

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW026o_108_As_Built				Issued on Date	10/06/2021
Assessment Reference	001	Prop Type Ref	MFF			
Property						
SAP Rating	86 B	DER	13.23	TER	15.17	
Environmental	90 B	% DER<TER	12.80			
CO ₂ Emissions (t/year)	0.78	DFEE	26.35	TFEE	31.47	
General Requirements Compliance	Pass	% DFEE<TFEE	16.27			
Assessor Details	Mr. Robert Price, Robert Price, Tel: 01635 261582, keith@southernenergyconsultants.co.uk				Assessor ID	P865-0001
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

Mid-floor flat, total floor area 71 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) 15.17 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)31.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)26.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.25 (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:	3.71 (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
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6 Controls

Space heating controls:	Programmer, room thermostat and TRVs	OK
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Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

OK

8 Mechanical ventilation

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
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Based on:

Overshading:	Average
Windows facing South:	10.22 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Door U-value	1.00 W/m ² K
Air permeability	3.7 m ³ /m ² h

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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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					3.7100
Infiltration rate					0.1855 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1438 (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	0.1833	0.1797	0.1761	0.1581	0.1545	0.1366	0.1366	0.1330	0.1438	0.1545	0.1617	0.1689 (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)			10.2200	1.2357	12.6293		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)				67.9000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5186		(33)
Party Wall 1				15.8400	0.0000		(32)
Party Floor 1				70.8000			(32d)
Party Ceilings 1				70.8000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
7.5514 (36)
(33) + (36) = 33.0700 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068 (39)
Average = Sum(39)m / 12 =												61.1068 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631 (40)
HLP (average)												0.8631 (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
Average daily hot water use (litres/day)

2.2654 (42)
88.0030 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

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	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (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	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
Total internal gains	346.9513	344.8619	332.2833	312.1244	291.7817	272.1665	259.4395	265.2130	275.5954	295.9553	319.2850	336.6619 (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		
South					10.2200	46.7521	0.4500	0.0000	0.7700	165.5598 (78)		
Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589 (83)
Total gains	512.5111	616.0062	677.6730	702.4898	698.5666	663.6417	641.9345	636.6687	636.3958	588.4099	515.5299	479.7209 (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	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602
alpha	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640
util living area	0.9937	0.9804	0.9504	0.8853	0.7613	0.5808	0.4179	0.4401	0.6454	0.8951	0.9832	0.9958 (86)
MIT	20.2845	20.4683	20.6613	20.8356	20.9489	20.9921	20.9991	20.9988	20.9848	20.8477	20.5206	20.2317 (87)
Th 2	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990 (88)
util rest of house	0.9919	0.9749	0.9371	0.8566	0.7109	0.5118	0.3423	0.3642	0.5774	0.8628	0.9775	0.9945 (89)
MIT 2	19.5507	19.7310	19.9162	20.0749	20.1671	20.1955	20.1988	20.1987	20.1917	20.0886	19.7840	19.4984 (90)
Living area fraction	19.8150	19.9965	20.1845	20.3488	20.4487	20.4824	20.4870	20.4868	20.4773	20.3620	20.0493	19.7625 (92)
Temperature adjustment	19.6650	19.8465	20.0345	20.1988	20.2987	20.3324	20.3370	20.3368	20.3273	20.2120	19.8993	19.6125 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9902	0.9719	0.9339	0.8566	0.7175	0.5235	0.3554	0.3774	0.5886	0.8634	0.9748	0.9933 (94)
Ext temp.	507.5138	598.6989	632.8942	601.7609	501.2050	347.4299	228.1536	240.2616	374.5981	508.0513	502.5443	476.4828 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	938.9057	913.3360	827.0533	690.4365	525.4403	350.2903	228.3583	240.5675	380.5316	587.3592	782.1230	941.8092 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	320.9556	211.4361	144.4544	63.8464	18.0311	0.0000	0.0000	0.0000	0.0000	59.0051	201.2967	346.2029 (98)
												1365.2282 (98)
												19.2829 (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													1508.5394 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	320.9556	211.4361	144.4544	63.8464	18.0311	0.0000	0.0000	0.0000	0.0000	59.0051	201.2967	346.2029	(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)	354.6470	233.6311	159.6181	70.5485	19.9238	0.0000	0.0000	0.0000	0.0000	65.1990	222.4273	382.5446	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	89.4204	89.2072	88.8760	88.3478	87.6983	87.3000	87.3000	87.3000	87.3000	88.2677	89.1504	89.4941	(216)
Fuel for water heating, kWh/month	176.2983	154.9896	161.5708	143.1862	139.5181	122.5854	115.2203	129.9021	130.7668	148.7446	158.8600	171.0798	(219)
Water heating fuel used												1752.7222	(219)
Annual totals kWh/year													
Space heating fuel - main system												1508.5394	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													3708.5784 (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	1508.5394	0.2160	325.8445 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1752.7222	0.2160	378.5880 (264)
Space and water heating			704.4325 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total CO2, kg/year			936.5899 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2300 (273)

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

DER			13.2300 ZC1
Total Floor Area		TFA	70.8000
Assumed number of occupants		N	2.2654
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6690 ZC2
CO2 emissions from cooking, equation (L16)			2.4487 ZC3
Total CO2 emissions			32.3477 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			32.3477 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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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) =				30.0000 / (5) = 0.1766 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4266 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3306 (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	0.4215	0.4132	0.4050	0.3636	0.3554	0.3141	0.3141	0.3058	0.3306	0.3554	0.3719	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5468	0.5546	0.5631	0.5692	0.5754 (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)			10.2200	1.3258	13.5492		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1800	3.2022		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1800	3.7224		(29a)
WT-I-11	17.0900		17.0900	0.1800	3.0762		(29a)
Total net area of external elements Aum, m ²			67.9000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.6700	(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)							5.8421 (36)
Total fabric heat loss						(33) + (36) =	31.5121 (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	33.0176	32.8242	32.6346	31.7442	31.5776	30.8020	30.8020	30.6584	31.1007	31.5776	31.9146	32.2669 (38)
Heat transfer coeff	64.5297	64.3363	64.1468	63.2563	63.0897	62.3141	62.3141	62.1705	62.6129	63.0897	63.4267	63.7791 (39)
Average = Sum(39)m / 12 =												63.2555 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9114	0.9087	0.9060	0.8935	0.8911	0.8801	0.8801	0.8781	0.8844	0.8911	0.8959	0.9008 (40)
HLP (average)												0.8934 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	49.3299	42.9358	45.7423	42.5308	42.1546	39.0589	40.3608	42.1546	42.5308	45.7423	46.0027	49.3299 (61)
Total heat required for water heating calculated for each month	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567 (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	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567 (64)
Heat gains from water heating, kWh/month	60.0650	52.4811	54.5149	48.1903	46.5761	40.8623	38.9067	43.6060	44.0949	50.4326	54.0690	58.5589 (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	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	80.7325	78.0969	73.2727	66.9310	62.6023	56.7532	52.2939	58.6102	61.2430	67.7857	75.0958	78.7082 (72)
Total internal gains	358.7926	356.1079	342.9374	322.1883	301.2518	281.0444	268.3237	274.6891	285.6682	306.6183	330.5362	348.5068 (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
South					10.2200	46.7521	0.6300	0.7000			0.7700			146.0238 (78)
Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879			126.1780 (83)
Total gains	504.8164	595.2572	647.5711	666.4906	660.0361	626.3255	605.6844	602.3129	603.8942	564.5632	503.6241			474.6848 (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	76.1922	76.4213	76.6472	77.7261	77.9314	78.9013	78.9013	79.0836	78.5249	77.9314	77.5173	77.0890
alpha	6.0795	6.0948	6.1098	6.1817	6.1954	6.2601	6.2601	6.2722	6.2350	6.1954	6.1678	6.1393
util living area	0.9947	0.9852	0.9640	0.9128	0.8056	0.6225	0.4509	0.4725	0.6877	0.9168	0.9862	0.9962 (86)
MIT	20.2019	20.3765	20.5754	20.7815	20.9234	20.9876	20.9985	20.9980	20.9767	20.8071	20.4646	20.1682 (87)
Th 2	20.1578	20.1601	20.1624	20.1731	20.1751	20.1844	20.1844	20.1861	20.1808	20.1751	20.1710	20.1668 (88)
util rest of house	0.9930	0.9808	0.9535	0.8881	0.7566	0.5493	0.3683	0.3901	0.6169	0.8884	0.9813	0.9951 (89)
MIT 2	19.0976	19.3514	19.6359	19.9261	20.1031	20.1763	20.1839	20.1853	20.1640	19.9660	19.4889	19.0555 (90)
Living area fraction	19.4953	19.7206	19.9743	20.2342	20.3986	20.4685	20.4773	20.4780	20.4567	20.2689	19.8403	19.4563 (92)
MIT	19.4953	19.7206	19.9743	20.2342	20.3986	20.4685	20.4773	20.4780	20.4567	20.2689	19.8403	19.4563 (93)
Temperature adjustment												0.0000
adjusted MIT	19.4953	19.7206	19.9743	20.2342	20.3986	20.4685	20.4773	20.4780	20.4567	20.2689	19.8403	19.4563 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9914	0.9780	0.9507	0.8901	0.7707	0.5753	0.3981	0.4199	0.6415	0.8920	0.9789	0.9937 (94)
Ext temp.	500.4506	582.1323	615.6461	593.2551	508.6859	360.3416	241.1477	252.8875	387.4098	503.6093	492.9939	471.7018 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	980.5500	953.5036	864.3309	716.9571	548.7897	365.6906	241.6090	253.5340	398.0129	610.0110	808.0769	973.0325 (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	357.1939	249.5615	185.0215	89.0655	29.8372	0.0000	0.0000	0.0000	0.0000	79.1629	226.8597	372.9901 (98)
												1589.6923 (98)
												22.4533 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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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													1702.0260 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	357.1939	249.5615	185.0215	89.0655	29.8372	0.0000	0.0000	0.0000	0.0000	79.1629	226.8597	372.9901	(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)	382.4346	267.1965	198.0958	95.3592	31.9456	0.0000	0.0000	0.0000	0.0000	84.7568	242.8905	399.3470	(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	192.8864	168.4912	175.3042	155.4860	150.5379	132.5854	127.0269	141.6052	143.1691	163.0265	174.0276	188.3567	(64)
Efficiency of water heater	86.5814	86.0384	85.1871	83.7060	81.8120	80.3000	80.3000	80.3000	80.3000	83.3436	85.7196	86.7392	(217)
Fuel for water heating, kWh/month	222.7804	195.8326	205.7872	185.7525	184.0047	165.1125	158.1904	176.3452	178.2928	195.6077	203.0196	217.1528	(219)
Water heating fuel used												2287.8783	(219)
Annual totals kWh/year													
Space heating fuel - main system												1702.0260	(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)												334.1731	(232)
Total delivered energy for all uses												4399.0775	(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	1702.0260	0.2160	367.6376 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2287.8783	0.2160	494.1817 (264)
Space and water heating			861.8193 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total CO2, kg/m2/year			1074.1802 (272)
Emissions per m2 for space and water heating			12.1726 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4497 (272b)
Emissions per m2 for pumps and fans			0.5498 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.1726 * 1.00) + 2.4497 + 0.5498, rounded to 2 d.p.			15.1700 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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
Pressure test					30.0000 / (5) = 0.1766 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.3621 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2806 (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	0.3578	0.3507	0.3437	0.3087	0.3016	0.2666	0.2666	0.2595	0.2806	0.3016	0.3157	0.3297 (22b)
Effective ac	0.5640	0.5615	0.5591	0.5476	0.5455	0.5355	0.5355	0.5337	0.5394	0.5455	0.5498	0.5543 (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)			10.2200	1.2357	12.6293		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum, m ²			67.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5186		(33)
Party Wall 1			15.8400	0.0000	0.0000		(32)
Party Floor 1			70.8000				(32d)
Party Ceilings 1			70.8000				(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)							7.5514 (36)
Total fabric heat loss						(33) + (36) =	33.0700 (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	31.6252	31.4858	31.3493	30.7077	30.5877	30.0290	30.0290	29.9255	30.2442	30.5877	30.8305	31.0844 (38)
Heat transfer coeff	64.6952	64.5559	64.4193	63.7778	63.6577	63.0990	63.0990	62.9955	63.3142	63.6577	63.9005	64.1544 (39)
Average = Sum(39)m / 12 =												63.7772 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9138	0.9118	0.9099	0.9008	0.8991	0.8912	0.8912	0.8898	0.8943	0.8991	0.9026	0.9061 (40)
HLP (average)												0.9008 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (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												

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.5058	26.6805	27.5319	24.0030	23.0314	19.8744	18.4165	21.1332	21.3856	24.9229	27.2053	29.5432 (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	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482	(67)
Appliances gains (calculated in Appendix L13, equation L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	(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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	(71)
Water heating gains (Table 5)	41.0024	39.7032	37.0053	33.3375	30.9562	27.6033	24.7534	28.4049	29.7023	33.4985	37.7851	39.7086	(72)
Total internal gains	316.0624	314.7142	303.6699	285.5948	266.6058	248.8946	237.7832	241.4838	251.1275	269.3311	290.2255	306.5072	(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		
South				10.2200	46.7521	0.4500	0.0000			0.7700	165.5598 (78)		
Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589	(83)
Total gains	481.6222	585.8585	649.0597	675.9602	673.3907	640.3697	620.2783	612.9394	611.9279	561.7857	486.4704	449.5662	(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	75.9974	76.1614	76.3229	77.0906	77.2360	77.9199	77.9199	78.0479	77.6550	77.2360	76.9425	76.6380	
alpha	6.0665	6.0774	6.0882	6.1394	6.1491	6.1947	6.1947	6.2032	6.1770	6.1491	6.1295	6.1092	
util living area	0.9959	0.9864	0.9640	0.9101	0.7992	0.6167	0.4459	0.4704	0.6860	0.9201	0.9886	0.9972	(86)
MIT	20.1672	20.3601	20.5722	20.7825	20.9251	20.9876	20.9985	20.9980	20.9762	20.7983	20.4342	20.1262	(87)
Th 2	20.1558	20.1575	20.1591	20.1668	20.1682	20.1750	20.1750	20.1762	20.1724	20.1682	20.1653	20.1623	(88)
util rest of house	0.9946	0.9823	0.9535	0.8848	0.7495	0.5432	0.3632	0.3874	0.6146	0.8924	0.9844	0.9963	(89)
MIT 2	19.3979	19.5897	19.7970	19.9994	20.1205	20.1695	20.1746	20.1756	20.1607	20.0185	19.6708	19.3625	(90)
Living area fraction									fLA = Living area / (4) =			0.3602	(91)
MIT	19.6750	19.8672	20.0762	20.2814	20.4103	20.4642	20.4713	20.4718	20.4544	20.2993	19.9458	19.6376	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6750	19.8672	20.0762	20.2814	20.4103	20.4642	20.4713	20.4718	20.4544	20.2993	19.9458	19.6376	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	478.5535	574.5040	618.0798	600.6785	514.9849	364.6936	243.8164	255.8331	391.4538	504.0905	478.2497	447.5887	(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	994.6875	966.2185	874.5696	725.8818	554.4766	370.0221	244.2778	256.5056	402.3245	617.4369	820.8520	990.3875	(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	384.0037	263.2321	190.8284	90.1464	29.3818	0.0000	0.0000	0.0000	0.0000	84.3297	246.6737	403.8423	(98)
Space heating												1692.4380	(98)
Space heating per m2										(98) / (4) =		23.9045	(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	593.1305	466.9325	478.7659	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9616	0.9856	0.9831	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	570.3320	460.2052	470.6547	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	833.1555	808.0087	800.9617	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	189.2329	258.7658	245.7484	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												693.7472	(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	47.3082	64.6914	61.4371	0.0000	0.0000	0.0000 (107)
Space cooling											173.4368 (107)
Space cooling per m2											2.4497 (108)
Energy for space heating											23.9045 (99)
Energy for space cooling											2.4497 (108)
Total											26.3542 (109)
Dwelling Fabric Energy Efficiency (DFEE)											26.4 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1766 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4266 (18)
					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3306 (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												
	0.4215	0.4132	0.4050	0.3636	0.3554	0.3141	0.3141	0.3058	0.3306	0.3554	0.3719	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5468	0.5546	0.5631	0.5692	0.5754 (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)			10.2200	1.3258	13.5492		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1800	3.2022		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1800	3.7224		(29a)
WT-I-11	17.0900		17.0900	0.1800	3.0762		(29a)
Total net area of external elements Aum, m ²			67.9000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.6700	(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)							5.8421 (36)
Total fabric heat loss						(33) + (36) =	31.5121 (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	33.0176	32.8242	32.6346	31.7442	31.5776	30.8020	30.8020	30.6584	31.1007	31.5776	31.9146	32.2669 (38)
Heat transfer coeff	64.5297	64.3363	64.1468	63.2563	63.0897	62.3141	62.3141	62.1705	62.6129	63.0897	63.4267	63.7791 (39)
Average = Sum(39)m / 12 =												63.2555 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9114	0.9087	0.9060	0.8935	0.8911	0.8801	0.8801	0.8781	0.8844	0.8911	0.8959	0.9008 (40)
HLP (average)												0.8934 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (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	30.5058	26.6805	27.5319	24.0030	23.0314	19.8744	18.4165	21.1332	21.3856	24.9229	27.2053	29.5432 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695	113.2695 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9223	16.8066	13.6680	10.3476	7.7349	6.5302	7.0561	9.1717	12.3103	15.6308	18.2434	19.4482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.1570	201.2236	196.0158	184.9289	170.9337	157.7803	148.9929	146.9263	152.1341	163.2210	177.2161	190.3696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269	34.3269 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	41.0024	39.7032	37.0053	33.3375	30.9562	27.6033	24.7534	28.4049	29.7023	33.4985	37.7851	39.7086 (72)
Total internal gains	316.0624	314.7142	303.6699	285.5948	266.6058	248.8946	237.7832	241.4838	251.1275	269.3311	290.2255	306.5072 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
South	10.2200	46.7521	0.6300	0.7000	0.7700	146.0238 (78)						
Solar gains	146.0238	239.1493	304.6338	344.3023	358.7843	345.2811	337.3606	327.6239	318.2259	257.9449	173.0879	126.1780 (83)
Total gains	462.0862	553.8635	608.3037	629.8971	625.3900	594.1756	575.1438	569.1077	569.3535	527.2760	463.3135	432.6852 (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	76.1922	76.4213	76.6472	77.7261	77.9314	78.9013	78.9013	79.0836	78.5249	77.9314	77.5173	77.0890
alpha	6.0795	6.0948	6.1098	6.1817	6.1954	6.2601	6.2601	6.2722	6.2350	6.1954	6.1678	6.1393
util living area	0.9967	0.9896	0.9728	0.9295	0.8321	0.6519	0.4743	0.4992	0.7209	0.9361	0.9909	0.9977 (86)
MIT	20.1442	20.3233	20.5303	20.7497	20.9076	20.9840	20.9981	20.9973	20.9699	20.7737	20.4123	20.1110 (87)
Th 2	20.1578	20.1601	20.1624	20.1731	20.1751	20.1844	20.1844	20.1861	20.1808	20.1751	20.1710	20.1668 (88)
util rest of house	0.9956	0.9865	0.9645	0.9081	0.7855	0.5770	0.3877	0.4126	0.6497	0.9123	0.9876	0.9970 (89)
MIT 2	19.3767	19.5560	19.7602	19.9768	20.1146	20.1772	20.1839	20.1854	20.1657	20.0037	19.6543	19.3512 (90)
Living area fraction									fLA = Living area / (4) =			0.3602 (91)
MIT	19.6532	19.8324	20.0376	20.2551	20.4002	20.4678	20.4771	20.4778	20.4554	20.2811	19.9273	19.6248 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6532	19.8324	20.0376	20.2551	20.4002	20.4678	20.4771	20.4778	20.4554	20.2811	19.9273	19.6248 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9948	0.9849	0.9630	0.9105	0.7991	0.6037	0.4190	0.4439	0.6745	0.9158	0.9864	0.9964 (94)
Ext temp.	459.6864	545.5211	585.8134	573.5184	499.7601	358.7107	240.9847	252.6363	384.0505	482.8595	457.0128	431.1159 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	990.7352	960.6931	868.3924	718.2842	548.8945	365.6468	241.6002	253.5203	397.9268	610.7746	813.5968	983.7813 (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	395.1003	278.9956	210.2388	104.2313	36.5560	0.0000	0.0000	0.0000	0.0000	95.1688	256.7405	411.1830 (98)
Space heating per m2												1788.2143 (98)
										(98) / (4) =		25.2573 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9524	0.9817	0.9788	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	557.8696	452.7080	462.4935	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	779.1624	755.2542	749.7298	0.0000	0.0000	0.0000	0.0000 (102)
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 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	159.3308	225.0943	213.7038	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												598.1289 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

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	39.8327	56.2736	53.4259	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												149.5322 (107)
Space cooling per m2												2.1120 (108)
Energy for space heating												25.2573 (99)
Energy for space cooling												2.1120 (108)
Total												27.3693 (109)
Target Fabric Energy Efficiency (TFEE)												31.5 (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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.1855 (18)
					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1438 (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	0.1510	0.1438	0.1438	0.1330	0.1330	0.1186	0.1222	0.1150	0.1186	0.1258	0.1258	0.1366 (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)			10.2200	1.2357	12.6293		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)			67.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5186		(33)
Party Wall 1			15.8400	0.0000	0.0000		(32)
Party Floor 1			70.8000				(32d)
Party Ceilings 1			70.8000				(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)							7.5514 (36)
Total fabric heat loss						(33) + (36) =	33.0700 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068 (39)
Average = Sum(39)m / 12 =												61.1068 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631 (40)
HLP (average)												0.8631 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
RHI water heating demand	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (65)
Heat gains from water heating, kWh/month												1550 (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	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577 (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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Water heating gains (Table 5)	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
Total internal gains	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	FF	Access	Gains			
				m2	Table 6a	Specific data	Specific data	factor	W			
					W/m2	or Table 6b	or Table 6c	Table 6d				
South				10.2200	50.9848	0.4500	0.0000	0.7700	180.5490 (78)			
Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394 (83)
Total gains	693.1606	773.7329	821.8819	847.5466	825.0491	810.7420	779.9401	782.5592	785.8906	744.2725	692.1860	653.4224 (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	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602
alpha	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640
util living area	0.9636	0.9330	0.8690	0.7523	0.5837	0.3764	0.2429	0.2498	0.4494	0.7320	0.9160	0.9723 (86)
MIT	20.5749	20.6933	20.8364	20.9430	20.9898	20.9995	21.0000	21.0000	20.9983	20.9586	20.7755	20.5293 (87)
Th 2	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990 (88)
util rest of house	0.9541	0.9174	0.8418	0.7102	0.5286	0.3163	0.1801	0.1873	0.3881	0.6815	0.8940	0.9648 (89)
MIT 2	19.8333	19.9439	20.0727	20.1606	20.1937	20.1988	20.1990	20.1990	20.1983	20.1734	20.0218	19.7899 (90)
Living area fraction									fLA = Living area / (4) =			0.3602 (91)
MIT	20.1004	20.2138	20.3478	20.4424	20.4804	20.4872	20.4875	20.4875	20.4865	20.4562	20.2933	20.0562 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.9504	20.0638	20.1978	20.2924	20.3304	20.3372	20.3375	20.3375	20.3365	20.3062	20.1433	19.9062 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9507	0.9145	0.8418	0.7153	0.5378	0.3267	0.1910	0.1981	0.3987	0.6885	0.8923	0.9615 (94)
Useful gains	658.9828	707.5563	691.8645	606.2444	443.6932	264.8870	148.9432	155.0528	313.3242	512.4480	617.6517	628.2527 (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	907.4602	883.8367	782.0321	635.0464	447.9389	265.0319	148.9464	155.0570	313.8727	532.0090	742.0363	904.7619 (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	184.8672	118.4604	67.0847	20.7374	3.1588	0.0000	0.0000	0.0000	0.0000	14.5534	89.5569	205.7228 (98)
Space heating												704.1415 (98)
RHI space heating demand												704 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					3.7100
Infiltration rate					0.1855 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1438 (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	0.1833	0.1797	0.1761	0.1581	0.1545	0.1366	0.1366	0.1330	0.1438	0.1545	0.1617	0.1689 (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)			10.2200	1.2357	12.6293		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)				67.9000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5186		(33)
Party Wall 1				15.8400	0.0000	0.0000	(32)
Party Floor 1				70.8000			(32d)
Party Ceilings 1				70.8000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
7.5514 (36)
(33) + (36) = 33.0700 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068 (39)
Average = Sum(39)m / 12 =												61.1068 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631 (40)
HLP (average)												0.8631 (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
Average daily hot water use (litres/day)

2.2654 (42)
88.0030 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

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	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338 (68)
Pumps, fans	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156 (71)
Total internal gains	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633 (72)
	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830 (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			

South				10.2200	46.7521	0.4500	0.0000	0.7700	165.5598 (78)			

Solar gains	165.5598	271.1443	345.3898	390.3654	406.7849	391.4751	382.4950	371.4557	360.8004	292.4546	196.2448	143.0589 (83)
Total gains	678.1714	779.5109	833.9048	848.2802	833.5450	790.3342	765.0879	761.9777	768.9777	731.4331	669.3652	641.8419 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602
util living area	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640
	0.9738	0.9424	0.8889	0.7983	0.6616	0.4920	0.3511	0.3685	0.5428	0.7966	0.9437	0.9805 (86)
MIT	20.4960	20.6512	20.7974	20.9129	20.9765	20.9968	20.9997	20.9996	20.9941	20.9261	20.6953	20.4440 (87)
Th 2	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990 (88)
util rest of house	0.9670	0.9291	0.8659	0.7616	0.6111	0.4317	0.2874	0.3045	0.4822	0.7534	0.9283	0.9753 (89)
MIT 2	19.7571	19.9042	20.0379	20.1368	20.1851	20.1977	20.1989	20.1989	20.1963	20.1493	19.9484	19.7068 (90)
Living area fraction	20.0232	20.1733	20.3115	20.4164	20.4701	20.4855	20.4873	20.4873	20.4836	20.4291	20.2174	19.9723 (92)
Temperature adjustment	19.8732	20.0233	20.1615	20.2664	20.3201	20.3355	20.3373	20.3373	20.3336	20.2791	20.0674	19.8223 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9637	0.9258	0.8647	0.7648	0.6190	0.4421	0.2984	0.3156	0.4925	0.7580	0.9254	0.9723 (94)
Ext temp.	653.5770	721.7041	721.0545	648.8013	515.9319	349.3723	228.3030	240.4859	378.7064	554.4167	619.4422	624.0739 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	951.6300	924.1351	834.8092	694.5619	526.7476	350.4784	228.3760	240.5932	380.9182	591.4567	792.3964	954.6290 (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	221.7514	136.0336	84.6335	32.9476	8.0469	0.0000	0.0000	0.0000	0.0000	27.5578	124.5270	245.9330 (98)
												881.4309 (98)
												12.4496 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													973.9568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	221.7514	136.0336	84.6335	32.9476	8.0469	0.0000	0.0000	0.0000	0.0000	27.5578	124.5270	245.9330	(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)	245.0292	150.3134	93.5177	36.4062	8.8916	0.0000	0.0000	0.0000	0.0000	30.4506	137.5989	271.7492	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	89.1423	88.8582	88.4599	87.9425	87.4909	87.3000	87.3000	87.3000	87.3000	87.8388	88.7686	89.2448	(216)
Fuel for water heating, kWh/month	176.8483	155.5982	162.3308	143.8460	139.8488	122.5854	115.2203	129.9021	130.7668	149.4709	159.5434	171.5576	(219)
Water heating fuel used												1757.5187	(219)
Annual totals kWh/year													
Space heating fuel - main system												973.9568	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													3178.7923 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	973.9568	3.4800	33.8937 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1757.5187	3.4800	61.1617 (247)
Mechanical ventilation fans	38.1436	13.1900	5.0311 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	334.1731	13.1900	44.0774 (250)
Additional standing charges			120.0000 (251)
Total energy cost			274.0564 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.9940 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	86.1339
SAP rating (Section 12)		86 (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	973.9568	0.2160	210.3747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1757.5187	0.2160	379.6240 (264)
Space and water heating			589.9987 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total kg/year			822.1561 (272)
CO2 emissions per m2			11.6100 (273)
EI value			90.4863
EI rating			90 (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	$3.48 / 0.8808 = 3.951$, stars = 4
Water heating environmental impact	$0.216 / 0.8808 = 0.2452$, 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	70.8000 (1b)	x 2.4000 (2b)	= 169.9200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 169.9200 (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					3.7100
Infiltration rate					0.1855 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1438 (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	0.1510	0.1438	0.1438	0.1330	0.1330	0.1186	0.1222	0.1150	0.1186	0.1258	0.1258	0.1366 (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)			10.2200	1.2357	12.6293		(27)
WT-E-03	28.0100	10.2200	17.7900	0.1600	2.8464		(29a)
WT-I-02	22.8000	2.1200	20.6800	0.1584	3.2761		(29a)
WT-I-11	17.0900		17.0900	0.2719	4.6468		(29a)
Total net area of external elements Aum(A, m ²)				67.9000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5186		(33)
Party Wall 1				15.8400	0.0000	0.0000	(32)
Party Floor 1				70.8000			(32d)
Party Ceilings 1				70.8000			(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)							7.5514 (36)
Total fabric heat loss							(33) + (36) = 33.0700 (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	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368	28.0368 (38)
Heat transfer coeff	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068	61.1068 (39)
Average = Sum(39)m / 12 =												61.1068 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631	0.8631 (40)
HLP (average)												0.8631 (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												2.2654 (42)
Average daily hot water use (litres/day)												88.0030 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	96.8033	93.2832	89.7631	86.2429	82.7228	79.2027	79.2027	82.7228	86.2429	89.7631	93.2832	96.8033 (44)
Energy conte	143.5565	125.5554	129.5620	112.9552	108.3833	93.5265	86.6661	99.4506	100.6383	117.2843	128.0249	139.0268 (45)
Energy content (annual)												Total = Sum(45)m = 1384.6298 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	21.5335	18.8333	19.4343	16.9433	16.2575	14.0290	12.9999	14.9176	15.0957	17.5926	19.2037	20.8540 (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	14.0901	12.7064	14.0357	13.5466	13.9717	13.4906	13.9213	13.9540	13.5211	14.0092	13.5994	14.0796 (61)
Total heat required for water heating calculated for each month	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064 (64)
Heat gains from water heating, kWh/month	51.2551	44.9238	46.5883	40.9443	39.5304	34.4702	32.2968	36.5558	36.8425	42.4993	45.9681	49.7463 (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	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	135.9234	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3057	42.0165	34.1701	25.8690	19.3373	16.3254	17.6402	22.9294	30.7757	39.0769	45.6085	48.6204	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.2492	300.3337	292.5608	276.0133	255.1250	235.4929	222.3775	219.2930	227.0659	243.6134	264.5017	284.1338	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	50.8577	(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)	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	-90.6156	(71)
Water heating gains (Table 5)	68.8912	66.8509	62.6186	56.8670	53.1322	47.8753	43.4097	49.1342	51.1702	57.1227	63.8447	66.8633	(72)
Total internal gains	512.6116	508.3665	488.5151	457.9148	426.7601	398.8591	382.5928	390.5220	408.1773	438.9785	473.1204	498.7830	(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			
South				10.2200	50.9848	0.4500	0.0000	0.7700	180.5490 (78)			
Solar gains	180.5490	265.3663	333.3669	389.6318	398.2891	411.8829	397.3472	392.0371	377.7133	305.2939	219.0656	154.6394 (83)
Total gains	693.1606	773.7329	821.8819	847.5466	825.0491	810.7420	779.9401	782.5592	785.8906	744.2725	692.1860	653.4224 (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	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	80.4602	
alpha	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	6.3640	
util living area	0.9636	0.9330	0.8690	0.7523	0.5837	0.3764	0.2429	0.2498	0.4494	0.7320	0.9160	0.9723	(86)
MIT	20.5749	20.6933	20.8364	20.9430	20.9898	20.9995	21.0000	21.0000	20.9983	20.9586	20.7755	20.5293	(87)
Th 2	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	20.1990	(88)
util rest of house	0.9541	0.9174	0.8418	0.7102	0.5286	0.3163	0.1801	0.1873	0.3881	0.6815	0.8940	0.9648	(89)
MIT 2	19.8333	19.9439	20.0727	20.1606	20.1937	20.1988	20.1990	20.1990	20.1983	20.1734	20.0218	19.7899	(90)
Living area fraction	20.1004	20.2138	20.3478	20.4424	20.4804	20.4872	20.4875	20.4875	20.4865	20.4562	20.2933	20.0562	(92)
Temperature adjustment	19.9504	20.0638	20.1978	20.2924	20.3304	20.3372	20.3375	20.3375	20.3365	20.3062	20.1433	19.9062	(93)
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	658.9828	707.5563	691.8645	606.2444	443.6932	264.8870	148.9432	155.0528	313.3242	512.4480	617.6517	628.2527	(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	907.4602	883.8367	782.0321	635.0464	447.9389	265.0319	148.9464	155.0570	313.8727	532.0090	742.0363	904.7619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	184.8672	118.4604	67.0847	20.7374	3.1588	0.0000	0.0000	0.0000	0.0000	14.5534	89.5569	205.7228	(98)
Space heating												704.1415	(98)
Space heating per m2												9.9455	(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													778.0569 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	184.8672	118.4604	67.0847	20.7374	3.1588	0.0000	0.0000	0.0000	0.0000	14.5534	89.5569	205.7228	(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)	204.2731	130.8955	74.1267	22.9143	3.4904	0.0000	0.0000	0.0000	0.0000	16.0811	98.9579	227.3180	(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	157.6466	138.2618	143.5976	126.5018	122.3550	107.0171	100.5874	113.4046	114.1594	131.2935	141.6244	153.1064	(64)
Efficiency of water heater (217)m	88.9985	88.7480	88.2941	87.7369	87.3778	87.3000	87.3000	87.3000	87.3000	87.6091	88.5124	89.1064	(216)
Fuel for water heating, kWh/month	177.1340	155.7914	162.6356	144.1831	140.0299	122.5854	115.2203	129.9021	130.7668	149.8628	160.0051	171.8243	(219)
Water heating fuel used												1759.9409	(219)
Annual totals kWh/year													
Space heating fuel - main system												778.0569	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													38.1436 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.1436 (231)
Electricity for lighting (calculated in Appendix L)													334.1731 (232)
Total delivered energy for all uses													2985.3146 (238)

10a. Fuel costs - using BEDF prices (478)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	778.0569	3.8700	30.1108 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1759.9409	3.8700	68.1097 (247)
Mechanical ventilation fans	38.1436	18.9000	7.2091 (249)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	334.1731	18.9000	63.1587 (250)
Additional standing charges			93.0000 (251)
Total energy cost			275.7634 (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	778.0569	0.2160	168.0603 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1759.9409	0.2160	380.1472 (264)
Space and water heating			548.2075 (265)
Pumps and fans	113.1436	0.5190	58.7215 (267)
Energy for lighting	334.1731	0.5190	173.4359 (268)
Total kg/year			780.3649 (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	778.0569	1.2200	949.2295 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1759.9409	1.2200	2147.1279 (264)
Space and water heating			3096.3574 (265)
Pumps and fans	113.1436	3.0700	347.3510 (267)
Energy for lighting	334.1731	3.0700	1025.9115 (268)
Primary energy kWh/year			4469.6199 (272)
Primary energy kWh/m2/year			63.1302 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 90

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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Not applicable
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Not applicable
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
L2	Not applicable
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 86	
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 478 TEST (27 May 2021)
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	£85	£85	£0
Mains gas	£191	£191	£0
Space heating	£144	£144	£0
Water heating	£68	£68	£0
Lighting	£63	£63	£0
Total cost of fuels	£276	£276	£0
Total cost of uses	£275	£275	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 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	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	336.44 (P1)
Transmission heat loss coefficient	33.07 (P7)
Summer heat loss coefficient	369.51 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type	
Orientation				
South	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
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
South	10.2200	112.2060	0.4500	0.0000
total:				464.4318

Solar gains	Jun	Jul	Aug	
Internal gains	481	464	458	(P4)
Total summer gains	396	380	388	
	877	844	846	(P5)
Summer gain/loss ratio	2.37	2.28	2.29	(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	18.62	20.43	20.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			