5034	567.2839	528.0066	493.0845	472.8935	482.0813	504.2837	542.7298	585.3676	617.7650	617.7650	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
East	8.4000	19.6403	0.5700	0.7000	0.7700	45.6176 (76)
South	1.6800	46.7521	0.5700	0.7000	0.7700	21.7178 (78)
West	6.6000	19.6403	0.5700	0.7000	0.7700	35.8424 (80)
Horizontal	0.6400	26.0000	0.5700	0.7000	1.0000	5.9754 (82)

Solar gains	109.1533	207.3318	329.8026	468.4223	566.5514	577.4881	550.7534	477.4872	378.9781	242.6180	134.8983	90.5813	90.5813	(83)
Total gains	744.3635	837.5073	935.3060	1035.7062	1094.5579	1070.5726	1023.6470	959.5685	883.2618	785.3478	720.2660	708.3463	708.3463	(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	62.1846	62.3830	62.5787	63.5145	63.6928	64.5357	64.5357	64.6943	64.2084	63.6928	63.3333	62.9617	62.9617	
alpha	5.1456	5.1589	5.1719	5.2343	5.2462	5.3024	5.3024	5.3130	5.2806	5.2462	5.2222	5.1974	5.1974	
util living area	0.9945	0.9892	0.9732	0.9217	0.8038	0.6171	0.4561	0.5048	0.7600	0.9493	0.9891	0.9957	0.9957	(86)
MIT	19.9408	20.0926	20.3432	20.6550	20.8768	20.9764	20.9960	20.9934	20.9319	20.6348	20.2336	19.9162	19.9162	(87)
Th 2	19.9872	19.9901	19.9929	20.0063	20.0088	20.0204	20.0204	20.0226	20.0159	20.0088	20.0037	19.9984	19.9984	(88)
util rest of house	0.9928	0.9857	0.9645	0.8967	0.7488	0.5322	0.3568	0.4013	0.6798	0.9276	0.9850	0.9943	0.9943	(89)
MIT 2	18.5906	18.8128	19.1744	19.6159	19.8945	20.0056	20.0190	20.0200	19.9653	19.6004	19.0288	18.5629	18.5629	(90)
Living area fraction										fLA = Living area / (4) =		0.4834	0.4834	(91)
MIT	19.2433	19.4315	19.7394	20.1182	20.3694	20.4749	20.4913	20.4905	20.4326	20.1004	19.6112	19.2171	19.2171	(92)
Temperature adjustment												0.0000	0.0000	(93)
adjusted MIT	19.2433	19.4315	19.7394	20.1182	20.3694	20.4749	20.4913	20.4905	20.4326	20.1004	19.6112	19.2171	19.2171	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9910	0.9832	0.9618	0.8999	0.7701	0.5726	0.4049	0.4515	0.7158	0.9300	0.9829	0.9929	0.9929	(94)
Ext temp.	737.7000	823.4431	899.5865	932.0431	842.9499	612.9890	414.5248	433.2269	632.2377	730.3738	707.9611	703.3048	703.3048	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	4.2000	(96)
Month fracti	1660.4459	1609.5484	1461.8480	1220.4206	940.4991	629.0184	416.6348	436.8923	681.4712	1030.6557	1364.9857	1648.0517	1648.0517	(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	1.0000	(97a)
Space heating	686.5229	528.2628	418.3225	207.6318	72.5766	0.0000	0.0000	0.0000	0.0000	223.4098	473.0577	702.8917	702.8917	(98)
Space heating per m2											(98) / (4) =	33.2932	33.2932	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3652.3437 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	686.5229	528.2628	418.3225	207.6318	72.5766	0.0000	0.0000	0.0000	0.0000	223.4098	473.0577	702.8917	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	756.9161	582.4286	461.2156	228.9215	80.0183	0.0000	0.0000	0.0000	0.0000	246.3173	521.5630	774.9633	(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	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986	(64)
Efficiency of water heater (217)m	89.8684	89.7795	89.5758	89.0781	88.1664	87.0000	87.0000	87.0000	87.0000	89.1112	89.6811	87.0000	(216)
Fuel for water heating, kWh/month	212.4327	186.9009	195.4976	174.5002	171.5034	153.4560	145.6319	162.2183	162.6940	180.9701	192.2940	206.6711	(219)
Water heating fuel used												2144.7702	(219)
Annual totals kWh/year													
Space heating fuel - main system													3652.3437 (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)													423.2507 (232)
Total delivered energy for all uses													6295.3645 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3652.3437	3.4800	127.1016 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2144.7702	3.4800	74.6380 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	423.2507	13.1900	55.8268 (250)
Additional standing charges			120.0000 (251)
Total energy cost			387.4588 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1262 (257)
SAP value		84.2898
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3652.3437	0.2160	788.9062 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2144.7702	0.2160	463.2704 (264)
Space and water heating			1252.1766 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.2507	0.5190	219.6671 (268)
Total kg/year			1510.7687 (272)
CO2 emissions per m2			15.1800 (273)
EI value			85.9901
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8860 = 3.928$, stars = 4
Water heating environmental impact	$0.216 / 0.8860 = 0.2438$, stars = 4

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	99.5000 (1b)	x 2.4500 (2b)	= 243.7750 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.7750 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1231 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3731 (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) =	0.3731 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	4.8000	4.9000	4.3000	4.3000	3.8000	3.9000	4.0000	4.2000	4.4000	4.4000	4.7000 (22)
Wind factor	1.2500	1.2000	1.2250	1.0750	1.0750	0.9500	0.9750	1.0000	1.0500	1.1000	1.1000	1.1750 (22a)
Adj infilt rate	0.4663	0.4477	0.4570	0.4010	0.4010	0.3544	0.3637	0.3731	0.3917	0.4104	0.4104	0.4384 (22b)
Effective ac	0.6087	0.6002	0.6044	0.5804	0.5804	0.5628	0.5662	0.5696	0.5767	0.5842	0.5842	0.5961 (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
Windows (Uw = 1.50)			16.6800	1.4151	23.6038		(27)
Door			1.6800	1.6000	2.6880		(26)
Roof Window (Uw = 1.50)			0.6400	1.4151	0.9057		(27a)
External Wall	52.9000	16.6800	36.2200	0.1400	5.0708		(29a)
Shelter Wall	31.4000	1.6800	29.7200	0.1974	5.8658		(29a)
Flat Roof	99.5000	0.6400	98.8600	0.1000	9.8860		(30)
Total net area of external elements Aum(A, m2)			183.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 48.0200		(33)
Party Floor			99.5000				(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7730 (36)
 Total fabric heat loss (33) + (36) = 61.7930 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.9699	48.2841	48.6235	46.6922	46.6922	45.2752	45.5446	45.8210	46.3948	46.9966	46.9966	47.9517 (38)
Average = Sum(39)m / 12 =	110.7629	110.0772	110.4165	108.4852	108.4852	107.0682	107.3376	107.6140	108.1878	108.7896	108.7896	109.7448 (39)
HLP (average)	1.1132	1.1063	1.1097	1.0903	1.0903	1.0761	1.0788	1.0815	1.0873	1.0934	1.0934	1.1030 (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 2.7348 (42)
 Average daily hot water use (litres/day) 99.1527 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.0679	105.1018	101.1357	97.1696	93.2035	89.2374	89.2374	93.2035	97.1696	101.1357	105.1018	109.0679 (44)
Energy conte	161.7446	141.4628	145.9770	127.2663	122.1150	105.3760	97.6463	112.0506	113.3888	132.1438	144.2452	156.6410 (45)
Energy content (annual)	Total = Sum(45)m = 1560.0574 (45)											
Distribution loss (46)m = 0.15 x (45)m	24.2617	21.2194	21.8965	19.0899	18.3173	15.8064	14.6469	16.8076	17.0083	19.8216	21.6368	23.4961 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	29.1653	26.3359	29.1417	28.1752	29.0934	28.1308	29.0534	29.0793	28.1550	29.1209	28.2061	29.1577							(61)
Total heat required for water heating calculated for each month	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986							(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	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986							(64)
Heat gains from water heating, kWh/month	61.0714	53.6204	55.8228	49.3598	47.8766	42.0702	39.7308	44.5267	44.7405	51.2180	55.0131	59.3725							(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	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	164.0909	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.9155	53.2164	43.2785	32.7646	24.4919	20.6771	22.3424	29.0414	38.9794	49.4933	57.7659	61.5808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.3685	385.3259	375.3534	354.1230	327.3235	302.1357	285.3087	281.3513	291.3238	312.5542	339.3537	364.5415	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	54.1439	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	-109.3940	(71)
Water heating gains (Table 5)	82.0852	79.7922	75.0306	68.5553	64.3503	58.4308	53.4016	59.8477	62.1396	68.8414	76.4070	79.8018	(72)
Total internal gains	635.2102	630.1755	605.5034	567.2839	528.0066	493.0845	472.8935	482.0813	504.2837	542.7298	585.3676	617.7650	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	8.4000	22.3485	0.5700	0.5700	0.7000	0.7700	51.9079	(76)					
South	1.6800	51.1372	0.5700	0.5700	0.7000	0.7700	23.7548	(78)					
West	6.6000	22.3485	0.5700	0.5700	0.7000	0.7700	40.7848	(80)					
Horizontal	0.6400	30.0000	0.5700	0.5700	0.7000	1.0000	6.8947	(82)					
Solar gains	123.3423	214.6514	331.2014	481.0766	564.1180	618.6650	586.4238	520.2739	412.3383	259.8581	156.1887	101.3481	(83)
Total gains	758.5525	844.8269	936.7048	1048.3604	1092.1246	1111.7495	1059.3173	1002.3552	916.6220	802.5879	741.5563	719.1131	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)	tau	62.3830	62.7716	62.5787	63.6928	63.6928	64.5357	64.3737	64.2084	63.8678	63.5145	63.5145	21.0000	(85)
alpha	5.1589	5.1848	5.1719	5.2462	5.2462	5.3024	5.2916	5.2806	5.2579	5.2343	5.2343	5.1974		
util living area	0.9937	0.9883	0.9707	0.9084	0.7786	0.5384	0.3736	0.3954	0.7043	0.9349	0.9864	0.9952	(86)	
MIT	19.9796	20.1187	20.3737	20.6976	20.9004	20.9888	20.9987	20.9982	20.9553	20.6885	20.2866	19.9469	(87)	
Th 2	19.9901	19.9957	19.9929	20.0088	20.0088	20.0204	20.0182	20.0159	20.0112	20.0063	20.0063	19.9984	(88)	
util rest of house	0.9917	0.9846	0.9611	0.8797	0.7180	0.4508	0.2752	0.2913	0.6154	0.9073	0.9812	0.9936	(89)	
MIT 2	18.6491	18.8546	19.2179	19.6741	19.9207	20.0145	20.0179	20.0155	19.9814	19.6700	19.1070	18.6077	(90)	
Living area fraction	MIT	19.2923	19.4657	19.7767	20.1689	20.3943	20.4855	20.4920	20.4522	20.1623	19.6772	19.2551	(92)	
Temperature adjustment	adjusted MIT	19.2923	19.4657	19.7767	20.1689	20.3943	20.4855	20.4920	20.4522	20.1623	19.6772	19.2551	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9898	0.9821	0.9586	0.8849	0.7429	0.4930	0.3229	0.3418	0.6569	0.9123	0.9790	0.9920	(94)
Useful gains	750.8180	829.6965	897.8887	927.7057	811.3262	548.1128	342.0325	342.5613	602.0844	732.2314	725.9988	713.3671	(95)
Ext temp.	4.5000	5.0000	6.8000	9.3000	12.2000	15.3000	17.3000	17.3000	14.6000	11.1000	7.4000	4.4000	(96)
Heat loss rate W	1638.4376	1592.3408	1432.8392	1179.1100	888.9591	555.1999	342.6234	343.3504	633.1353	985.8889	1335.6307	1630.2707	(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	660.3890	512.4970	398.0031	181.0111	57.7588	0.0000	0.0000	0.0000	0.0000	188.7212	438.9349	682.1762	(98)
Space heating												3119.4913	(98)
Space heating per m2										(98) / (4) =		31.3517	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3439.3510 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	660.3890	512.4970	398.0031	181.0111	57.7588	0.0000	0.0000	0.0000	0.0000	188.7212	438.9349	682.1762 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	728.1025	565.0463	438.8127	199.5712	63.6812	0.0000	0.0000	0.0000	0.0000	208.0718	483.9415	752.1237 (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	190.9099	167.7988	175.1186	155.4415	151.2084	133.5067	126.6997	141.1299	141.5438	161.2647	172.4513	185.7986 (64)
Efficiency of water heater (217)m	89.8431	89.7584	89.5365	88.9522	87.9922	87.0000	87.0000	87.0000	87.0000	88.9568	89.6249	87.0000 (216)
Fuel for water heating, kWh/month	212.4925	186.9448	195.5835	174.7471	171.8431	153.4560	145.6319	162.2183	162.6940	181.2843	192.4146	206.7146 (219)
Water heating fuel used												2146.0246 (219)
Annual totals kWh/year												3439.3510 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												30.0000 (230c)
Electricity for pumps and fans:												45.0000 (230e)
central heating pump												75.0000 (231)
main heating flue fan												423.2507 (232)
Total electricity for the above, kWh/year												6083.6263 (238)
Electricity for lighting (calculated in Appendix L)												
Total delivered energy for all uses												

10a. Fuel costs - using BEDF prices (460)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3439.3510	3.9700	136.5422 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2146.0246	3.9700	85.1972 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Energy for lighting	423.2507	18.2700	77.3279 (250)
Additional standing charges			90.0000 (251)
Total energy cost			402.7698 (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	3439.3510	0.2160	742.8998 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.0246	0.2160	463.5413 (264)
Space and water heating			1206.4411 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	423.2507	0.5190	219.6671 (268)
Total kg/year			1465.0332 (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	3439.3510	1.2200	4196.0082 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.0246	1.2200	2618.1501 (264)
Space and water heating			6814.1582 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	423.2507	3.0700	1299.3796 (268)
Primary energy kWh/year			8343.7878 (272)
Primary energy kWh/m2/year			83.8572 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
 Current environmental impact rating: B 86

(For testing purposes):

A Not considered
 B Not considered

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Calculation Type: New Build (As Designed)

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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	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
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: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m ²	

Potential energy efficiency rating: B 84
 Potential environmental impact rating: B 86

Fuel prices for cost data on this page from database revision number 460 TEST (27 Apr 2020)
 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	£91	£91	£0
Mains gas	£312	£312	£0
Space heating	£240	£240	£0
Water heating	£85	£85	£0
Lighting	£77	£77	£0
Total cost of fuels	£403	£403	£0
Total cost of uses	£402	£402	£0
Delivered energy	61 kWh/m ²	61 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	84 kWh/m ²	84 kWh/m ²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	482.67 (P1)
Transmission heat loss coefficient	61.79 (37)
Summer heat loss coefficient	544.47 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)
Horizontal	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	8.4000	117.5071	0.5700	0.7000	0.9000	319.0077
South	1.6800	112.2060	0.5700	0.7000	0.9000	60.9233
West	6.6000	117.5071	0.5700	0.7000	0.9000	250.6489
Horizontal	0.6400	203.0000	0.5700	0.7000	1.0000	46.6543
total:						677.2342

	Jun	Jul	Aug	
Solar gains	718	677	601	(P3)
Internal gains	490	470	479	
Total summer gains	1208	1147	1080	(P5)
Summer gain/loss ratio	2.22	2.11	1.98	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.47	20.26	20.03	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			