

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025w_142_As_Built				Issued on Date	01/03/2022
Assessment Reference	001	Prop Type Ref	TFF			
Property						
SAP Rating	84 B	DER	17.97	TER	19.33	
Environmental	88 B	% DER<TER	7.02			
CO ₂ Emissions (t/year)	0.80	DFEE	42.71	TFEE	46.83	
General Requirements Compliance	Pass	% DFEE<TFEE	8.81			
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

Top-floor flat, total floor area 54 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) 19.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.97 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 46.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.29 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.24 (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: 4.75 (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): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.44 m², No overhang
Windows facing East: 6.42 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K

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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	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7500
Infiltration rate					0.2375 (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) =				0.2019 (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	0.2574	0.2523	0.2473	0.2221	0.2170	0.1918	0.1918	0.1867	0.2019	0.2170	0.2271	0.2372 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5074	0.5023	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 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129		(27)
WT-E-01	43.5600	7.8600	35.7000	0.2000	7.1400		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.2890	1.4739		(29a)
Flat Roof	53.7000		53.7000	0.1500	8.0550		(30)
Total net area of external elements Aum(A, m2)			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.5018	(33)
Party Wall 1			21.3600	0.0000	0.0000		(32)
Party Floor 1			53.7000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4186 (36)
Total fabric heat loss						(33) + (36) =	34.9204 (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	21.5795	21.3649	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652 (38)
Average = Sum(39)m / 12 =	56.4999	56.2853	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856 (39)
												56.2201 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0521	1.0481	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy content (annual)	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8241	16.4637	16.9891	14.8115	14.2120	12.2639	11.3643	13.0407	13.1964	15.3791	16.7875	18.2302 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.0114	12.6401	13.9699	13.4915	13.9210	13.4487	13.8825	13.9074	13.4720	13.9496	13.5318	14.0034	(61)
Total heat required for water heating calculated for each month	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)
Heat gains from water heating, kWh/month	45.2297	39.6546	41.1516	36.2050	34.9835	30.5470	28.6614	32.3837	32.6200	37.5778	40.5953	43.9111	(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	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8565	13.1954	10.7312	8.1242	6.0729	5.1270	5.5399	7.2010	9.6652	12.2722	14.3235	15.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.8293	158.4567	154.3557	145.6252	134.6045	124.2466	117.3269	115.6995	119.8004	128.5310	139.5517	149.9096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	60.7926	59.0098	55.3113	50.2847	47.0208	42.4264	38.5234	43.5264	45.3056	50.5078	56.3824	59.0202	(72)
Total internal gains	285.4661	283.6496	273.3859	257.0218	240.6859	224.7877	214.3778	219.4146	227.7589	244.2987	263.2452	277.1869	(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
North					1.4400	10.6334	0.4500	0.0000			0.7700	5.3056 (74)
East					6.4200	19.6403	0.4500	0.0000			0.7700	43.6904 (76)

Solar gains	48.9960	95.6069	157.9822	232.9544	288.8583	297.4445	282.4444	240.1708	184.4166	113.4841	61.0219	40.3519 (83)
Total gains	334.4621	379.2565	431.3681	489.9762	529.5442	522.2322	496.8223	459.5854	412.1756	357.7828	324.2671	317.5388 (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	66.0031	66.2548	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	
alpha	5.4002	5.4170	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	
util living area	0.9976	0.9948	0.9848	0.9462	0.8387	0.6574	0.4919	0.5512	0.8174	0.9717	0.9950	0.9982	(86)
MIT	19.9140	20.0575	20.3050	20.6145	20.8602	20.9710	20.9949	20.9909	20.9095	20.5781	20.1830	19.8824	(87)
Th 2	20.0401	20.0434	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	(88)
util rest of house	0.9968	0.9931	0.9796	0.9275	0.7888	0.5720	0.3882	0.4425	0.7441	0.9583	0.9930	0.9976	(89)
MIT 2	19.0502	19.1957	19.4416	19.7388	19.9537	20.0321	20.0437	20.0424	19.9962	19.7102	19.3224	19.0227	(90)
Living area fraction	19.3092	19.4541	19.7004	20.0014	20.2255	20.3136	20.3289	20.3268	20.2700	19.9704	19.5804	19.2804	(92)
Temperature adjustment	19.1592	19.3041	19.5504	19.8514	20.0755	20.1636	20.1789	20.1768	20.1200	19.8204	19.4304	19.1304	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	333.0611	375.9374	421.0368	452.2310	418.6291	304.5431	200.1930	210.4620	309.3740	341.4036	321.4389	316.5217	(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	839.5435	810.7366	733.2467	615.3097	470.5821	312.5942	201.0808	212.2003	338.2394	518.0528	692.7935	838.8750	(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	376.8229	292.1851	232.2841	117.4167	38.6530	0.0000	0.0000	0.0000	0.0000	131.4270	267.3753	388.6308	(98)
Space heating												1844.7950	(98)
Space heating per m ²												34.3537	(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													2038.4475	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	376.8229	292.1851	232.2841	117.4167	38.6530	0.0000	0.0000	0.0000	0.0000	131.4270	267.3753	388.6308	(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)	416.3789	322.8564	256.6676	129.7422	42.7105	0.0000	0.0000	0.0000	0.0000	145.2232	295.4423	429.4264	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)	
Efficiency of water heater (217)m	89.6125	89.5311	89.3411	88.9073	88.1175	87.3000	87.3000	87.3000	87.3000	88.9678	89.4529	89.6503	(216)	
Fuel for water heating, kWh/month	155.6766	136.7102	142.4097	126.2379	123.3211	109.0580	102.6852	115.5156	116.2062	130.9207	140.2400	151.1851	(219)	
Water heating fuel used												1550.1664	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2038.4475	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)														
mechanical ventilation fans (SFP = 0.1840)													28.9310	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													103.9310	(231)
Electricity for lighting (calculated in Appendix L)													262.3699	(232)
Total delivered energy for all uses													3954.9148	(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	2038.4475	0.2160	440.3047	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1550.1664	0.2160	334.8359	(264)
Space and water heating			775.1406	(265)
Pumps and fans	103.9310	0.5190	53.9402	(267)
Energy for lighting	262.3699	0.5190	136.1700	(268)
Total CO2, kg/year			965.2508	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9700	(273)

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

DER		17.9700	ZC1
Total Floor Area		53.7000	
Assumed number of occupants		1.7992	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		17.3061	ZC2
CO2 emissions from cooking, equation (L16)		3.0201	ZC3
Total CO2 emissions		38.2962	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		38.2962	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	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1552 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4052 (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) =				0.3444 (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	0.4391	0.4305	0.4219	0.3788	0.3702	0.3272	0.3272	0.3186	0.3444	0.3702	0.3875	0.4047 (22b)
Effective ac	0.5964	0.5927	0.5890	0.5718	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5751	0.5819 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.8600	1.3258	10.4205		(27)
WT-E-01	43.5600	7.8600	35.7000	0.1800	6.4260		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.1800	0.9180		(29a)
Flat Roof	53.7000		53.7000	0.1300	6.9810		(30)
Total net area of external elements Aum, m ²			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.8655	(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)							5.1931 (36)
Total fabric heat loss						(33) + (36) =	32.0586 (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	25.3656	25.2064	25.0503	24.3173	24.1801	23.5416	23.5416	23.4234	23.7876	24.1801	24.4576	24.7477 (38)
Heat transfer coeff	57.4242	57.2650	57.1089	56.3758	56.2387	55.6002	55.6002	55.4820	55.8461	56.2387	56.5161	56.8062 (39)
Average = Sum(39)m / 12 =												56.3752 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0694	1.0664	1.0635	1.0498	1.0473	1.0354	1.0354	1.0332	1.0400	1.0473	1.0524	1.0578 (40)
HLP (average)												1.0498 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy conte	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Energy content (annual)										Total = Sum(45)m =		1210.4159 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8241	16.4637	16.9891	14.8115	14.2120	12.2639	11.3643	13.0407	13.1964	15.3791	16.7875	18.2302 (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)

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Combi loss	43.1232	37.5336	39.9870	37.1796	36.8508	34.1445	35.2826	36.8508	37.1796	39.9870	40.2146	43.1232 (61)
Total heat required for water heating calculated for each month	168.6175	147.2917	153.2475	135.9228	131.5972	115.9035	111.0444	123.7885	125.1556	142.5146	152.1315	164.6577 (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	168.6175	147.2917	153.2475	135.9228	131.5972	115.9035	111.0444	123.7885	125.1556	142.5146	152.1315	164.6577 (64)
Heat gains from water heating, kWh/month	52.5076	45.8780	47.6559	42.1270	40.7159	35.7210	34.0114	38.1195	38.5469	44.0872	47.2660	51.1910 (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	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8565	13.1954	10.7312	8.1242	6.0729	5.1270	5.5399	7.2010	9.6652	12.2722	14.3235	15.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.8293	158.4567	154.3557	145.6252	134.6045	124.2466	117.3269	115.6995	119.8004	128.5310	139.5517	149.9096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	70.5748	68.2708	64.0536	58.5097	54.7257	49.6125	45.7143	51.2359	53.5374	59.2569	65.6472	68.8051	(72)
Total internal gains	295.2483	292.9106	282.1282	265.2468	248.3908	231.9738	221.5688	227.1240	235.9907	253.0478	272.5101	286.9718	(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
North					1.4400	10.6334	0.6300	0.7000			0.7700	4.6796
East					6.4200	19.6403	0.6300	0.7000			0.7700	38.5349 (74)
Solar gains	43.2145	84.3253	139.3403	205.4658	254.7730	262.3460	249.1160	211.8307	162.6555	100.0930	53.8213	35.5903 (83)
Total gains	338.4627	377.2359	421.4685	470.7126	503.1638	494.3198	470.6848	438.9547	398.6462	353.1407	326.3314	322.5621 (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	64.9407	65.1213	65.2992	66.1483	66.3096	67.0711	67.0711	67.2140	66.7757	66.3096	65.9841	65.6472	
alpha	5.3294	5.3414	5.3533	5.4099	5.4206	5.4714	5.4714	5.4809	5.4517	5.4206	5.3989	5.3765	
util living area	0.9975	0.9950	0.9866	0.9541	0.8601	0.6820	0.5127	0.5686	0.8303	0.9732	0.9949	0.9981	(86)
MIT	19.8971	20.0292	20.2675	20.5849	20.8392	20.9665	20.9941	20.9899	20.9030	20.5701	20.1793	19.8751	(87)
Th 2	20.0259	20.0284	20.0308	20.0420	20.0441	20.0539	20.0539	20.0558	20.0502	20.0441	20.0399	20.0354	(88)
util rest of house	0.9966	0.9933	0.9819	0.9376	0.8134	0.5964	0.4062	0.4584	0.7591	0.9604	0.9929	0.9974	(89)
MIT 2	18.5552	18.7496	19.0968	19.5546	19.8875	20.0319	20.0517	20.0516	19.9726	19.5431	18.9777	18.5300	(90)
Living area fraction									fLA = Living area / (4) =			0.2998	(91)
MIT	18.9575	19.1333	19.4477	19.8635	20.1728	20.3121	20.3343	20.3329	20.2516	19.8510	19.3379	18.9333	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9575	19.1333	19.4477	19.8635	20.1728	20.3121	20.3343	20.3329	20.2516	19.8510	19.3379	18.9333	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9912	0.9782	0.9338	0.8204	0.6208	0.4383	0.4916	0.7760	0.9571	0.9908	0.9963	(94)
Useful gains	336.8817	373.9025	412.2700	439.5612	412.7853	306.8917	206.3014	215.8001	309.3397	337.9956	323.3201	321.3821	(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	841.6970	815.0677	739.4316	618.0745	476.4998	317.5930	207.6257	218.2061	343.5412	520.2634	691.6406	836.9432	(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	375.5826	296.4630	243.4083	128.5295	47.4036	0.0000	0.0000	0.0000	0.0000	135.6073	265.1908	383.5774	(98)
Space heating												1875.7625	(98)
Space heating per m2												34.9304	(99)
										(98) / (4) =			

8c. Space cooling requirement

Not applicable

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

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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													2008.3110 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	375.5826	296.4630	243.4083	128.5295	47.4036	0.0000	0.0000	0.0000	0.0000	135.6073	265.1908	383.5774	(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)	402.1227	317.4122	260.6084	137.6119	50.7533	0.0000	0.0000	0.0000	0.0000	145.1898	283.9302	410.6825	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	168.6175	147.2917	153.2475	135.9228	131.5972	115.9035	111.0444	123.7885	125.1556	142.5146	152.1315	164.6577	(64)
Efficiency of water heater	87.0091	86.7772	86.2107	84.9107	82.7483	80.3000	80.3000	80.3000	80.3000	84.9264	86.4367	87.1093	(216)
(217)m	87.0091	86.7772	86.2107	84.9107	82.7483	80.3000	80.3000	80.3000	80.3000	84.9264	86.4367	87.1093	(217)
Fuel for water heating, kWh/month	193.7929	169.7355	177.7593	160.0773	159.0331	144.3381	138.2869	154.1575	155.8600	167.8095	176.0032	189.0242	(219)
Water heating fuel used												1985.8775	(219)
Annual totals kWh/year													
Space heating fuel - main system												2008.3110	(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)												262.3699	(232)
Total delivered energy for all uses												4331.5585	(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	2008.3110	0.2160	433.7952 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1985.8775	0.2160	428.9495 (264)
Space and water heating			862.7447 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	262.3699	0.5190	136.1700 (268)
Total CO2, kg/m2/year			1037.8397 (272)
Emissions per m2 for space and water heating			16.0660 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5358 (272b)
Emissions per m2 for pumps and fans			0.7249 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0660 * 1.00) + 2.5358 + 0.7249, rounded to 2 d.p.			19.3300 (273)

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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	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (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					2 * 10 = 20.0000 (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					20.0000 / (5) = 0.1552 (8)
Measured/design AP50					Yes
Infiltration rate					4.7500
Number of sides sheltered					0.3927 (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) =				0.3338 (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												
	0.4256	0.4172	0.4089	0.3672	0.3588	0.3171	0.3171	0.3087	0.3338	0.3588	0.3755	0.3922 (22b)
Effective ac	0.5906	0.5870	0.5836	0.5674	0.5644	0.5503	0.5503	0.5477	0.5557	0.5644	0.5705	0.5769 (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 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129		(27)
WT-E-01	43.5600	7.8600	35.7000	0.2000	7.1400		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.2890	1.4739		(29a)
Flat Roof	53.7000		53.7000	0.1500	8.0550		(30)
Total net area of external elements Aum, m ²			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					28.5018		(32)
Party Wall 1			21.3600	0.0000	0.0000		(32)
Party Floor 1			53.7000				(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)							6.4186 (36)
Total fabric heat loss						(33) + (36) =	34.9204 (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	25.1165	24.9670	24.8204	24.1319	24.0030	23.4034	23.4034	23.2923	23.6343	24.0030	24.2637	24.5361 (38)
Heat transfer coeff	60.0369	59.8874	59.7408	59.0523	58.9234	58.3237	58.3237	58.2127	58.5547	58.9234	59.1840	59.4565 (39)
Average = Sum(39)m / 12 =												59.0516 (39)
HLP	1.1180	1.1152	1.1125	1.0997	1.0973	1.0861	1.0861	1.0840	1.0904	1.0973	1.1021	1.1072 (40)
HLP (average)												1.0997 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
Daily hot water use	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy conte	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Energy content (annual)										Total = Sum(45)m =		1210.4159 (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)

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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	(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	(59)
Heat gains from water heating, kWh/month	26.6675	23.3236	24.0679	20.9829	20.1336	17.3738	16.0994	18.4743	18.6949	21.7871	23.7823	25.8261 (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	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8565	13.1954	10.7312	8.1242	6.0729	5.1270	5.5399	7.2010	9.6652	12.2722	14.3235	15.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.8293	158.4567	154.3557	145.6252	134.6045	124.2466	117.3269	115.6995	119.8004	128.5310	139.5517	149.9096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	35.8434	34.7077	32.3493	29.1430	27.0613	24.1303	21.6389	24.8310	25.9651	29.2837	33.0310	34.7125	(72)
Total internal gains	257.5169	256.3475	247.4239	232.8801	217.7264	203.4916	194.4934	197.7192	205.4185	220.0746	236.8938	249.8791	(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
North											1.4400	10.6334	0.4500	0.0000	0.7700	5.3056 (74)
East											6.4200	19.6403	0.4500	0.0000	0.7700	43.6904 (76)
Solar gains	48.9960	95.6069	157.9822	232.9544	288.8583	297.4445	282.4444	240.1708	184.4166	113.4841	61.0219	40.3519 (83)				
Total gains	306.5129	351.9545	405.4061	465.8344	506.5847	500.9360	476.9378	437.8900	389.8351	333.5587	297.9158	290.2310 (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	62.1145	62.2697	62.4225	63.1503	63.2883	63.9391	63.9391	64.0611	63.6869	63.2883	63.0097	62.7209	
alpha	5.1410	5.1513	5.1615	5.2100	5.2192	5.2626	5.2626	5.2707	5.2458	5.2192	5.2006	5.1814	
util living area	0.9984	0.9965	0.9893	0.9597	0.8703	0.6972	0.5283	0.5929	0.8545	0.9805	0.9968	0.9988	(86)
MIT	19.7746	19.9202	20.1809	20.5279	20.8108	20.9575	20.9918	20.9856	20.8746	20.4954	20.0725	19.7503	(87)
Th 2	19.9862	19.9884	19.9906	20.0011	20.0031	20.0122	20.0122	20.0139	20.0087	20.0031	19.9991	19.9950	(88)
util rest of house	0.9979	0.9952	0.9855	0.9445	0.8242	0.6084	0.4148	0.4751	0.7859	0.9706	0.9954	0.9984	(89)
MIT 2	18.8675	19.0145	19.2750	19.6207	19.8765	19.9929	20.0101	20.0098	19.9386	19.5964	19.1754	18.8504	(90)
Living area fraction									fLA = Living area / (4) =			0.2998	(91)
MIT	19.1395	19.2861	19.5466	19.8927	20.1566	20.2821	20.3044	20.3023	20.2193	19.8659	19.4444	19.1202	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1395	19.2861	19.5466	19.8927	20.1566	20.2821	20.3044	20.3023	20.2193	19.8659	19.4444	19.1202	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9973	0.9941	0.9833	0.9426	0.8322	0.6340	0.4491	0.5108	0.8025	0.9688	0.9944	0.9979	(94)
Ext temp.	305.6779	349.8776	398.6206	439.0772	421.5812	317.6135	214.2127	223.6697	312.8399	323.1591	296.2478	289.6327	(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	890.9175	861.5448	779.4120	649.1412	498.2918	331.4028	216.0570	227.1656	358.3122	545.9791	730.5895	887.1035	(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	435.4183	343.8403	283.3088	151.2460	57.0727	0.0000	0.0000	0.0000	0.0000	165.7781	312.7260	444.5183	(98)
Space heating												2193.9086	(98)
Space heating per m2												40.8549	(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	548.2432	431.5957	442.4164	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9042	0.9509	0.9302	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	495.7466	410.4033	411.5539	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	653.6307	624.3112	579.8163	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	113.6765	159.1475	125.1872	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												398.0112	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled Fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	28.4191	39.7869	31.2968	0.0000	0.0000	0.0000 (107)
Space cooling											99.5028 (107)
Space cooling per m2											1.8529 (108)
Energy for space heating											40.8549 (99)
Energy for space cooling											1.8529 (108)
Total											42.7078 (109)
Dwelling Fabric Energy Efficiency (DFEE)											42.7 (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	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1552 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4052 (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) =				0.3444 (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	0.4391	0.4305	0.4219	0.3788	0.3702	0.3272	0.3272	0.3186	0.3444	0.3702	0.3875	0.4047 (22b)
Effective ac	0.5964	0.5927	0.5890	0.5718	0.5685	0.5535	0.5535	0.5507	0.5593	0.5685	0.5751	0.5819 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.8600	1.3258	10.4205		(27)
WT-E-01	43.5600	7.8600	35.7000	0.1800	6.4260		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.1800	0.9180		(29a)
Flat Roof	53.7000		53.7000	0.1300	6.9810		(30)
Total net area of external elements Aum, m ²			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	26.8655	(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)							5.1931 (36)
Total fabric heat loss						(33) + (36) =	32.0586 (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	25.3656	25.2064	25.0503	24.3173	24.1801	23.5416	23.5416	23.4234	23.7876	24.1801	24.4576	24.7477 (38)
Heat transfer coeff	57.4242	57.2650	57.1089	56.3758	56.2387	55.6002	55.6002	55.4820	55.8461	56.2387	56.5161	56.8062 (39)
Average = Sum(39)m / 12 =												56.3752 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0694	1.0664	1.0635	1.0498	1.0473	1.0354	1.0354	1.0332	1.0400	1.0473	1.0524	1.0578 (40)
HLP (average)												1.0498 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy conte	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Energy content (annual)										Total = Sum(45)m =		1210.4159 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 (59)
Heat gains from water heating, kWh/month	26.6675	23.3236	24.0679	20.9829	20.1336	17.3738	16.0994	18.4743	18.6949	21.7871	23.7823	25.8261 (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	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	89.9589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8565	13.1954	10.7312	8.1242	6.0729	5.1270	5.5399	7.2010	9.6652	12.2722	14.3235	15.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.8293	158.4567	154.3557	145.6252	134.6045	124.2466	117.3269	115.6995	119.8004	128.5310	139.5517	149.9096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	31.9959	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	35.8434	34.7077	32.3493	29.1430	27.0613	24.1303	21.6389	24.8310	25.9651	29.2837	33.0310	34.7125	(72)
Total internal gains	257.5169	256.3475	247.4239	232.8801	217.7264	203.4916	194.4934	197.7192	205.4185	220.0746	236.8938	249.8791	(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
North					1.4400	10.6334		0.6300	0.7000	0.7700		4.6796
East					6.4200	19.6403		0.6300	0.7000	0.7700		38.5349 (74)

Solar gains	43.2145	84.3253	139.3403	205.4658	254.7730	262.3460	249.1160	211.8307	162.6555	100.0930	53.8213	35.5903 (83)
Total gains	300.7314	340.6728	386.7642	438.3458	472.4994	465.8376	443.6094	409.5498	368.0739	320.1675	290.7152	285.4695 (84)

7. 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)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.9407	65.1213	65.2992	66.1483	66.3096	67.0711	67.0711	67.2140	66.7757	66.3096	65.9841	65.6472	
alpha	5.3294	5.3414	5.3533	5.4099	5.4206	5.4714	5.4714	5.4809	5.4517	5.4206	5.3989	5.3765	
util living area	0.9986	0.9969	0.9909	0.9653	0.8838	0.7138	0.5417	0.6047	0.8637	0.9824	0.9971	0.9989	(86)
MIT	19.8309	19.9658	20.2096	20.5386	20.8121	20.9583	20.9923	20.9865	20.8797	20.5182	20.1174	19.8097	(87)
Th 2	20.0259	20.0284	20.0308	20.0420	20.0441	20.0539	20.0539	20.0558	20.0502	20.0441	20.0399	20.0354	(88)
util rest of house	0.9981	0.9958	0.9876	0.9521	0.8413	0.6278	0.4304	0.4899	0.7988	0.9734	0.9958	0.9986	(89)
MIT 2	18.9558	19.0923	19.3364	19.6665	19.9163	20.0347	20.0519	20.0518	19.9818	19.6530	19.2532	18.9424	(90)
Living area fraction									fLA = Living area / (4) =			0.2998	(91)
MIT	19.2182	19.3542	19.5982	19.9280	20.1849	20.3116	20.3339	20.3321	20.2510	19.9124	19.5123	19.2024	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2182	19.3542	19.5982	19.9280	20.1849	20.3116	20.3339	20.3321	20.2510	19.9124	19.5123	19.2024	(93)

8. Space heating requirement

Utilisation	0.9975	0.9948	0.9856	0.9502	0.8484	0.6526	0.4641	0.5247	0.8144	0.9718	0.9949	0.9981	(94)
Useful gains	299.9934	338.9180	381.2125	416.5003	400.8591	304.0084	205.8580	214.8737	299.7577	311.1457	289.2456	284.9386	(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	856.6640	827.7194	748.0229	621.7103	477.1768	317.5672	207.6041	218.1589	343.5097	523.7152	701.4950	852.2303	(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	414.1630	328.4745	272.9069	147.7512	56.7803	0.0000	0.0000	0.0000	0.0000	158.1517	296.8196	422.0651	(98)
Space heating												2097.1123	(98)
Alpha heating per m2												39.0524	(99)
										(98) / (4) =			

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	522.6419	411.4415	421.6629	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9041	0.9519	0.9323	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	472.5221	391.6594	393.1271	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	612.6065	585.3558	546.6914	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	100.8608	144.1102	114.2519	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												359.2228	(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 TARGET 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	25.2152	36.0275	28.5630	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2													89.8057 (107)
Energy for space heating													1.6724 (108)
Energy for space cooling													39.0524 (99)
Total													1.6724 (108)
Target Fabric Energy Efficiency (TFEE)													40.7247 (109)
													46.8 (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	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (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) =					Air changes per hour 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7500
Infiltration rate					0.2375 (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) =	0.2019 (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	0.2120	0.2019	0.2019	0.1867	0.1867	0.1665	0.1716	0.1615	0.1665	0.1766	0.1766	0.1918 (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 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129		(27)
WT-E-01	43.5600	7.8600	35.7000	0.2000	7.1400		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.2890	1.4739		(29a)
Flat Roof	53.7000		53.7000	0.1500	8.0550		(30)
Total net area of external elements Aum(A, m ²)			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.5018		(33)
Party Wall 1			21.3600	0.0000	0.0000		(32)
Party Floor 1			53.7000				(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)							6.4186 (36)
Total fabric heat loss						(33) + (36) =	34.9204 (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	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652 (38)
Average = Sum(39)m / 12 =	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy content (annual)	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8241	16.4637	16.9891	14.8115	14.2120	12.2639	11.3643	13.0407	13.1964	15.3791	16.7875	18.2302 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	14.0114	12.6401	13.9699	13.4915	13.9210	13.4487	13.8825	13.9074	13.4720	13.9496	13.5318	14.0034	(61)
Total heat required for water heating calculated for each month	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	45.2297	39.6546	41.1516	36.2050	34.9835	30.5470	28.6614	32.3837	32.6200	37.5778	40.5953	43.9111	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.1412	32.9885	26.8280	20.3105	15.1824	12.8176	13.8499	18.0026	24.1630	30.6805	35.8087	38.1734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0736	236.5026	230.3817	217.3511	200.9022	185.4427	175.1147	172.6858	178.8066	191.8373	208.2861	223.7457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	60.7926	59.0098	55.3113	50.2847	47.0208	42.4264	38.5234	43.5264	45.3056	50.5078	56.3824	59.0202	(72)
Total internal gains	418.5852	415.0786	399.0988	374.5241	349.6832	327.2645	314.0658	320.7925	334.8530	359.6034	387.0550	407.5172	(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		
North					1.4400	11.9814	0.4500	0.0000	0.7700	5.9783 (74)		
East					6.4200	22.3313	0.4500	0.0000	0.7700	49.6767 (76)		
Solar gains	55.6549	97.7852	159.5325	241.9742	291.8016	321.3054	301.9062	262.9046	201.7295	123.9279	71.0307	45.3787 (83)
Total gains	474.2401	512.8638	558.6313	616.4983	641.4848	648.5699	615.9719	583.6972	536.5826	483.5313	458.0857	452.8959 (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	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	
alpha	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	
util living area	0.9846	0.9753	0.9433	0.8492	0.6668	0.4305	0.2826	0.3077	0.5907	0.8791	0.9688	0.9875	(86)
MIT	20.2399	20.3492	20.5772	20.8215	20.9612	20.9970	20.9998	20.9996	20.9841	20.8162	20.4891	20.2047	(87)
Th 2	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	(88)
util rest of house	0.9799	0.9678	0.9263	0.8094	0.5990	0.3496	0.1956	0.2161	0.5009	0.8363	0.9576	0.9835	(89)
MIT 2	19.3765	19.4830	19.7009	19.9184	20.0243	20.0440	20.0449	20.0449	20.0388	19.9199	19.6206	19.3421	(90)
Living area fraction									fLA = Living area / (4) =			0.2998	(91)
MIT	19.6353	19.7427	19.9636	20.1892	20.3052	20.3297	20.3312	20.3311	20.3222	20.1887	19.8810	19.6008	(92)
Temperature adjustment													-0.1500
adjusted MIT	19.4853	19.5927	19.8136	20.0392	20.1552	20.1797	20.1812	20.1811	20.1722	20.0387	19.7310	19.4508	(93)

8. Space heating requirement

Utilisation	0.9763	0.9634	0.9214	0.8092	0.6072	0.3612	0.2080	0.2291	0.5133	0.8359	0.9531	0.9803	(94)
Useful gains	463.0077	494.0893	514.7288	498.8510	389.5026	234.2348	128.1498	133.7507	275.4264	404.2066	436.5997	443.9904	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	808.2491	786.1878	697.4655	569.6749	402.0203	234.8413	128.1701	133.7856	279.3685	474.1314	659.1105	806.3058	(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	256.8596	196.2902	135.9561	50.9932	9.3132	0.0000	0.0000	0.0000	0.0000	52.0241	160.2078	269.5627	(98)
Space heating													
RHI space heating demand													

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7500
Infiltration rate					0.2375 (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) =				0.2019 (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	0.2574	0.2523	0.2473	0.2221	0.2170	0.1918	0.1918	0.1867	0.2019	0.2170	0.2271	0.2372 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5074	0.5023	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 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129		(27)
WT-E-01	43.5600	7.8600	35.7000	0.2000	7.1400		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.2890	1.4739		(29a)
Flat Roof	53.7000		53.7000	0.1500	8.0550		(30)
Total net area of external elements Aum(A, m2)			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.5018	(33)
Party Wall 1			21.3600	0.0000	0.0000		(32)
Party Floor 1			53.7000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4186 (36)
Total fabric heat loss						(33) + (36) =	34.9204 (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	21.5795	21.3649	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652 (38)
Average = Sum(39)m / 12 =	56.4999	56.2853	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856 (39)
	56.4999	56.2853	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.2201 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0521	1.0481	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy content (annual)	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8241	16.4637	16.9891	14.8115	14.2120	12.2639	11.3643	13.0407	13.1964	15.3791	16.7875	18.2302 (46)
	Total = Sum(45)m =											1210.4159 (45)

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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	14.0114	12.6401	13.9699	13.4915	13.9210	13.4487	13.8825	13.9074	13.4720	13.9496	13.5318	14.0034	(61)
Total heat required for water heating calculated for each month	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)
Heat gains from water heating, kWh/month	45.2297	39.6546	41.1516	36.2050	34.9835	30.5470	28.6614	32.3837	32.6200	37.5778	40.5953	43.9111	(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	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.1412	32.9885	26.8280	20.3105	15.1824	12.8176	13.8499	18.0026	24.1630	30.6805	35.8087	38.1734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0736	236.5026	230.3817	217.3511	200.9022	185.4427	175.1147	172.6858	178.8066	191.8373	208.2861	223.7457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	60.7926	59.0098	55.3113	50.2847	47.0208	42.4264	38.5234	43.5264	45.3056	50.5078	56.3824	59.0202	(72)
Total internal gains	418.5852	415.0786	399.0988	374.5241	349.6832	327.2645	314.0658	320.7925	334.8530	359.6034	387.0550	407.5172	(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
North					1.4400	10.6334	0.4500	0.0000			0.7700	5.3056 (74)
East					6.4200	19.6403	0.4500	0.0000			0.7700	43.6904 (76)

Solar gains	48.9960	95.6069	157.9822	232.9544	288.8583	297.4445	282.4444	240.1708	184.4166	113.4841	61.0219	40.3519 (83)
Total gains	467.5812	510.6856	557.0810	607.4785	638.5415	624.7090	596.5102	560.9634	519.2697	473.0875	448.0769	447.8690 (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	66.0031	66.2548	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	
alpha	5.4002	5.4170	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	
util living area	0.9885	0.9800	0.9559	0.8877	0.7491	0.5630	0.4124	0.4570	0.7008	0.9185	0.9785	0.9907	(86)
MIT	20.1429	20.2770	20.4970	20.7494	20.9213	20.9860	20.9978	20.9963	20.9576	20.7329	20.3894	20.1083	(87)
Th 2	20.0401	20.0434	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	(88)
util rest of house	0.9850	0.9740	0.9430	0.8569	0.6919	0.4845	0.3240	0.3641	0.6210	0.8885	0.9710	0.9879	(89)
MIT 2	19.2767	19.4109	19.6248	19.8566	19.9967	20.0391	20.0444	20.0440	20.0243	19.8483	19.5240	19.2467	(90)
Living area fraction	19.5364	19.6706	19.8863	20.1243	20.2739	20.3230	20.3303	20.3295	20.3042	20.1135	19.7834	19.5050	(92)
Temperature adjustment	19.3864	19.5206	19.7363	19.9743	20.1239	20.1730	20.1803	20.1795	20.1542	19.9635	19.6334	19.3550	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	459.1552	495.3511	522.5202	518.9634	445.0462	309.3933	200.7924	211.6716	327.4955	418.9135	433.2366	441.2573	(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	852.3794	822.9241	743.6885	622.2144	473.3031	313.1217	201.1592	212.3519	340.1562	526.0940	704.1987	851.4938	(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	292.5588	220.1291	164.5492	74.3408	21.0231	0.0000	0.0000	0.0000	0.0000	79.7423	195.0927	305.2159	(98)
Space heating												1352.6519	(98)
Space heating per m2												25.1890	(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													1494.6430 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	292.5588	220.1291	164.5492	74.3408	21.0231	0.0000	0.0000	0.0000	0.0000	79.7423	195.0927	305.2159	(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)	323.2694	243.2365	181.8223	82.1445	23.2299	0.0000	0.0000	0.0000	0.0000	88.1131	215.5721	337.2552	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)
Efficiency of water heater (217)m	89.4414	89.3299	89.0763	88.5475	87.8033	87.3000	87.3000	87.3000	87.3000	88.5728	89.2201	89.4913	(216)
Fuel for water heating, kWh/month	155.9743	137.0181	142.8331	126.7508	123.7625	109.0580	102.6852	115.5156	116.2062	131.5046	140.6059	151.4537	(219)
Water heating fuel used												1553.3681	(219)
Annual totals kWh/year													
Space heating fuel - main system												1494.6430	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													28.9310 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													103.9310 (231)
Electricity for lighting (calculated in Appendix L)													262.3699 (232)
Total delivered energy for all uses													3414.3120 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1494.6430	3.4800	52.0136	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1553.3681	3.4800	54.0572	(247)
Mechanical ventilation fans	28.9310	13.1900	3.8160	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	262.3699	13.1900	34.6066	(250)
Additional standing charges			120.0000	(251)
Total energy cost			274.3859	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.1676 (257)
SAP value		83.7120
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	1494.6430	0.2160	322.8429	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1553.3681	0.2160	335.5275	(264)
Space and water heating			658.3704	(265)
Pumps and fans	103.9310	0.5190	53.9402	(267)
Energy for lighting	262.3699	0.5190	136.1700	(268)
Total kg/year			848.4806	(272)
CO2 emissions per m2			15.8000	(273)
EI value			88.4806	
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	$3.48 / 0.8839 = 3.937$, stars = 4
Water heating environmental impact	$0.216 / 0.8839 = 0.2444$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.7000 (1b)	x 2.4000 (2b)	= 128.8800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.8800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7500
Infiltration rate					0.2375 (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) =				0.2019 (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	0.2120	0.2019	0.2019	0.1867	0.1867	0.1665	0.1716	0.1615	0.1665	0.1766	0.1766	0.1918 (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 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 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			7.8600	1.2357	9.7129		(27)
WT-E-01	43.5600	7.8600	35.7000	0.2000	7.1400		(29a)
WT-I-01	7.2200	2.1200	5.1000	0.2890	1.4739		(29a)
Flat Roof	53.7000		53.7000	0.1500	8.0550		(30)
Total net area of external elements Aum(A, m2)			104.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.5018	(33)
Party Wall 1			21.3600	0.0000	0.0000		(32)
Party Floor 1			53.7000				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4186 (36)
Total fabric heat loss						(33) + (36) =	34.9204 (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	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652	21.2652 (38)
Average = Sum(39)m / 12 =	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856	56.1856 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463	1.0463 (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												1.7992 (42)
Average daily hot water use (litres/day)												76.9305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.6235	81.5463	78.4691	75.3919	72.3146	69.2374	69.2374	72.3146	75.3919	78.4691	81.5463	84.6235 (44)
Energy content (annual)	125.4942	109.7581	113.2605	98.7432	94.7465	81.7590	75.7617	86.9377	87.9760	102.5276	111.9169	121.5345 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8241	16.4637	16.9891	14.8115	14.2120	12.2639	11.3643	13.0407	13.1964	15.3791	16.7875	18.2302 (46)
	Total = Sum(45)m =										1210.4159 (45)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	14.0114	12.6401	13.9699	13.4915	13.9210	13.4487	13.8825	13.9074	13.4720	13.9496	13.5318	14.0034	(61)
Total heat required for water heating calculated for each month	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379	(64)
Heat gains from water heating, kWh/month	45.2297	39.6546	41.1516	36.2050	34.9835	30.5470	28.6614	32.3837	32.6200	37.5778	40.5953	43.9111	(65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)													
Total per year (kWh/year) = Sum(64)m = 1374.6452 (64)													

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	107.9507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.1412	32.9885	26.8280	20.3105	15.1824	12.8176	13.8499	18.0026	24.1630	30.6805	35.8087	38.1734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0736	236.5026	230.3817	217.3511	200.9022	185.4427	175.1147	172.6858	178.8066	191.8373	208.2861	223.7457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	47.5942	(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)	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	-71.9671	(71)
Water heating gains (Table 5)	60.7926	59.0098	55.3113	50.2847	47.0208	42.4264	38.5234	43.5264	45.3056	50.5078	56.3824	59.0202	(72)
Total internal gains	418.5852	415.0786	399.0988	374.5241	349.6832	327.2645	314.0658	320.7925	334.8530	359.6034	387.0550	407.5172	(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		
North	1.4400				11.9814	0.4500	0.0000	0.7700		5.9783 (74)		
East	6.4200				22.3313	0.4500	0.0000	0.7700		49.6767 (76)		

Solar gains	55.6549	97.7852	159.5325	241.9742	291.8016	321.3054	301.9062	262.9046	201.7295	123.9279	71.0307	45.3787 (83)
Total gains	474.2401	512.8638	558.6313	616.4983	641.4848	648.5699	615.9719	583.6972	536.5826	483.5313	458.0857	452.8959 (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	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	66.3723	
alpha	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	5.4248	
util living area	0.9846	0.9753	0.9433	0.8492	0.6668	0.4305	0.2826	0.3077	0.5907	0.8791	0.9688	0.9875	(86)
MIT	20.2399	20.3492	20.5772	20.8215	20.9612	20.9970	20.9998	20.9996	20.9841	20.8162	20.4891	20.2047	(87)
Th 2	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	20.0449	(88)
util rest of house	0.9799	0.9678	0.9263	0.8094	0.5990	0.3496	0.1956	0.2161	0.5009	0.8363	0.9576	0.9835	(89)
MIT 2	19.3765	19.4830	19.7009	19.9184	20.0243	20.0440	20.0449	20.0449	20.0388	19.9199	19.6206	19.3421	(90)
Living area fraction	19.6353	19.7427	19.9636	20.1892	20.3052	20.3297	20.3312	20.3311	20.3222	20.1887	19.8810	19.6008	(92)
Temperature adjustment	19.4853	19.5927	19.8136	20.0392	20.1552	20.1797	20.1812	20.1811	20.1722	20.0387	19.7310	19.4508	(93)
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	463.0077	494.0893	514.7288	498.8510	389.5026	234.2348	128.1498	133.7507	275.4264	404.2066	436.5997	443.9904	(94)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	808.2491	786.1878	697.4655	569.6749	402.0203	234.8413	128.1701	133.7856	279.3685	474.1314	659.1105	806.3058	(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	256.8596	196.2902	135.9561	50.9932	9.3132	0.0000	0.0000	0.0000	0.0000	52.0241	160.2078	269.5627	(98)
Space heating												1131.2069	(98)
Space heating per m ²										(98) / (4) =		21.0653	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	1249.9524 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	256.8596	196.2902	135.9561	50.9932	9.3132	0.0000	0.0000	0.0000	0.0000	52.0241	160.2078	269.5627 (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)	283.8228	216.8953	150.2278	56.3461	10.2909	0.0000	0.0000	0.0000	0.0000	57.4852	177.0252	297.8593 (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	139.5057	122.3982	127.2303	112.2347	108.6675	95.2077	89.6442	100.8452	101.4480	116.4772	125.4487	135.5379 (64)
Efficiency of water heater (217)m	89.3473	89.2436	88.9243	88.2751	87.5444	87.3000	87.3000	87.3000	87.3000	88.2636	89.0663	87.3000 (216)
Fuel for water heating, kWh/month	156.1386	137.1506	143.0772	127.1419	124.1285	109.0580	102.6852	115.5156	116.2062	131.9652	140.8487	151.6023 (219)
Water heating fuel used												1555.5183 (219)
Annual totals kWh/year												
Space heating fuel - main system												1249.9524 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 3.8640, total flow = 21.0000, SFP = 0.1840)												
mechanical ventilation fans (SFP = 0.1840)												28.9310 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												103.9310 (231)
Electricity for lighting (calculated in Appendix L)												262.3699 (232)
Total delivered energy for all uses												3171.7716 (238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1249.9524	3.6300	45.3733 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1555.5183	3.6300	56.4653 (247)
Mechanical ventilation fans	28.9310	19.4400	5.6242 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	262.3699	19.4400	51.0047 (250)
Additional standing charges			95.0000 (251)
Total energy cost			268.0475 (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	1249.9524	0.2160	269.9897 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1555.5183	0.2160	335.9919 (264)
Space and water heating			605.9817 (265)
Pumps and fans	103.9310	0.5190	53.9402 (267)
Energy for lighting	262.3699	0.5190	136.1700 (268)
Total kg/year			796.0918 (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	1249.9524	1.2200	1524.9419 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1555.5183	1.2200	1897.7323 (264)
Space and water heating			3422.6742 (265)
Pumps and fans	103.9310	3.0700	319.0681 (267)
Energy for lighting	262.3699	3.0700	805.4757 (268)
Primary energy kWh/year			4547.2180 (272)
Primary energy kWh/m2/year			84.6782 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 88

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
	Total Savings £0		0.00 kg/m²
Potential energy efficiency rating:		B 84	
Potential environmental impact rating:			B 88

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)
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	£71	£71	£0
Mains gas	£197	£197	£0
Space heating	£161	£161	£0
Water heating	£56	£56	£0
Lighting	£51	£51	£0
Total cost of fuels	£268	£268	£0
Total cost of uses	£268	£268	£0
Delivered energy	59 kWh/m²	59 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	West
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	255.18 (P1)
Transmission heat loss coefficient	34.92 (37)
Summer heat loss coefficient	290.10 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	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
North	1.4400	81.1852	0.4500	0.0000	0.9000	47.3472
East	6.4200	117.5071	0.4500	0.0000	0.9000	305.5301
total:						352.8773

	Jun	Jul	Aug	
Solar gains	376	353	307	(P4)
Internal gains	324	311	318	
Total summer gains	700	664	625	(P5)
Summer gain/loss ratio	2.41	2.29	2.15	(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	18.66	20.44	20.20	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			