

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025b_050_As_Built				Issued on Date	05/08/2020
Assessment Reference	001	Prop Type Ref	GFF			
Property						
SAP Rating	85 B	DER	16.31	TER	18.52	
Environmental	88 B	% DER<TER	11.93			
CO ₂ Emissions (t/year)	1.09	DFEE	42.10	TFEE	52.66	
General Requirements Compliance	Pass	% DFEE<TFEE	20.06			
Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk				Assessor ID	d168-0001
Client	Bellway Homes Thames Valley					

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

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DWELLING AS BUILT

Ground-floor flat, total floor area 81 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) 18.52 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.31 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.1 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof (no roof)			
Openings	1.30 (max. 2.00)	1.30 (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: 3.39 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1600
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing East: 8.83 m², No overhang
Windows facing South: 5.24 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

10 Key features

Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.4 m³/m²h

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					3.3900
Infiltration rate					0.1695 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1441 (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	0.1837	0.1801	0.1765	0.1585	0.1549	0.1369	0.1369	0.1333	0.1441	0.1549	0.1621	0.1693 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			14.0700	1.2357	17.3869		(27)
Heat Loss Floor			81.1500	0.1000	8.1150		(28a)
WT-E-01	78.0500	14.0700	63.9800	0.2000	12.7960		(29a)
WT-E-01	25.5800		25.5800	0.1876	4.7992		(29a)
Total net area of external elements Aum(A, m ²)			184.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 43.0971		(33)
Party Ceilings 1			81.1500				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2776 (36)
Total fabric heat loss							(33) + (36) = 56.3747 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354 (38)
Heat transfer coeff	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101 (39)
Average = Sum(39)m / 12 =												88.5101 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907 (40)
HLP (average)												1.0907 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy conte	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Energy content (annual)												Total = Sum(45)m = 1466.4394 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8058	19.9461	20.5826	17.9444	17.2180	14.8579	13.7680	15.7990	15.9877	18.6321	20.3384	22.0862 (46)
Water storage loss:												
Total storage loss												

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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 (56)
Combi loss	14.1215	12.7406	14.0696	13.5750	13.9979	13.5122	13.9413	13.9780	13.5464	14.0400	13.6343	14.1099 (57)
Total heat required for water heating calculated for each month	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (64)
Heat gains from water heating, kWh/month	54.0831	47.3989	49.1421	43.1704	41.6662	36.3130	34.0044	38.5156	38.8259	44.8111	48.4920	52.4851 (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	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3252	18.0526	14.6814	11.1148	8.3084	7.0143	7.5792	9.8518	13.2230	16.7896	19.5960	20.8901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.8272	224.1291	218.3284	205.9796	190.3913	175.7406	165.9530	163.6511	169.4517	181.8006	197.3889	212.0396	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	72.6924	70.5341	66.0512	59.9589	56.0029	50.4347	45.7048	51.7682	53.9249	60.2300	67.3500	70.5445	(72)
Total internal gains	378.1096	375.9806	362.3258	340.3181	317.9674	296.4544	282.5018	288.5359	299.8644	322.0850	347.5996	366.7390	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.8300	19.6403	0.4500	0.0000	0.7700	60.0913	(76)
South	5.2400	46.7521	0.4500	0.0000	0.7700	84.8859	(78)

Solar gains	144.9771	256.5724	370.6784	482.4879	554.5847	554.9281	533.3361	480.1225	410.1430	289.4318	175.5454	122.7653	(83)
Total gains	523.0867	632.5530	733.0042	822.8060	872.5521	851.3824	815.8379	768.6584	710.0074	611.5168	523.1450	489.5043	(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	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	
alpha	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	
util living area	0.9972	0.9921	0.9766	0.9280	0.8144	0.6368	0.4721	0.5206	0.7706	0.9574	0.9935	0.9980	(86)
MIT	19.8810	20.0670	20.3360	20.6403	20.8684	20.9716	20.9950	20.9918	20.9256	20.6080	20.1687	19.8319	(87)
Th 2	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	(88)
util rest of house	0.9963	0.9895	0.9688	0.9045	0.7605	0.5499	0.3685	0.4131	0.6907	0.9384	0.9909	0.9974	(89)
MIT 2	18.9915	19.1762	19.4404	19.7288	19.9244	19.9961	20.0072	20.0062	19.9704	19.7056	19.2782	18.9426	(90)
Living area fraction	19.3824	19.5677	19.8340	20.1294	20.3392	20.4248	20.4413	20.4394	20.3901	20.1021	19.6695	19.3334	(91)
MIT	19.3824	19.5677	19.8340	20.1294	20.3392	20.4248	20.4413	20.4394	20.3901	20.1021	19.6695	19.3334	(92)
Temperature adjustment	19.2324	19.4177	19.6840	19.9794	20.1892	20.2748	20.2913	20.2894	20.2401	19.9521	19.5195	19.1834	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	520.6326	624.6519	707.8337	743.5590	672.8887	488.8422	325.0992	341.4148	504.8079	573.0693	517.5088	487.8431	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1321.6650	1284.9599	1166.9139	980.6358	751.3806	502.2758	326.7174	344.2472	543.4647	827.7589	1099.2540	1326.1818	(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	595.9681	443.7270	341.5557	170.6952	58.3979	0.0000	0.0000	0.0000	0.0000	189.4890	418.8565	623.7241	(98)
Space heating												2842.4135	(98)
Space heating per m2												35.0267	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3140.7884 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	595.9681	443.7270	341.5557	170.6952	58.3979	0.0000	0.0000	0.0000	0.0000	189.4890	418.8565	623.7241	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	658.5283	490.3061	377.4096	188.6135	64.5281	0.0000	0.0000	0.0000	0.0000	209.3802	462.8249	689.1979	(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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510	(64)
Efficiency of water heater (217)m	89.7825	89.6873	89.4930	89.0690	88.2738	87.3000	87.3000	87.3000	87.3000	89.1220	89.6369	89.8233	(216)
Fuel for water heating, kWh/month	185.0693	162.4693	169.0485	149.5517	145.8926	128.9400	121.1088	136.6604	137.6070	155.1289	166.4755	179.6315	(219)
Water heating fuel used												1837.5835	(219)
Annual totals kWh/year													
Space heating fuel - main system												3140.7884	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													43.7197 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7197 (231)
Electricity for lighting (calculated in Appendix L)													358.9491 (232)
Total delivered energy for all uses													5456.0407 (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	3140.7884	0.2160	678.4103 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1837.5835	0.2160	396.9180 (264)
Space and water heating			1075.3283 (265)
Pumps and fans	118.7197	0.5190	61.6155 (267)
Energy for lighting	358.9491	0.5190	186.2946 (268)
Total CO2, kg/year			1323.2385 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3100 (273)

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

DER			16.3100 ZC1
Total Floor Area		TFA	81.1500
Assumed number of occupants		N	2.4843
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1984 ZC2
CO2 emissions from cooking, equation (L16)			2.2012 ZC3
Total CO2 emissions			34.7096 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			34.7096 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1540 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4040 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3434 (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												
	0.4379	0.4293	0.4207	0.3778	0.3692	0.3263	0.3263	0.3177	0.3434	0.3692	0.3864	0.4035 (22b)
Effective ac	0.5959	0.5921	0.5885	0.5714	0.5681	0.5532	0.5532	0.5505	0.5590	0.5681	0.5746	0.5814 (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 Opening Type (Uw = 1.40)			14.0700	1.3258	18.6534		(27)
Heat Loss Floor			81.1500	0.1300	10.5495		(28a)
WT-E-01	78.0500	14.0700	63.9800	0.1800	11.5164		(29a)
WT-E-01	25.5800		25.5800	0.1800	4.6044		(29a)
Total net area of external elements Aum(A, m ²)			184.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.3237		(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)							12.5094 (36)
Total fabric heat loss						(33) + (36) =	57.8331 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	38.2968	38.0576	37.8231	36.7215	36.5154	35.5560	35.5560
Heat transfer coeff	96.1299	95.8907	95.6562	94.5546	94.3485	93.3892	93.3892
Average = Sum(39)m / 12 =							
	96.1299	95.8907	95.6562	94.5546	94.3485	93.3892	93.3892
HLP	1.1846	1.1816	1.1788	1.1652	1.1626	1.1508	1.1508
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
Daily hot water use	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy conte	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Energy content (annual)												1466.4394 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8058	19.9461	20.5826	17.9444	17.2180	14.8579	13.7680	15.7990	15.9877	18.6321	20.3384	22.0862 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	45.4726	48.4449	45.0437	44.6453	41.3666	42.7455	44.6453	45.0437	48.4449	48.7207	50.9589 (61)

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Total heat required for water heating calculated for each month												
	202.9973	178.4464	185.6619	164.6728	159.4323	140.4191	134.5322	149.9718	151.6281	172.6588	184.3099	198.2000 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	202.9973	178.4464	185.6619	164.6728	159.4323	140.4191	134.5322	149.9718	151.6281	172.6588	184.3099	198.2000 (64)
								Total per year (kWh/year) = Sum(64)m =				2022.9305 (64)
Heat gains from water heating, kWh/month												
	63.2925	55.5819	57.7359	51.0376	49.3280	43.2766	41.2054	46.1824	46.7002	53.4123	57.2636	61.6974 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3252	18.0526	14.6814	11.1148	8.3084	7.0143	7.5792	9.8518	13.2230	16.7896	19.5960	20.8901 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.8272	224.1291	218.3284	205.9796	190.3913	175.7406	165.9530	163.6511	169.4517	181.8006	197.3889	212.0396 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216 (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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728 (71)
Water heating gains (Table 5)	85.0706	82.7112	77.6020	70.8855	66.3011	60.1064	55.3837	62.0731	64.8614	71.7908	79.5327	82.9266 (72)
Total internal gains	390.4877	388.1577	373.8766	351.2447	328.2656	306.1260	292.1806	298.8407	310.8010	333.6458	359.7824	379.1211 (73)

[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	8.8300	19.6403	0.6300	0.7000	0.7700	53.0005 (76)
South	5.2400	46.7521	0.6300	0.7000	0.7700	74.8693 (78)

Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	58.6229	58.7692	58.9133	59.5996	59.7298	60.3434	60.3434	60.4584	60.1055	59.7298	59.4670	59.1947
alpha	4.9082	4.9179	4.9276	4.9733	4.9820	5.0229	5.0229	5.0306	5.0070	4.9820	4.9645	4.9463
util living area	0.9974	0.9935	0.9826	0.9481	0.8609	0.6972	0.5274	0.5753	0.8169	0.9670	0.9942	0.9981 (86)
MIT	19.7483	19.9260	20.1959	20.5295	20.7994	20.9502	20.9899	20.9847	20.8873	20.5246	20.0707	19.7174 (87)
Th 2	19.9323	19.9347	19.9370	19.9480	19.9500	19.9595	19.9595	19.9613	19.9559	19.9500	19.9459	19.9415 (88)
util rest of house	0.9965	0.9913	0.9765	0.9292	0.8118	0.6049	0.4086	0.4546	0.7393	0.9513	0.9919	0.9974 (89)
MIT 2	18.2711	18.5315	18.9236	19.4022	19.7559	19.9269	19.9559	19.9552	19.8681	19.4055	18.7515	18.2325 (90)
Living area fraction									fLA = Living area / (4) =			0.4394 (91)
MIT	18.9202	19.1443	19.4827	19.8976	20.2144	20.3766	20.4103	20.4076	20.3160	19.8973	19.3312	18.8850 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9202	19.1443	19.4827	19.8976	20.2144	20.3766	20.4103	20.4076	20.3160	19.8973	19.3312	18.8850 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9891	0.9731	0.9281	0.8255	0.6438	0.4612	0.5079	0.7687	0.9503	0.9900	0.9964 (94)
Useful gains	515.9038	607.7456	681.9667	720.9464	674.7803	512.1606	351.6719	366.8883	517.0056	559.6332	509.4925	485.6665 (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	1405.4430	1365.8944	1241.8746	1039.8723	803.3243	539.4672	355.8404	373.5527	582.8004	877.1862	1159.0957	1398.0340 (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	661.8172	509.4760	416.5714	229.6267	95.6367	0.0000	0.0000	0.0000	0.0000	236.2594	467.7143	678.8015 (98)
Space heating												3295.9032 (98)
Space heating per m2												40.6149 (99)
										(98) / (4) =		

Not applicable

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													3528.8043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	661.8172	509.4760	416.5714	229.6267	95.6367	0.0000	0.0000	0.0000	0.0000	236.2594	467.7143	678.8015	(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)	708.5837	545.4775	446.0080	245.8530	102.3948	0.0000	0.0000	0.0000	0.0000	252.9544	500.7648	726.7682	(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	202.9973	178.4464	185.6619	164.6728	159.4323	140.4191	134.5322	149.9718	151.6281	172.6588	184.3099	198.2000	(64)
Efficiency of water heater	87.8076	87.5437	87.0255	85.8883	83.8109	80.3000	80.3000	80.3000	80.3000	85.8412	87.2963	87.9014	(217)
Fuel for water heating, kWh/month	231.1843	203.8369	213.3420	191.7289	190.2285	174.8681	167.5369	186.7644	188.8270	201.1375	211.1315	225.4800	(219)
Water heating fuel used												2386.0660	(219)
Annual totals kWh/year													
Space heating fuel - main system												3528.8043	(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)												358.9491	(232)
Total delivered energy for all uses												6348.8194	(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	3528.8043	0.2160	762.2217 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2386.0660	0.2160	515.3903 (264)
Space and water heating			1277.6120 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	358.9491	0.5190	186.2946 (268)
Total CO2, kg/m2/year			1502.8316 (272)
Emissions per m2 for space and water heating			15.7438 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2957 (272b)
Emissions per m2 for pumps and fans			0.4797 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7438 * 1.00) + 2.2957 + 0.4797, rounded to 2 d.p.			18.5200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					3.3900
Number of sides sheltered					0.3235 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2750 (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												
	0.3506	0.3438	0.3369	0.3025	0.2956	0.2613	0.2613	0.2544	0.2750	0.2956	0.3094	0.3231 (22b)
Effective ac	0.5615	0.5591	0.5567	0.5458	0.5437	0.5341	0.5341	0.5324	0.5378	0.5437	0.5479	0.5522 (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
Opening Type 2 (Uw = 1.30)			14.0700	1.2357	17.3869		(27)
Heat Loss Floor			81.1500	0.1000	8.1150		(28a)
WT-E-01	78.0500	14.0700	63.9800	0.2000	12.7960		(29a)
WT-E-01	25.5800		25.5800	0.1876	4.7992		(29a)
Total net area of external elements Aum(A, m ²)			184.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.0971		(33)
Party Ceilings 1			81.1500				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2776 (36)
Total fabric heat loss						(33) + (36) =	56.3747 (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	36.0862	35.9328	35.7824	35.0761	34.9440	34.3288	34.3288	34.2149	34.5657	34.9440	35.2113	35.4908 (38)
Heat transfer coeff	92.4609	92.3075	92.1572	91.4508	91.3187	90.7035	90.7035	90.5896	90.9405	91.3187	91.5860	91.8655 (39)
Average = Sum(39)m / 12 =												91.4502 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1394	1.1375	1.1356	1.1269	1.1253	1.1177	1.1177	1.1163	1.1206	1.1253	1.1286	1.1320 (40)
HLP (average)												1.1269 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy conte	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Energy content (annual)										Total = Sum(45)m =		1466.4394 (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)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.12R02



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF 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	(59)
Heat gains from water heating, kWh/month	32.3082	28.2569	29.1586	25.4212	24.3922	21.0486	19.5047	22.3819	22.6492	26.3955	28.8127	31.2887 (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	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3252	18.0526	14.6814	11.1148	8.3084	7.0143	7.5792	9.8518	13.2230	16.7896	19.5960	20.8901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.8272	224.1291	218.3284	205.9796	190.3913	175.7406	165.9530	163.6511	169.4517	181.8006	197.3889	212.0396	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	43.4249	42.0490	39.1917	35.3072	32.7853	29.2342	26.2159	30.0832	31.4572	35.4778	40.0176	42.0547	(72)
Total internal gains	345.8421	344.4955	332.4663	312.6663	291.7498	272.2539	260.0129	263.8508	274.3967	294.3328	317.2673	335.2492	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d		Gains W		
East					8.8300	19.6403	0.4500	0.0000	0.7700		60.0913 (76)		
South					5.2400	46.7521	0.4500	0.0000	0.7700		84.8859 (78)		
Solar gains	144.9771	256.5724	370.6784	482.4879		554.5847	554.9281	533.3361	480.1225	410.1430	289.4318	175.5454	122.7653 (83)
Total gains	490.8192	601.0679	703.1448	795.1542		846.3345	827.1819	793.3490	743.9733	684.5397	583.7646	492.8127	458.0145 (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	60.9492	61.0505	61.1501	61.6224	61.7115	62.1301	62.1301	62.2082	61.9682	61.7115	61.5314	61.3442	
alpha	5.0633	5.0700	5.0767	5.1082	5.1141	5.1420	5.1420	5.1472	5.1312	5.1141	5.1021	5.0896	
util living area	0.9979	0.9939	0.9814	0.9400	0.8379	0.6636	0.4956	0.5473	0.7984	0.9663	0.9951	0.9985	(86)
MIT	19.7775	19.9691	20.2502	20.5826	20.8371	20.9632	20.9932	20.9889	20.9058	20.5517	20.0907	19.7390	(87)
Th 2	19.9688	19.9703	19.9718	19.9789	19.9802	19.9864	19.9864	19.9875	19.9840	19.9802	19.9775	19.9747	(88)
util rest of house	0.9972	0.9919	0.9750	0.9192	0.7860	0.5738	0.3854	0.4333	0.7198	0.9504	0.9932	0.9981	(89)
MIT 2	18.8565	19.0483	19.3267	19.6508	19.8745	19.9702	19.9847	19.9845	19.9347	19.6294	19.1759	18.8229	(90)
Living area fraction									fLA = Living area / (4) =			0.4394	(91)
MIT	19.2612	19.4529	19.7325	20.0603	20.2975	20.4066	20.4279	20.4259	20.3615	20.0347	19.5779	19.2255	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2612	19.4529	19.7325	20.0603	20.2975	20.4066	20.4279	20.4259	20.3615	20.0347	19.5779	19.2255	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9906	0.9732	0.9211	0.8035	0.6125	0.4341	0.4838	0.7515	0.9515	0.9922	0.9976	(94)
Ext temp.	489.1484	595.3947	684.2908	732.4222	680.0347	506.6453	344.3948	359.9025	514.4004	555.4295	488.9539	456.8980	(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	1383.3255	1343.3435	1219.4729	1020.6194	785.1112	526.6758	347.1998	364.7011	569.4198	861.5636	1142.8028	1380.3232	(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	665.2678	502.6216	398.1755	207.5020	78.1769	0.0000	0.0000	0.0000	0.0000	227.7638	470.7712	687.0283	(98)
Space heating												3237.3072	(98)
Space heating per m2												39.8929	(99)
										(98) / (4) =			

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	852.6130	671.2060	688.4809	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9133	0.9567	0.9418	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	778.7165	642.1294	648.3961	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1059.7632	1018.3114	962.2267	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	202.3536	279.8794	233.4900	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												715.7230	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
										fC = cooled area / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	50.5884	69.9699	58.3725	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2													178.9307 (107)
Energy for space heating													2.2049 (108)
Energy for space cooling													39.8929 (99)
Total													2.2049 (108)
Dwelling Fabric Energy Efficiency (DFEE)													42.0978 (109)
													42.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1540 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4040 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3434 (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	0.4379	0.4293	0.4207	0.3778	0.3692	0.3263	0.3263	0.3177	0.3434	0.3692	0.3864	0.4035 (22b)
Effective ac	0.5959	0.5921	0.5885	0.5714	0.5681	0.5532	0.5532	0.5505	0.5590	0.5681	0.5746	0.5814 (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 Opening Type (Uw = 1.40)			14.0700	1.3258	18.6534		(27)					
Heat Loss Floor			81.1500	0.1300	10.5495		(28a)					
WT-E-01	78.0500	14.0700	63.9800	0.1800	11.5164		(29a)					
WT-E-01	25.5800		25.5800	0.1800	4.6044		(29a)					
Total net area of external elements Aum(A, m2)			184.7800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.3237		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5094 (36)					
Total fabric heat loss						(33) + (36) =	57.8331 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	38.2968	38.0576	37.8231	36.7215	36.5154	35.5560	35.5560	35.3784	35.9256	36.5154	36.9324	37.3682 (38)
Heat transfer coeff	96.1299	95.8907	95.6562	94.5546	94.3485	93.3892	93.3892	93.2115	93.7587	94.3485	94.7655	95.2013 (39)
Average = Sum(39)m / 12 =												94.5537 (39)
HLP	1.1846	1.1816	1.1788	1.1652	1.1626	1.1508	1.1508	1.1486	1.1554	1.1626	1.1678	1.1732 (40)
HLP (average)												1.1652 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy conte	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Energy content (annual)	Total = Sum(45)m =										1466.4394 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
32.3082 28.2569 29.1586 25.4212 24.3922 21.0486 19.5047 22.3819 22.6492 26.3955 28.8127 31.2887 (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	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	124.2160	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3252	18.0526	14.6814	11.1148	8.3084	7.0143	7.5792	9.8518	13.2230	16.7896	19.5960	20.8901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.8272	224.1291	218.3284	205.9796	190.3913	175.7406	165.9530	163.6511	169.4517	181.8006	197.3889	212.0396	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	35.4216	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	43.4249	42.0490	39.1917	35.3072	32.7853	29.2342	26.2159	30.0832	31.4572	35.4778	40.0176	42.0547	(72)
Total internal gains	345.8421	344.4955	332.4663	312.6663	291.7498	272.2539	260.0129	263.8508	274.3967	294.3328	317.2673	335.2492	(73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	W
East					8.8300	19.6403	0.6300		0.7000		0.7700	53.0005
South					5.2400	46.7521	0.6300		0.7000		0.7700	74.8693 (76)
Solar gains	127.8698	226.2969	326.9384	425.5543	489.1437	489.4465	470.4024	423.4681	361.7461	255.2789	154.8311	108.2790 (83)
Total gains	473.7119	570.7924	659.4047	738.2206	780.8935	761.7004	730.4153	687.3189	636.1428	549.6116	472.0983	443.5282 (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	58.6229	58.7692	58.9133	59.5996	59.7298	60.3434	60.3434	60.4584	60.1055	59.7298	59.4670	59.1947	
alpha	4.9082	4.9179	4.9276	4.9733	4.9820	5.0229	5.0229	5.0306	5.0070	4.9820	4.9645	4.9463	
util living area	0.9982	0.9953	0.9864	0.9567	0.8774	0.7196	0.5484	0.6006	0.8405	0.9747	0.9961	0.9987	(86)
MIT	19.6976	19.8772	20.1520	20.4947	20.7780	20.9426	20.9881	20.9815	20.8702	20.4856	20.0229	19.6673	(87)
Th 2	19.9323	19.9347	19.9370	19.9480	19.9500	19.9595	19.9595	19.9613	19.9559	19.9500	19.9459	19.9415	(88)
util rest of house	0.9976	0.9936	0.9815	0.9403	0.8315	0.6274	0.4260	0.4765	0.7668	0.9621	0.9944	0.9983	(89)
MIT 2	18.7476	18.9284	19.2024	19.5435	19.8010	19.9334	19.9566	19.9561	19.8850	19.5420	19.0831	18.7247	(90)
Living area fraction										fLA = Living area / (4) =		0.4394	(91)
MIT	19.1650	19.3453	19.6197	19.9615	20.2303	20.3769	20.4098	20.4067	20.3179	19.9566	19.4961	19.1389	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1650	19.3453	19.6197	19.9615	20.2303	20.3769	20.4098	20.4067	20.3179	19.9566	19.4961	19.1389	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9924	0.9796	0.9406	0.8451	0.6665	0.4803	0.5315	0.7952	0.9622	0.9935	0.9978	(94)
Useful gains	472.3068	566.4816	645.9781	694.3484	659.9665	507.6788	350.8085	365.3391	505.8425	528.8206	469.0274	442.5689	(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	1428.9758	1385.1741	1254.9754	1045.9116	804.8206	539.4964	355.7971	373.4739	582.9863	882.7831	1174.7224	1422.2049	(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	711.7617	550.1614	453.0940	253.1255	107.7715	0.0000	0.0000	0.0000	0.0000	263.3481	508.1004	728.8492	(98)
Space heating												3576.2117	(98)
Space heating per m2												44.0692	(99)
											(98) / (4) =		

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	877.8581	691.0798	708.4073	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8774	0.9341	0.9152	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	770.2578	645.5720	648.3507	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	983.2263	944.7526	896.0072	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	153.3373	222.5904	184.2565	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												560.1842	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.3343	55.6476	46.0641	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													140.0460 (107)
Space cooling per m2													1.7258 (108)
Energy for space heating													44.0692 (99)
Energy for space cooling													1.7258 (108)
Total													45.7949 (109)
Target Fabric Energy Efficiency (TFEE)													52.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					3.3900
Infiltration rate					0.1695 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1441 (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	0.1513	0.1441	0.1441	0.1333	0.1333	0.1189	0.1225	0.1153	0.1189	0.1261	0.1261	0.1369 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 2 (Uw = 1.30)			14.0700	1.2357	17.3869		(27)
Heat Loss Floor			81.1500	0.1000	8.1150		(28a)
WT-E-01	78.0500	14.0700	63.9800	0.2000	12.7960		(29a)
WT-E-01	25.5800		25.5800	0.1876	4.7992		(29a)
Total net area of external elements Aum(A, m ²)			184.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 43.0971		(33)
Party Ceilings 1			81.1500				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2776 (36)
Total fabric heat loss							(33) + (36) = 56.3747 (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	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354 (38)
Average = Sum(39)m / 12 =	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101 (39)
HLP	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907 (40)
HLP (average)												1.0907 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy content (annual)	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1466.4394 (45)
Water storage loss:	22.8058	19.9461	20.5826	17.9444	17.2180	14.8579	13.7680	15.7990	15.9877	18.6321	20.3384	22.0862 (46)
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 (56)
Combi loss	14.1215	12.7406	14.0696	13.5750	13.9979	13.5122	13.9413	13.9780	13.5464	14.0400	13.6343	14.1099 (57)
Total heat required for water heating calculated for each month	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (64)
RHI water heating demand												1631.7063 (64)
Heat gains from water heating, kWh/month	54.0831	47.3989	49.1421	43.1704	41.6662	36.3130	34.0044	38.5156	38.8259	44.8111	48.4920	52.4851 (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	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8130	45.1316	36.7035	27.7869	20.7710	17.5358	18.9480	24.6294	33.0575	41.9741	48.9900	52.2252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.0854	334.5210	325.8634	307.4322	284.1661	262.2993	247.6910	244.2553	252.9130	271.3442	294.6102	316.4770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	72.6924	70.5341	66.0512	59.9589	56.0029	50.4347	45.7048	51.7682	53.9249	60.2300	67.3500	70.5445	(72)
Total internal gains	559.6674	555.2634	533.6946	500.2547	466.0167	435.3464	417.4205	425.7296	444.9720	478.6249	516.0268	544.3234	(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					8.8300	22.3313	0.4500	0.0000	0.7700	68.3248 (76)		
South					5.2400	50.9848	0.4500	0.0000	0.7700	92.5711 (78)		
Solar gains	160.8959	256.2860	366.1519	492.3628	552.8451	592.8246	563.2520	517.3012	439.5064	308.7702	199.5959	134.9285 (83)
Total gains	720.5632	811.5494	899.8465	992.6175	1018.8618	1028.1710	980.6724	943.0308	884.4784	787.3951	715.6227	679.2519 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	
alpha	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	
util living area	0.9852	0.9722	0.9345	0.8355	0.6599	0.4275	0.2795	0.3000	0.5659	0.8621	0.9670	0.9885	(86)
MIT	20.1841	20.3284	20.5755	20.8209	20.9582	20.9964	20.9997	20.9996	20.9850	20.8208	20.4634	20.1391	(87)
Th 2	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	(88)
util rest of house	0.9805	0.9639	0.9153	0.7933	0.5904	0.3442	0.1903	0.2072	0.4757	0.8153	0.9552	0.9849	(89)
MIT 2	19.2913	19.4316	19.6664	19.8829	19.9864	20.0074	20.0084	20.0084	20.0028	19.8888	19.5646	19.2473	(90)
Living area fraction									fLA = Living area / (4) =			0.4394	(91)
MIT	19.6836	19.8257	20.0659	20.2951	20.4135	20.4420	20.4440	20.4440	20.4344	20.2983	19.9596	19.6392	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5336	19.6757	19.9159	20.1451	20.2635	20.2920	20.2940	20.2940	20.2844	20.1483	19.8096	19.4892	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9777	0.9605	0.9132	0.7996	0.6089	0.3682	0.2160	0.2340	0.5015	0.8227	0.9523	0.9824	(94)
Ext temp.	704.5258	779.4637	821.7549	793.7088	620.4213	378.5921	211.8411	220.6566	443.5367	647.7556	681.4771	667.2870	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1277.5183	1245.8402	1107.7813	906.7941	642.8893	379.8874	211.8949	220.7399	450.0209	756.6125	1045.2688	1273.5880	(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	426.3064	313.4050	212.8036	81.4214	16.7162	0.0000	0.0000	0.0000	0.0000	80.9896	261.9300	451.0880	(98)
RHI space heating demand												1844.6602	(98)
												1845	(98)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					3.3900
Infiltration rate					0.1695 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1441 (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	0.1837	0.1801	0.1765	0.1585	0.1549	0.1369	0.1369	0.1333	0.1441	0.1549	0.1621	0.1693 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23b)
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
Opening Type 2 (Uw = 1.30)			14.0700	1.2357	17.3869		(27)
Heat Loss Floor			81.1500	0.1000	8.1150		(28a)
WT-E-01	78.0500	14.0700	63.9800	0.2000	12.7960		(29a)
WT-E-01	25.5800		25.5800	0.1876	4.7992		(29a)
Total net area of external elements Aum(A, m2)			184.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.0971		(33)
Party Ceilings 1			81.1500				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2776 (36)
Total fabric heat loss							(33) + (36) = 56.3747 (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	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354 (38)
Average = Sum(39)m / 12 =	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.5228	98.7947	95.0666	91.3385	87.6104	83.8823	83.8823	87.6104	91.3385	95.0666	98.7947	102.5228 (44)
Energy content (annual)	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1466.4394 (45)
Water storage loss:	22.8058	19.9461	20.5826	17.9444	17.2180	14.8579	13.7680	15.7990	15.9877	18.6321	20.3384	22.0862 (46)
Total storage loss												

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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 (56)
Combi loss	14.1215	12.7406	14.0696	13.5750	13.9979	13.5122	13.9413	13.9780	13.5464	14.0400	13.6343	14.1099 (57)
Total heat required for water heating calculated for each month	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (64)
Heat gains from water heating, kWh/month	54.0831	47.3989	49.1421	43.1704	41.6662	36.3130	34.0044	38.5156	38.8259	44.8111	48.4920	52.4851 (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	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8130	45.1316	36.7035	27.7869	20.7710	17.5358	18.9480	24.6294	33.0575	41.9741	48.9900	52.2252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.0854	334.5210	325.8634	307.4322	284.1661	262.2993	247.6910	244.2553	252.9130	271.3442	294.6102	316.4770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	72.6924	70.5341	66.0512	59.9589	56.0029	50.4347	45.7048	51.7682	53.9249	60.2300	67.3500	70.5445	(72)
Total internal gains	559.6674	555.2634	533.6946	500.2547	466.0167	435.3464	417.4205	425.7296	444.9720	478.6249	516.0268	544.3234	(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	8.8300				19.6403	0.4500	0.0000	0.7700	60.0913 (76)			
South	5.2400				46.7521	0.4500	0.0000	0.7700	84.8859 (78)			

Solar gains	144.9771	256.5724	370.6784	482.4879	554.5847	554.9281	533.3361	480.1225	410.1430	289.4318	175.5454	122.7653 (83)
Total gains	704.6445	811.8358	904.3731	982.7425	1020.6014	990.2745	950.7566	905.8521	855.1150	768.0567	691.5722	667.0887 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	
alpha	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	
util living area	0.9891	0.9768	0.9469	0.8737	0.7381	0.5585	0.4074	0.4457	0.6744	0.9054	0.9781	0.9917	(86)
MIT	20.0861	20.2606	20.5004	20.7515	20.9184	20.9844	20.9975	20.9960	20.9602	20.7366	20.3520	20.0343	(87)
Th 2	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	(88)
util rest of house	0.9858	0.9700	0.9317	0.8401	0.6791	0.4778	0.3168	0.3516	0.5927	0.8718	0.9703	0.9891	(89)
MIT 2	19.1945	19.3652	19.5954	19.8240	19.9589	20.0020	20.0079	20.0074	19.9895	19.8176	19.4568	19.1434	(90)
Living area fraction	19.5863	19.7587	19.9931	20.2316	20.3805	20.4337	20.4427	20.4418	20.4161	20.2214	19.8502	19.5349	(91)
MIT	19.5863	19.7587	19.9931	20.2316	20.3805	20.4337	20.4427	20.4418	20.4161	20.2214	19.8502	19.5349	(92)
Temperature adjustment	19.4363	19.6087	19.8431	20.0816	20.2305	20.2837	20.2927	20.2918	20.2661	20.0714	19.7002	19.3849	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	692.9434	784.7447	839.9487	828.2590	707.3330	495.8626	326.0504	343.1241	525.8193	671.4641	668.9983	658.4531	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1339.7172	1301.8669	1181.0006	989.6837	755.0393	503.0625	326.8444	344.4672	545.7598	838.3166	1115.2448	1344.0180	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	481.1997	347.5061	253.7426	116.2257	35.4935	0.0000	0.0000	0.0000	0.0000	124.1382	321.2975	510.0603	(98)
Space heating												2189.6636	(98)
Space heating per m2												26.9829	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2419.5178 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	481.1997	347.5061	253.7426	116.2257	35.4935	0.0000	0.0000	0.0000	0.0000	124.1382	321.2975	510.0603	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	531.7124	383.9846	280.3786	128.4262	39.2193	0.0000	0.0000	0.0000	0.0000	137.1693	355.0248	563.6025	(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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510	(64)
Efficiency of water heater (217)m	89.6565	89.5305	89.2777	88.7625	87.9721	87.3000	87.3000	87.3000	87.3000	88.7852	89.4600	89.7098	(216)
Fuel for water heating, kWh/month	185.3295	162.7539	169.4563	150.0681	146.3929	128.9400	121.1088	136.6604	137.6070	155.7172	166.8046	179.8589	(219)
Water heating fuel used												1840.6977	(219)
Annual totals kWh/year													
Space heating fuel - main system													2419.5178 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													43.7197 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7197 (231)
Electricity for lighting (calculated in Appendix L)													358.9491 (232)
Total delivered energy for all uses													4737.8843 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2419.5178	3.4800	84.1992 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1840.6977	3.4800	64.0563 (247)
Mechanical ventilation fans	43.7197	13.1900	5.7666 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	358.9491	13.1900	47.3454 (250)
Additional standing charges			120.0000 (251)
Total energy cost			331.2600 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1029 (257)
SAP value		84.6147
SAP rating (Section 12)		85 (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	2419.5178	0.2160	522.6158 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1840.6977	0.2160	397.5907 (264)
Space and water heating			920.2065 (265)
Pumps and fans	118.7197	0.5190	61.6155 (267)
Energy for lighting	358.9491	0.5190	186.2946 (268)
Total kg/year			1168.1167 (272)
CO2 emissions per m2			14.3900 (273)
EI value			87.5919
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8853 = 3.931$, stars = 4
Water heating environmental impact	$0.216 / 0.8853 = 0.2440$, stars = 4

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Calculation Type: New Build (As Built)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	81.1500 (1b)	x 2.4000 (2b)	= 194.7600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.7600 (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					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					3.3900							
Infiltration rate					0.1695 (18)							
Number of sides sheltered					2 (19)							
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)							
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1441 (21)							
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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	0.1513	0.1441	0.1441	0.1333	0.1333	0.1189	0.1225	0.1153	0.1189	0.1261	0.1261	0.1369 (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					
Opening Type 2 (Uw = 1.30)			14.0700	1.2357	17.3869		(27)					
Heat Loss Floor			81.1500	0.1000	8.1150		(28a)					
WT-E-01	78.0500	14.0700	63.9800	0.2000	12.7960		(29a)					
WT-E-01	25.5800		25.5800	0.1876	4.7992		(29a)					
Total net area of external elements Aum(A, m2)			184.7800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	43.0971		(33)					
Party Ceilings 1			81.1500				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2776 (36)					
Total fabric heat loss							(33) + (36) = 56.3747 (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	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354	32.1354 (38)
Heat transfer coeff	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101	88.5101 (39)
Average = Sum(39)m / 12 =												88.5101 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907	1.0907 (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												2.4843 (42)
Average daily hot water use (litres/day)												93.2026 (43)
Daily hot water use	Jan 102.5228	Feb 98.7947	Mar 95.0666	Apr 91.3385	May 87.6104	Jun 83.8823	Jul 83.8823	Aug 87.6104	Sep 91.3385	Oct 95.0666	Nov 98.7947	Dec 102.5228 (44)
Energy conte	152.0384	132.9738	137.2170	119.6291	114.7870	99.0524	91.7866	105.3265	106.5844	124.2139	135.5892	147.2411 (45)
Energy content (annual)												Total = Sum(45)m = 1466.4394 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8058	19.9461	20.5826	17.9444	17.2180	14.8579	13.7680	15.7990	15.9877	18.6321	20.3384	22.0862 (46)
Water storage loss:												
Total storage loss												

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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 (56)
Combi loss	14.1215	12.7406	14.0696	13.5750	13.9979	13.5122	13.9413	13.9780	13.5464	14.0400	13.6343	14.1099 (57)
Total heat required for water heating calculated for each month	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510 (64)
Heat gains from water heating, kWh/month	54.0831	47.3989	49.1421	43.1704	41.6662	36.3130	34.0044	38.5156	38.8259	44.8111	48.4920	52.4851 (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	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	149.0591	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8130	45.1316	36.7035	27.7869	20.7710	17.5358	18.9480	24.6294	33.0575	41.9741	48.9900	52.2252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.0854	334.5210	325.8634	307.4322	284.1661	262.2993	247.6910	244.2553	252.9130	271.3442	294.6102	316.4770	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	52.3902	(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)	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	-99.3728	(71)
Water heating gains (Table 5)	72.6924	70.5341	66.0512	59.9589	56.0029	50.4347	45.7048	51.7682	53.9249	60.2300	67.3500	70.5445	(72)
Total internal gains	559.6674	555.2634	533.6946	500.2547	466.0167	435.3464	417.4205	425.7296	444.9720	478.6249	516.0268	544.3234	(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					8.8300	22.3313	0.4500	0.0000			0.7700	68.3248
South					5.2400	50.9848	0.4500	0.0000			0.7700	92.5711 (76)
Solar gains	160.8959	256.2860	366.1519	492.3628	552.8451	592.8246	563.2520	517.3012	439.5064	308.7702	199.5959	134.9285 (83)
Total gains	720.5632	811.5494	899.8465	992.6175	1018.8618	1028.1710	980.6724	943.0308	884.4784	787.3951	715.6227	679.2519 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	63.6697	
alpha	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	5.2446	
util living area	0.9852	0.9722	0.9345	0.8355	0.6599	0.4275	0.2795	0.3000	0.5659	0.8621	0.9670	0.9885	(86)
MIT	20.1841	20.3284	20.5755	20.8209	20.9582	20.9964	20.9997	20.9996	20.9850	20.8208	20.4634	20.1391	(87)
Th 2	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	20.0084	(88)
util rest of house	0.9805	0.9639	0.9153	0.7933	0.5904	0.3442	0.1903	0.2072	0.4757	0.8153	0.9552	0.9849	(89)
MIT 2	19.2913	19.4316	19.6664	19.8829	19.9864	20.0074	20.0084	20.0084	20.0028	19.8888	19.5646	19.2473	(90)
Living area fraction	19.6836	19.8257	20.0659	20.2951	20.4135	20.4420	20.4440	20.4440	20.4344	20.2983	19.9596	19.6392	(92)
Temperature adjustment	19.5336	19.6757	19.9159	20.1451	20.2635	20.2920	20.2940	20.2940	20.2844	20.1483	19.8096	19.4892	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9777	0.9605	0.9132	0.7996	0.6089	0.3682	0.2160	0.2340	0.5015	0.8227	0.9523	0.9824	(94)
Ext temp.	704.5258	779.4637	821.7549	793.7088	620.4213	378.5921	211.8411	220.6566	443.5367	647.7556	681.4771	667.2870	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1277.5183	1245.8402	1107.7813	906.7941	642.8893	379.8874	211.8949	220.7399	450.0209	756.6125	1045.2688	1273.5880	(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 per m2	426.3064	313.4050	212.8036	81.4214	16.7162	0.0000	0.0000	0.0000	0.0000	80.9896	261.9300	451.0880	(98)
												1844.6602	(98)
												22.7315	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2038.2986 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	426.3064	313.4050	212.8036	81.4214	16.7162	0.0000	0.0000	0.0000	0.0000	80.9896	261.9300	451.0880	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	471.0568	346.3039	235.1421	89.9684	18.4709	0.0000	0.0000	0.0000	0.0000	89.4912	289.4254	498.4397	(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	166.1599	145.7143	151.2866	133.2042	128.7849	112.5646	105.7280	119.3045	120.1309	138.2539	149.2235	161.3510	(64)
Efficiency of water heater (217)m	89.5791	89.4593	89.1423	88.4870	87.6561	87.3000	87.3000	87.3000	87.3000	88.4554	89.3118	89.6344	(216)
Fuel for water heating, kWh/month	185.4895	162.8834	169.7137	150.5353	146.9207	128.9400	121.1088	136.6604	137.6070	156.2978	167.0814	180.0102	(219)
Water heating fuel used												1843.2482	(219)
Annual totals kWh/year													
Space heating fuel - main system												2038.2986	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													43.7197 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7197 (231)
Electricity for lighting (calculated in Appendix L)													358.9491 (232)
Total delivered energy for all uses													4359.2156 (238)

10a. Fuel costs - using BEDF prices (463)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2038.2986	3.9500	80.5128 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1843.2482	3.9500	72.8083 (247)
Mechanical ventilation fans	43.7197	18.7000	8.1756 (249)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	358.9491	18.7000	67.1235 (250)
Additional standing charges			91.0000 (251)
Total energy cost			333.6452 (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	2038.2986	0.2160	440.2725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1843.2482	0.2160	398.1416 (264)
Space and water heating			838.4141 (265)
Pumps and fans	118.7197	0.5190	61.6155 (267)
Energy for lighting	358.9491	0.5190	186.2946 (268)
Total kg/year			1086.3242 (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	2038.2986	1.2200	2486.7243 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1843.2482	1.2200	2248.7629 (264)
Space and water heating			4735.4871 (265)
Pumps and fans	118.7197	3.0700	364.4696 (267)
Energy for lighting	358.9491	3.0700	1101.9738 (268)
Primary energy kWh/year			6201.9304 (272)
Primary energy kWh/m2/year			76.4255 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 88

(For testing purposes):

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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	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 impact	Environmental impact
Total Savings	£0	0.00 kg/m²	
Potential energy efficiency rating:		B 85	
Potential environmental impact rating:			B 88

Fuel prices for cost data on this page from database revision number 463 TEST (27 Jul 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	£89	£89	£0
Mains gas	£244	£244	£0
Space heating	£194	£194	£0
Water heating	£73	£73	£0
Lighting	£67	£67	£0
Total cost of fuels	£333	£333	£0
Total cost of uses	£334	£334	£0
Delivered energy	54 kWh/m²	54 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	76 kWh/m²	76 kWh/m²	0 kWh/m²

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built)



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

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built) 9.92

Overheating Calculation Input Data

Dwelling type EndTerrace Flat
 Number of storeys 1
 Cross ventilation possible Yes
 SAP Region Thames Valley
 Front of dwelling faces East
 Overshading Average or unknown
 Thermal mass parameter 250.0
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 192.81 (P1)
 Transmission heat loss coefficient 56.37 (37)
 Summer heat loss coefficient 249.19 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	8.8300	117.5071	0.4500	0.0000	0.9000	420.2229
South	5.2400	112.2060	0.4500	0.0000	0.9000	238.1236
total:						658.3465

	Jun	Jul	Aug	
Solar gains	693	658	605	(P4)
Internal gains	432	414	423	
Total summer gains	1125	1073	1027	(P5)
Summer gain/loss ratio	4.52	4.31	4.12	(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	20.77	22.46	22.17	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			