

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW017a_211_As_Built				Issued on Date	15/07/2021
Assessment Reference	001	Prop Type Ref	TFF			
Property						
SAP Rating	84 B	DER	17.52	TER	18.71	
Environmental	86 B	% DER<TER	6.37			
CO ₂ Emissions (t/year)	1.27	DFEE	49.01	TFEE	56.57	
General Requirements Compliance	Pass	% DFEE<TFEE	13.36			
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 88 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.25 (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	1.27 (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: 3.65 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 5.24 m², No overhang
Windows facing East: 4.98 m², No overhang
Windows facing South: 10.22 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.7 m³/m²h

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (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					3.6500
Infiltration rate					0.1825 (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) =				0.1551 (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	0.1978	0.1939	0.1900	0.1706	0.1668	0.1474	0.1474	0.1435	0.1551	0.1668	0.1745	0.1823 (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			2.0600	1.0000	2.0600		(26)
Opening Type 2 (Uw = 1.30)			20.4400	1.2357	25.2586		(27)
WT-E-01	68.0600	20.4400	47.6200	0.2000	9.5240		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.2544	4.0811		(29a)
Flat	87.7700		87.7700	0.1500	13.1655		(30)
Total net area of external elements Aum(A, m2)			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.0892	(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			87.7700				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.5496 (36)
Total fabric heat loss							(33) + (36) = 77.6387 (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	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569 (38)
Average = Sum(39)m / 12 =	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)										Total = Sum(45)m =	1507.4063 (45)	
Distribution loss (46)m = 0.15 x (45)m	23.4429	20.5033	21.1576	18.4457	17.6991	15.2729	14.1526	16.2403	16.4343	19.1526	20.9066	22.7032 (46)

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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	14.1316	12.7533	14.0874	13.5899	14.0116	13.5235	13.9518	13.9906	13.5597	14.0560	13.6473	14.1198	(61)
Total heat required for water heating calculated for each month	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(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	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(64)
Heat gains from water heating, kWh/month	55.4979	48.6373	50.4211	44.2854	42.7358	37.2359	34.8596	39.4971	39.8193	45.9689	49.7547	53.8553	(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	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9428	18.6012	15.1275	11.4525	8.5609	7.2275	7.8095	10.1511	13.6248	17.2998	20.1915	21.5249	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.9148	237.3524	231.2096	218.1321	201.6242	186.1090	175.7440	173.3063	179.4492	192.5266	209.0346	224.5497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	(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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	(71)
Water heating gains (Table 5)	74.5940	72.3769	67.7703	61.5075	57.4406	51.7165	46.8543	53.0875	55.3046	61.7862	69.1037	72.3862	(72)
Total internal gains	395.3608	393.2398	379.0166	356.0013	332.5349	309.9623	295.3171	301.4541	313.2878	336.5219	363.2390	383.3700	(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				5.2400	10.6334		0.4500		0.0000		0.7700		19.3066 (74)
East				4.9800	19.6403		0.4500		0.0000		0.7700		33.8906 (76)
South				10.2200	46.7521		0.4500		0.0000		0.7700		165.5598 (78)
Solar gains	218.7571	374.3376	517.2672	650.3058	737.5926	736.4715	708.2716	642.3967	563.1638	415.0417	262.3197	187.0239	(83)
Total gains	614.1179	767.5774	896.2838	1006.3071	1070.1275	1046.4338	1003.5887	943.8508	876.4516	751.5636	625.5587	570.3939	(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	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293		
alpha	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153		
util living area	0.9961	0.9889	0.9705	0.9206	0.8121	0.6440	0.4831	0.5318	0.7683	0.9493	0.9912	0.9972	(86)	
MIT	19.6776	19.9020	20.2058	20.5468	20.8158	20.9525	20.9898	20.9843	20.8932	20.5239	20.0152	19.6210	(87)	
Th 2	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	(88)	
util rest of house	0.9948	0.9852	0.9605	0.8938	0.7531	0.5462	0.3625	0.4075	0.6800	0.9262	0.9876	0.9963	(89)	
MIT 2	18.6672	18.8896	19.1869	19.5091	19.7403	19.8361	19.8538	19.8521	19.8028	19.4963	19.0033	18.6109	(90)	
Living area fraction									fLA = Living area / (4) =			0.3486	(91)	
MIT	19.0195	19.2426	19.5421	19.8709	20.1152	20.2253	20.2498	20.2468	20.1829	19.8546	19.3561	18.9630	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.8695	19.0926	19.3921	19.7209	19.9652	20.0753	20.0998	20.0968	20.0329	19.7046	19.2061	18.8130	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9820	0.9554	0.8901	0.7593	0.5661	0.3888	0.4346	0.6951	0.9224	0.9848	0.9950	(94)
Useful gains	609.9488	753.7380	856.3537	895.6865	812.5973	592.3604	390.1769	410.1795	609.2614	693.2278	616.0780	567.5614	(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	1637.5429	1595.1812	1449.0186	1216.2238	928.9776	615.4015	393.3661	415.5055	666.8373	1023.3148	1360.6718	1642.4397	(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	764.5300	565.4498	440.9427	230.7869	86.5869	0.0000	0.0000	0.0000	0.0000	245.5848	536.1076	799.7095	(98)
Space heating												3669.6981	(98)
Space heating per m2												(98) / (4) =	41.8104 (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												4054.9150 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	764.5300	565.4498	440.9427	230.7869	86.5869	0.0000	0.0000	0.0000	0.0000	245.5848	536.1076	799.7095 (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)	844.7845	624.8064	487.2295	255.0131	95.6762	0.0000	0.0000	0.0000	0.0000	271.3644	592.3841	883.6569 (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	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743 (64)
Efficiency of water heater (217)m	89.8994	89.8118	89.6448	89.2834	88.5401	87.3000	87.3000	87.3000	87.3000	89.3021	89.7693	87.3000 (216)
Fuel for water heating, kWh/month	189.5647	166.3944	173.0583	152.9523	149.0910	132.1227	124.0580	140.0453	141.0329	158.7196	170.4640	183.9935 (219)
Water heating fuel used												1881.4966 (219)
Annual totals kWh/year												
Space heating fuel - main system												4054.9150 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)												
mechanical ventilation fans (SFP = 0.1840)												47.2863 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												122.2863 (231)
Electricity for lighting (calculated in Appendix L)												369.8568 (232)
Total delivered energy for all uses												6428.5547 (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	4054.9150	0.2160	875.8616 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1881.4966	0.2160	406.4033 (264)
Space and water heating			1282.2649 (265)
Pumps and fans	122.2863	0.5190	63.4666 (267)
Energy for lighting	369.8568	0.5190	191.9557 (268)
Total CO2, kg/year			1537.6872 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5200 (273)

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

DER		17.5200 ZC1
Total Floor Area	TFA	87.7700
Assumed number of occupants	N	2.5939
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.8603 ZC2
CO2 emissions from cooking, equation (L16)		2.0651 ZC3
Total CO2 emissions		35.4454 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		35.4454 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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (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) =				30.0000 / (5) = 0.1424 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3924 (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) =				0.3336 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4253	0.4169	0.4086	0.3669	0.3586	0.3169	0.3169	0.3085	0.3336	0.3586	0.3752	0.3919 (22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			19.8800	1.3258	26.3561		(27)
WT-E-01	68.0600	19.8800	48.1800	0.1800	8.6724		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.1800	2.8872		(29a)
Flat	87.7700		87.7700	0.1300	11.4101		(30)
Total net area of external elements Aum, m ²			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.3858		(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)							21.5852 (36)
Total fabric heat loss						(33) + (36) =	72.9710 (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	41.0432	40.7991	40.5599	39.4360	39.2257	38.2469	38.2469	38.0656	38.6239	39.2257	39.6511	40.0958 (38)
Heat transfer coeff	114.0142	113.7701	113.5308	112.4070	112.1967	111.2179	111.2179	111.0366	111.5949	112.1967	112.6221	113.0668 (39)
Average = Sum(39)m / 12 =												112.4060 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2990	1.2962	1.2935	1.2807	1.2783	1.2672	1.2672	1.2651	1.2714	1.2783	1.2832	1.2882 (40)
HLP (average)												1.2807 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)												Total = Sum(45)m = 1507.4063 (45)
Distribution loss (46)m = 0.15 x (45)m	23.4429	20.5033	21.1576	18.4457	17.6991	15.2729	14.1526	16.2403	16.4343	19.1526	20.9066	22.7032 (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	50.9589	46.0274	49.7983	46.3020	45.8925	42.5223	43.9397	45.8925	46.3020	49.7983	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	207.2447	182.7159	190.8486	169.2731	163.8862	144.3418	138.2905	154.1615	155.8640	177.4823	188.6921	202.3133 (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	207.2447	182.7159	190.8486	169.2731	163.8862	144.3418	138.2905	154.1615	155.8640	177.4823	188.6921	202.3133 (64)
Heat gains from water heating, kWh/month	64.7048	56.9558	59.3488	52.4634	50.7060	44.4856	42.3566	47.4726	48.0049	54.9045	58.6716	63.0651 (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	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9388	18.5976	15.1246	11.4503	8.5592	7.2261	7.8080	10.1492	13.6222	17.2965	20.1875	21.5207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.9148	237.3524	231.2096	218.1321	201.6242	186.1090	175.7440	173.3063	179.4492	192.5266	209.0346	224.5497 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697 (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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580 (71)
Water heating gains (Table 5)	86.9688	84.7556	79.7699	72.8658	68.1533	61.7855	56.9309	63.8072	66.6734	73.7964	81.4884	84.7649 (72)
Total internal gains	407.7315	405.6150	391.0133	367.3575	343.2459	320.0299	305.3921	312.1719	324.6540	348.5287	375.6197	395.7446 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	5.1000	10.6334	0.6300		0.7000	0.7700	16.5735 (74)
East	4.8400	19.6403	0.6300		0.7000	0.7700	29.0512 (76)
South	9.9400	46.7521	0.6300		0.7000	0.7700	142.0231 (78)

Solar gains	187.6478	321.1004	443.6989	557.8154	632.6915	631.7326	607.5419	551.0322	483.0671	356.0143	225.0148	160.4278 (83)
Total gains	595.3793	726.7154	834.7123	925.1729	975.9374	951.7624	912.9340	863.2041	807.7211	704.5430	600.6346	556.1724 (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)												
tau	53.4595	53.5742	53.6871	54.2239	54.3255	54.8036	54.8036	54.8931	54.6184	54.3255	54.1203	53.9074
alpha	4.5640	4.5716	4.5791	4.6149	4.6217	4.6536	4.6536	4.6595	4.6412	4.6217	4.6080	4.5938
util living area	0.9966	0.9911	0.9775	0.9390	0.8485	0.6874	0.5220	0.5696	0.8025	0.9591	0.9925	0.9975 (86)
MIT	19.6346	19.8416	20.1342	20.4864	20.7748	20.9397	20.9865	20.9800	20.8725	20.4865	19.9874	19.5964 (87)
Th 2	19.8416	19.8438	19.8459	19.8560	19.8579	19.8667	19.8667	19.8683	19.8633	19.8579	19.8541	19.8501 (88)
util rest of house	0.9954	0.9881	0.9696	0.9169	0.7948	0.5890	0.3947	0.4403	0.7184	0.9397	0.9895	0.9966 (89)
MIT 2	18.0422	18.3446	18.7679	19.2693	19.6440	19.8281	19.8620	19.8606	19.7668	19.2811	18.5656	17.9924 (90)
Living area fraction									fLA = Living area / (4) =			0.3486 (91)
MIT	18.5974	18.8665	19.2443	19.6936	20.0382	20.2156	20.2541	20.2509	20.1523	19.7013	19.0613	18.5516 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5974	18.8665	19.2443	19.6936	20.0382	20.2156	20.2541	20.2509	20.1523	19.7013	19.0613	18.5516 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9936	0.9846	0.9643	0.9131	0.8043	0.6212	0.4394	0.4857	0.7422	0.9363	0.9865	0.9952 (94)
Ext temp.	591.5544	715.5400	804.8780	844.7490	784.9485	591.2480	401.1263	419.2565	599.5141	659.6706	592.4972	553.4946 (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	1630.1040	1588.9733	1446.8684	1213.2780	935.5238	624.5573	406.3979	427.5869	675.4042	1021.1396	1347.1028	1622.6894 (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	772.6809	586.9472	477.6409	265.3409	112.0280	0.0000	0.0000	0.0000	0.0000	268.9329	543.3160	795.4809 (98)
												3822.3677 (98)
												43.5498 (99)

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													4092.4708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	772.6809	586.9472	477.6409	265.3409	112.0280	0.0000	0.0000	0.0000	0.0000	268.9329	543.3160	795.4809	(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)	827.2815	628.4231	511.3928	284.0909	119.9443	0.0000	0.0000	0.0000	0.0000	287.9367	581.7088	851.6926	(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	207.2447	182.7159	190.8486	169.2731	163.8862	144.3418	138.2905	154.1615	155.8640	177.4823	188.6921	202.3133	(64)
Efficiency of water heater (217)m	88.0576	87.7790	87.2664	86.1783	84.1158	80.3000	80.3000	80.3000	80.3000	86.0947	87.5611	88.1519	(217)
Fuel for water heating, kWh/month	235.3513	208.1546	218.6966	196.4220	194.8341	179.7532	172.2173	191.9819	194.1022	206.1476	215.4977	229.5054	(219)
Water heating fuel used												2442.6640	(219)
Annual totals kWh/year													
Space heating fuel - main system												4092.4708	(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)												369.7850	(232)
Total delivered energy for all uses												6979.9198	(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	4092.4708	0.2160	883.9737 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2442.6640	0.2160	527.6154 (264)
Space and water heating			1411.5891 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	369.7850	0.5190	191.9184 (268)
Total CO2, kg/m2/year			1642.4325 (272)
Emissions per m2 for space and water heating			16.0828 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1866 (272b)
Emissions per m2 for pumps and fans			0.4435 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0828 * 1.00) + 2.1866 + 0.4435, rounded to 2 d.p.			18.7100 (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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (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) =
Measured/design AP50					Yes
Infiltration rate					3.6500
Number of sides sheltered					0.3249 (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) =				0.2762 (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	0.3521	0.3452	0.3383	0.3038	0.2969	0.2624	0.2624	0.2555	0.2762	0.2969	0.3107	0.3245 (22b)
Effective ac	0.5620	0.5596	0.5572	0.5461	0.5441	0.5344	0.5344	0.5326	0.5381	0.5441	0.5483	0.5527 (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			2.0600	1.0000	2.0600		(26)
Opening Type 2 (Uw = 1.30)			20.4400	1.2357	25.2586		(27)
WT-E-01	68.0600	20.4400	47.6200	0.2000	9.5240		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.2544	4.0811		(29a)
Flat	87.7700		87.7700	0.1500	13.1655		(30)
Total net area of external elements Aum, m ²			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0892		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			87.7700				(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)							23.5496 (36)
Total fabric heat loss						(33) + (36) =	77.6387 (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	39.0666	38.8993	38.7352	37.9647	37.8206	37.1495	37.1495	37.0253	37.4080	37.8206	38.1122	38.4171 (38)
Heat transfer coeff	116.7053	116.5380	116.3739	115.6035	115.4593	114.7883	114.7883	114.6640	115.0467	115.4593	115.7509	116.0558 (39)
Average = Sum(39)m / 12 =												115.6028 (39)
HLP	1.3297	1.3278	1.3259	1.3171	1.3155	1.3078	1.3078	1.3064	1.3108	1.3155	1.3188	1.3223 (40)
HLP (average)												1.3171 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)										Total = Sum(45)m =		1507.4063 (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	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	33.2107	29.0463	29.9732	26.1314	25.0737	21.6367	20.0495	23.0072	23.2819	27.1328	29.6176	32.1628 (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	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9428	18.6012	15.1275	11.4525	8.5609	7.2275	7.8095	10.1511	13.6248	17.2998	20.1915	21.5249	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.9148	237.3524	231.2096	218.1321	201.6242	186.1090	175.7440	173.3063	179.4492	192.5266	209.0346	224.5497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	(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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	(71)
Water heating gains (Table 5)	44.6381	43.2237	40.2866	36.2936	33.7012	30.0509	26.9483	30.9236	32.3360	36.4689	41.1356	43.2296	(72)
Total internal gains	362.4049	361.0866	348.5329	327.7874	305.7955	285.2967	272.4111	276.2903	287.3193	308.2046	332.2709	351.2134	(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	5.2400	10.6334	0.4500	0.0000	0.7700	19.3066	(74)
East	4.9800	19.6403	0.4500	0.0000	0.7700	33.8906	(76)
South	10.2200	46.7521	0.4500	0.0000	0.7700	165.5598	(78)

Solar gains	218.7571	374.3376	517.2672	650.3058	737.5926	736.4715	708.2716	642.3967	563.1638	415.0417	262.3197	187.0239	(83)
Total gains	581.1620	735.4242	865.8001	978.0932	1043.3881	1021.7682	980.6827	918.6869	850.4831	723.2463	594.5906	538.2373	(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	52.2267	52.3017	52.3755	52.7245	52.7904	53.0990	53.0990	53.1565	52.9797	52.7904	52.6574	52.5190	
alpha	4.4818	4.4868	4.4917	4.5150	4.5194	4.5399	4.5399	4.5438	4.5320	4.5194	4.5105	4.5013	
util living area	0.9969	0.9908	0.9751	0.9305	0.8304	0.6652	0.5024	0.5535	0.7899	0.9572	0.9929	0.9978	(86)
MIT	19.5809	19.8106	20.1257	20.4926	20.7846	20.9428	20.9871	20.9803	20.8731	20.4718	19.9426	19.5344	(87)
Th 2	19.8177	19.8191	19.8206	19.8274	19.8287	19.8347	19.8347	19.8358	19.8324	19.8287	19.8261	19.8234	(88)
util rest of house	0.9958	0.9877	0.9664	0.9059	0.7730	0.6551	0.3757	0.4236	0.7026	0.9368	0.9900	0.9970	(89)
MIT 2	18.5409	18.7700	19.0809	19.4358	19.6916	19.8103	19.8318	19.8308	19.7680	19.4257	18.9080	18.4990	(90)
Living area fraction	18.9035	19.1328	19.4451	19.8042	20.0727	20.2051	20.2346	20.2315	20.1533	19.7904	19.2687	18.8600	(91)
MIT	18.9035	19.1328	19.4451	19.8042	20.0727	20.2051	20.2346	20.2315	20.1533	19.7904	19.2687	18.8600	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9035	19.1328	19.4451	19.8042	20.0727	20.2051	20.2346	20.2315	20.1533	19.7904	19.2687	18.8600	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9854	0.9629	0.9054	0.7862	0.5987	0.4203	0.4693	0.7292	0.9360	0.9881	0.9961	(94)
Useful gains	578.0698	724.6518	833.6717	885.5402	820.3537	611.7823	412.2136	431.1754	620.1832	676.9348	587.5046	536.1637	(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	1704.3052	1658.6603	1506.4771	1260.5683	966.7010	643.4025	417.2072	439.3402	696.4129	1061.1187	1408.5391	1701.3782	(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	837.9191	627.6537	500.5673	270.0203	108.8824	0.0000	0.0000	0.0000	0.0000	285.8328	591.1448	866.9196	(98)
Space heating												4088.9400	(98)
Space heating per m2												(98) / (4) =	46.5870 (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	1079.0097	849.4331	871.4463	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8847	0.9358	0.9170	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	954.5951	794.8967	799.1453	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1291.7418	1241.6632	1170.8574	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	242.7456	332.3942	276.5538	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												851.6936 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	60.6864	83.0986	69.1384	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												212.9234 (107)
Space cooling per m2												2.4259 (108)
Energy for space heating												46.5870 (99)
Energy for space cooling												2.4259 (108)
Total												49.0129 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.0 (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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1424 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3924 (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) =		0.3336 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4253	0.4169	0.4086	0.3669	0.3586	0.3169	0.3169	0.3085	0.3336	0.3586	0.3752	0.3919 (22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			19.8800	1.3258	26.3561		(27)
WT-E-01	68.0600	19.8800	48.1800	0.1800	8.6724		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.1800	2.8872		(29a)
Flat	87.7700		87.7700	0.1300	11.4101		(30)
Total net area of external elements Aum, m ²			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.3858		(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)							21.5852 (36)
Total fabric heat loss						(33) + (36) =	72.9710 (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	41.0432	40.7991	40.5599	39.4360	39.2257	38.2469	38.2469	38.0656	38.6239	39.2257	39.6511	40.0958 (38)
Heat transfer coeff	114.0142	113.7701	113.5308	112.4070	112.1967	111.2179	111.2179	111.0366	111.5949	112.1967	112.6221	113.0668 (39)
Average = Sum(39)m / 12 =												112.4060 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2990	1.2962	1.2935	1.2807	1.2783	1.2672	1.2672	1.2651	1.2714	1.2783	1.2832	1.2882 (40)
HLP (average)												1.2807 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)												Total = Sum(45)m = 1507.4063 (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	33.2107	29.0463	29.9732	26.1314	25.0737	21.6367	20.0495	23.0072	23.2819	27.1328	29.6176	32.1628 (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	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	129.6975	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.9388	18.5976	15.1246	11.4503	8.5592	7.2261	7.8080	10.1492	13.6222	17.2965	20.1875	21.5207	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.9148	237.3524	231.2096	218.1321	201.6242	186.1090	175.7440	173.3063	179.4492	192.5266	209.0346	224.5497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	35.9697	(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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	(71)
Water heating gains (Table 5)	44.6381	43.2237	40.2866	36.2936	33.7012	30.0509	26.9483	30.9236	32.3360	36.4689	41.1356	43.2296	(72)
Total internal gains	362.4009	361.0830	348.5300	327.7852	305.7938	285.2953	272.4096	276.2883	287.3166	308.2012	332.2669	351.2093	(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	5.1000	10.6334	0.6300	0.7000	0.7700	16.5735	(74)
East	4.8400	19.6403	0.6300	0.7000	0.7700	29.0512	(76)
South	9.9400	46.7521	0.6300	0.7000	0.7700	142.0231	(78)

Solar gains	187.6478	321.1004	443.6989	557.8154	632.6915	631.7326	607.5419	551.0322	483.0671	356.0143	225.0148	160.4278	(83)
Total gains	550.0487	682.1834	792.2289	885.6006	938.4853	917.0278	879.9515	827.3205	770.3837	664.2155	557.2818	511.6371	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	53.4595	53.5742	53.6871	54.2239	54.3255	54.8036	54.8036	54.8931	54.6184	54.3255	54.1203	53.9074	
alpha	4.5640	4.5716	4.5791	4.6149	4.6217	4.6536	4.6536	4.6595	4.6412	4.6217	4.6080	4.5938	
util living area	0.9975	0.9931	0.9815	0.9471	0.8627	0.7060	0.5394	0.5907	0.8225	0.9667	0.9945	0.9982	(86)
MIT	19.5881	19.7970	20.0942	20.4551	20.7556	20.9326	20.9846	20.9768	20.8573	20.4514	19.9436	19.5505	(87)
Th 2	19.8416	19.8438	19.8459	19.8560	19.8579	19.8667	19.8667	19.8683	19.8633	19.8579	19.8541	19.8501	(88)
util rest of house	0.9967	0.9907	0.9748	0.9273	0.8117	0.6076	0.4089	0.4583	0.7415	0.9503	0.9922	0.9976	(89)
MIT 2	18.5668	18.7762	19.0713	19.4271	19.6973	19.8368	19.8630	19.8621	19.7880	19.4318	18.9311	18.5359	(90)
Living area fraction									fLA = Living area / (4) =			0.3486	(91)
MIT	18.9228	19.1321	19.4279	19.7855	20.0663	20.2188	20.2540	20.2507	20.1608	19.7873	19.2841	18.8896	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9228	19.1321	19.4279	19.7855	20.0663	20.2188	20.2540	20.2507	20.1608	19.7873	19.2841	18.8896	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9888	0.9718	0.9258	0.8222	0.6403	0.4549	0.5050	0.7654	0.9490	0.9906	0.9969	(94)
Useful gains	547.7073	674.5325	769.8559	819.8746	771.6208	587.1862	400.3108	417.8024	589.6153	630.3646	552.0428	510.0506	(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	1667.2115	1619.1865	1467.7152	1223.6053	938.6686	624.9103	406.3932	427.5722	676.3495	1030.7803	1372.1967	1660.9079	(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	832.9112	634.8075	519.2073	290.6861	124.2836	0.0000	0.0000	0.0000	0.0000	297.9093	590.5108	856.2378	(98)
Space heating												4146.5536	(98)
Space heating per m2												47.2434	(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	1045.4479	823.0122	843.8781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8659	0.9242	0.9039	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	905.2221	760.6133	762.7497	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.3161	1123.9234	1064.0628	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	190.1477	270.3027	224.1770	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												684.6274	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	47.5369	67.5757	56.0442	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											171.1568 (107)
Space cooling per m2											1.9501 (108)
Energy for space heating											47.2434 (99)
Energy for space cooling											1.9501 (108)
Total											49.1935 (109)
Target Fabric Energy Efficiency (TFEE)											56.6 (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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test							Yes					
Measured/design AP50								3.6500				
Infiltration rate								0.1825	(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) =	0.1551	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1629	0.1551	0.1551	0.1435	0.1435	0.1280	0.1319	0.1241	0.1280	0.1357	0.1357	0.1474 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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			2.0600	1.0000	2.0600		(26)
Opening Type 2 (Uw = 1.30)			20.4400	1.2357	25.2586		(27)
WT-E-01	68.0600	20.4400	47.6200	0.2000	9.5240		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.2544	4.0811		(29a)
Flat	87.7700		87.7700	0.1500	13.1655		(30)
Total net area of external elements Aum(A, m ²)			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0892		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			87.7700				(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)							23.5496 (36)
Total fabric heat loss							(33) + (36) = 77.6387 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
Daily hot water use	Jan 105.3869	Feb 101.5547	Mar 97.7224	Apr 93.8902	May 90.0579	Jun 86.2257	Jul 86.2257	Aug 90.0579	Sep 93.8902	Oct 97.7224	Nov 101.5547	Dec 105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)												Total = Sum(45)m = 1507.4063 (45)
Distribution loss (46)m = 0.15 x (45)m	23.4429	20.5033	21.1576	18.4457	17.6991	15.2729	14.1526	16.2403	16.4343	19.1526	20.9066	22.7032 (46)

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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	14.1316	12.7533	14.0874	13.5899	14.0116	13.5235	13.9518	13.9906	13.5597	14.0560	13.6473	14.1198	(61)
Total heat required for water heating calculated for each month	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(64)
								Total per year (kWh/year) = Sum(64)m =					1672.8289 (64)
RHI water heating demand												1673	(64)
Heat gains from water heating, kWh/month	55.4979	48.6373	50.4211	44.2854	42.7358	37.2359	34.8596	39.4971	39.8193	45.9689	49.7547	53.8553	(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	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.3571	46.5031	37.8188	28.6313	21.4022	18.0687	19.5238	25.3778	34.0620	43.2496	50.4787	53.8122 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.6191	354.2574	345.0889	325.5703	300.9316	277.7747	262.3045	258.6661	267.8346	287.3532	311.9919	335.1488 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576 (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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580 (71)
Water heating gains (Table 5)	74.5940	72.3769	67.7703	61.5075	57.4406	51.7165	46.8543	53.0875	55.3046	61.7862	69.1037	72.3862 (72)
Total internal gains	585.6068	581.1740	558.7147	523.7457	487.8111	455.5965	436.7192	445.1680	465.2379	500.4256	539.6109	569.3838 (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						5.2400	11.9814	0.4500	0.0000	0.7700		21.7542 (74)
East						4.9800	22.3313	0.4500	0.0000	0.7700		38.5342 (76)
South						10.2200	50.9848	0.4500	0.0000	0.7700		180.5490 (78)
Solar gains	240.8375	370.9150	507.4763	661.0544	734.3607	786.5981	747.5186	690.2756	600.0017	439.3317	295.8524	203.9365 (83)
Total gains	826.4442	952.0890	1066.1909	1184.8001	1222.1718	1242.1946	1184.2378	1135.4436	1065.2396	939.7573	835.4633	773.3203 (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	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293
alpha	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153
util living area	0.9845	0.9705	0.9339	0.8425	0.6783	0.4460	0.2935	0.3157	0.5857	0.8664	0.9661	0.9880 (86)
MIT	19.9826	20.1566	20.4431	20.7393	20.9267	20.9916	20.9991	20.9987	20.9707	20.7468	20.3164	19.9308 (87)
Th 2	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561 (88)
util rest of house	0.9794	0.9612	0.9134	0.7977	0.6005	0.3471	0.1856	0.2034	0.4817	0.8167	0.9534	0.9840 (89)
MIT 2	18.9687	19.1379	19.4107	19.6743	19.8178	19.8538	19.8560	19.8560	19.8454	19.6884	19.2958	18.9180 (90)
Living area fraction									fLA = Living area / (4) =			0.3486 (91)
MIT	19.3222	19.4930	19.7706	20.0456	20.2044	20.2505	20.2545	20.2544	20.2377	20.0574	19.6516	19.2711 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1722	19.3430	19.6206	19.8956	20.0544	20.1005	20.1045	20.1044	20.0877	19.9074	19.5016	19.1211 (93)

8. Space heating requirement

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (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					3.6500
Infiltration rate					0.1825 (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) =				0.1551 (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	0.1978	0.1939	0.1900	0.1706	0.1668	0.1474	0.1474	0.1435	0.1551	0.1668	0.1745	0.1823 (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			2.0600	1.0000	2.0600		(26)
Opening Type 2 (Uw = 1.30)			20.4400	1.2357	25.2586		(27)
WT-E-01	68.0600	20.4400	47.6200	0.2000	9.5240		(29a)
WT-I-01 Common	18.1000	2.0600	16.0400	0.2544	4.0811		(29a)
Flat	87.7700		87.7700	0.1500	13.1655		(30)
Total net area of external elements Aum(A, m2)			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.0892	(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			87.7700				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.5496 (36)
Total fabric heat loss							(33) + (36) = 77.6387 (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	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569 (38)
Average = Sum(39)m / 12 =	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)										Total = Sum(45)m =	1507.4063 (45)	
Distribution loss (46)m = 0.15 x (45)m	23.4429	20.5033	21.1576	18.4457	17.6991	15.2729	14.1526	16.2403	16.4343	19.1526	20.9066	22.7032 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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	14.1316	12.7533	14.0874	13.5899	14.0116	13.5235	13.9518	13.9906	13.5597	14.0560	13.6473	14.1198	(61)
Total heat required for water heating calculated for each month	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(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	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(64)
Heat gains from water heating, kWh/month	55.4979	48.6373	50.4211	44.2854	42.7358	37.2359	34.8596	39.4971	39.8193	45.9689	49.7547	53.8553	(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	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.3571	46.5031	37.8188	28.6313	21.4022	18.0687	19.5238	25.3778	34.0620	43.2496	50.4787	53.8122	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.6191	354.2574	345.0889	325.5703	300.9316	277.7747	262.3045	258.6661	267.8346	287.3532	311.9919	335.1488	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	(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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	(71)
Water heating gains (Table 5)	74.5940	72.3769	67.7703	61.5075	57.4406	51.7165	46.8543	53.0875	55.3046	61.7862	69.1037	72.3862	(72)
Total internal gains	585.6068	581.1740	558.7147	523.7457	487.8111	455.5965	436.7192	445.1680	465.2379	500.4256	539.6109	569.3838	(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					5.2400	10.6334	0.4500	0.0000			0.7700			19.3066 (74)
East					4.9800	19.6403	0.4500	0.0000			0.7700			33.8906 (76)
South					10.2200	46.7521	0.4500	0.0000			0.7700			165.5598 (78)
Solar gains	218.7571	374.3376	517.2672	650.3058	737.5926	736.4715	708.2716	642.3967	563.1638	415.0417	262.3197	187.0239	(83)	
Total gains	804.3638	955.5116	1075.9819	1174.0515	1225.4037	1192.0680	1144.9908	1087.5647	1028.4017	915.4673	801.9306	756.4077	(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	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293		
alpha	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153		
util living area	0.9885	0.9745	0.9446	0.8766	0.7511	0.5787	0.4268	0.4672	0.6907	0.9060	0.9770	0.9912	(86)	
MIT	19.8692	20.0819	20.3589	20.6542	20.8694	20.9692	20.9938	20.9907	20.9318	20.6451	20.1860	19.8100	(87)	
Th 2	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	(88)	
util rest of house	0.9848	0.9668	0.9280	0.8409	0.6867	0.4856	0.3185	0.3552	0.5994	0.8701	0.9686	0.9883	(89)	
MIT 2	18.8566	19.0647	19.3307	19.6009	19.7774	19.8436	19.8547	19.8538	19.8242	19.6013	19.1695	18.7983	(90)	
Living area fraction									fLA = Living area / (4) =			0.3486	(91)	
MIT	19.2096	19.4193	19.6892	19.9682	20.1582	20.2361	20.2519	20.2502	20.2104	19.9652	19.5239	19.1510	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.0596	19.2693	19.5392	19.8182	20.0082	20.0861	20.1019	20.1002	20.0604	19.8152	19.3739	19.0010	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9814	0.9618	0.9225	0.8396	0.6959	0.5050	0.3421	0.3796	0.6169	0.8686	0.9640	0.9855	(94)
Ext temp.	789.4370	918.9817	992.5541	985.7295	852.7963	602.0465	391.7211	412.8303	634.4171	795.1949	773.1003	745.4206	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.0600	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1658.9183	1615.0483	1465.5493	1227.1531	933.8001	616.6100	393.5955	415.8842	669.9185	1035.7522	1379.5306	1663.5693	(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	646.8941	467.7568	351.9084	173.8250	60.2669	0.0000	0.0000	0.0000	0.0000	178.9746	436.6298	683.1027	(98)
Space heating per m2												2999.3582	(98)
										(98) / (4) =		34.1729	(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													3314.2080 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	646.8941	467.7568	351.9084	173.8250	60.2669	0.0000	0.0000	0.0000	0.0000	178.9746	436.6298	683.1027	(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)	714.8001	516.8583	388.8491	192.0718	66.5932	0.0000	0.0000	0.0000	0.0000	197.7620	482.4639	754.8096	(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	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(64)
Efficiency of water heater (217)m	89.8136	89.7039	89.4963	89.0636	88.2784	87.3000	87.3000	87.3000	87.3000	89.0573	89.6472	87.3000	(216)
Fuel for water heating, kWh/month	189.7458	166.5947	173.3454	153.3297	149.5329	132.1227	124.0580	140.0453	141.0329	159.1560	170.6961	184.1514	(219)
Water heating fuel used												1883.8109	(219)
Annual totals kWh/year													
Space heating fuel - main system												3314.2080	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													47.2863 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													122.2863 (231)
Electricity for lighting (calculated in Appendix L)													369.8568 (232)
Total delivered energy for all uses													5690.1619 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3314.2080	3.4800	115.3344 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1883.8109	3.4800	65.5566 (247)
Mechanical ventilation fans	47.2863	13.1900	6.2371 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	369.8568	13.1900	48.7841 (250)
Additional standing charges			120.0000 (251)
Total energy cost			365.8047 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1572 (257)
SAP value		83.8574
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	3314.2080	0.2160	715.8689 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1883.8109	0.2160	406.9032 (264)
Space and water heating			1122.7721 (265)
Pumps and fans	122.2863	0.5190	63.4666 (267)
Energy for lighting	369.8568	0.5190	191.9557 (268)
Total kg/year			1378.1943 (272)
CO2 emissions per m2			15.7000 (273)
EI value			86.0904
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	87.7700 (1b)	x 2.4000 (2b)	= 210.6480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.7700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.6480 (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					3.6500
Infiltration rate					0.1825 (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) =				0.1551 (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	0.1629	0.1551	0.1551	0.1435	0.1435	0.1280	0.1319	0.1241	0.1280	0.1357	0.1357	0.1474 (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			2.0600	1.0000	2.0600		(26)
Opening Type 2 (Uw = 1.30)			20.4400	1.2357	25.2586		(27)
WT-E-01	68.0600	20.4400	47.6200	0.2000	9.5240		(29a)
WT-T-01 Common	18.1000	2.0600	16.0400	0.2544	4.0811		(29a)
Flat	87.7700		87.7700	0.1500	13.1655		(30)
Total net area of external elements Aum(A, m ²)			173.9300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.0892	(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			87.7700				(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)							23.5496 (36)
Total fabric heat loss							(33) + (36) = 77.6387 (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
	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569	34.7569 (38)
Heat transfer coeff	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956	112.3956 (39)
Average = Sum(39)m / 12 =												112.3956 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806	1.2806 (40)
HLP (average)												1.2806 (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												2.5939 (42)
Average daily hot water use (litres/day)												95.8063 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.3869	101.5547	97.7224	93.8902	90.0579	86.2257	86.2257	90.0579	93.8902	97.7224	101.5547	105.3869 (44)
Energy conte	156.2858	136.6885	141.0503	122.9711	117.9937	101.8196	94.3508	108.2689	109.5620	127.6840	139.3770	151.3544 (45)
Energy content (annual)												Total = Sum(45)m = 1507.4063 (45)
Distribution loss (46)m = 0.15 x (45)m	23.4429	20.5033	21.1576	18.4457	17.6991	15.2729	14.1526	16.2403	16.4343	19.1526	20.9066	22.7032 (46)

Southern Energy
Consultants
Energy & Sustainability Solutions

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	14.1316	12.7533	14.0874	13.5899	14.0116	13.5235	13.9518	13.9906	13.5597	14.0560	13.6473 (61)
Total heat required for water heating calculated for each month											
	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243 (64)
Total per year (kWh/year) = Sum(64)m =											1672.8289 (64)
Heat gains from water heating, kWh/month											
	55.4979	48.6373	50.4211	44.2854	42.7358	37.2359	34.8596	39.4971	39.8193	45.9689	53.8553 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370	155.6370 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.3571	46.5031	37.8188	28.6313	21.4022	18.0687	19.5238	25.3778	34.0620	43.2496	50.4787	53.8122 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	350.6191	354.2574	345.0889	325.5703	300.9316	277.7747	262.3045	258.6661	267.8346	287.3532	311.9919	335.1488 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576	53.1576 (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)	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580	-103.7580 (71)
Water heating gains (Table 5)	74.5940	72.3769	67.7703	61.5075	57.4406	51.7165	46.8543	53.0875	55.3046	61.7862	69.1037	72.3862 (72)
Total internal gains	585.6068	581.1740	558.7147	523.7457	487.8111	455.5965	436.7192	445.1680	465.2379	500.4256	539.6109	569.3838 (73)

[Jan					Area	Solar flux		g	FF	Access		Gains
					m2	Table 6a	Specific data		Specific data	factor	W	
						W/m2	or Table 6b		or Table 6c	Table 6d		
North					5.2400	11.9814	0.4500		0.0000	0.7700	21.7542 (74)	
East					4.9800	22.3313	0.4500		0.0000	0.7700	38.5342 (76)	
South					10.2200	50.9848	0.4500		0.0000	0.7700	180.5490 (78)	
Solar gains	240.8375	370.9150	507.4763	661.0544	734.3607	786.5981	747.5186	690.2756	600.0017	439.3317	295.8524	203.9365 (83)
Total gains	826.4442	952.0890	1066.1909	1184.8001	1222.1718	1242.1946	1184.2378	1135.4436	1065.2396	939.7573	835.4633	773.3203 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293	54.2293
alpha	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153	4.6153
util living area	0.9845	0.9705	0.9339	0.8425	0.6783	0.4460	0.2935	0.3157	0.5857	0.8664	0.9661	0.9880 (86)
MIT	19.9826	20.1566	20.4431	20.7393	20.9267	20.9916	20.9991	20.9987	20.9707	20.7468	20.3164	19.9308 (87)
Th 2	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561	19.8561 (88)
util rest of house	0.9794	0.9612	0.9134	0.7977	0.6005	0.3471	0.1856	0.2034	0.4817	0.8167	0.9534	0.9840 (89)
MIT 2	18.9687	19.1379	19.4107	19.6743	19.8178	19.8538	19.8560	19.8560	19.8454	19.6884	19.2958	18.9180 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.3486 (91)
MIT	19.3222	19.4930	19.7706	20.0456	20.2044	20.2505	20.2545	20.2544	20.2377	20.0574	19.6516	19.2711 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1722	19.3430	19.6206	19.8956	20.0544	20.1005	20.1045	20.1044	20.0877	19.9074	19.5016	19.1211 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9755	0.9560	0.9084	0.7994	0.6148	0.3686	0.2091	0.2279	0.5037	0.8193	0.9484	0.9806 (94)
Useful gains	806.1846	910.1769	968.5227	947.1212	751.4319	457.8810	247.6361	258.7833	536.5287	769.8984	792.3352	758.3077 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W												
Month fracti	1581.6487	1544.6580	1373.5445	1123.4598	792.8833	460.8769	247.7795	259.0014	549.3616	933.7120	1292.7336	1575.9068 (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)
	576.9453	426.3713	301.3362	126.9638	30.8399	0.0000	0.0000	0.0000	0.0000	121.8774	360.2869	608.2937 (98)
Space heating												2552.9145 (98)
Space heating per m2												29.0864 (99)
										(98) / (4) =		

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

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													2820.9000 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.9453	426.3713	301.3362	126.9638	30.8399	0.0000	0.0000	0.0000	0.0000	121.8774	360.2869	608.2937	(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)	637.5086	471.1285	332.9682	140.2915	34.0772	0.0000	0.0000	0.0000	0.0000	134.6711	398.1070	672.1478	(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	170.4174	149.4419	155.1377	136.5610	132.0053	115.3431	108.3026	122.2595	123.1217	141.7400	153.0243	165.4743	(64)
Efficiency of water heater (217)m	89.7498	89.6472	89.3865	88.8130	87.8885	87.3000	87.3000	87.3000	87.3000	88.7509	89.5218	87.3000	(216)
Fuel for water heating, kWh/month	189.8805	166.7001	173.5584	153.7624	150.1963	132.1227	124.0580	140.0453	141.0329	159.7055	170.9354	184.2778	(219)
Water heating fuel used												1886.2751	(219)
Annual totals kWh/year													
Space heating fuel - main system												2820.9000	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3360, total flow = 29.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													47.2863 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													122.2863 (231)
Electricity for lighting (calculated in Appendix L)													369.8568 (232)
Total delivered energy for all uses													5199.3181 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2820.9000	3.8700	109.1688 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1886.2751	3.8700	72.9988 (247)
Mechanical ventilation fans	47.2863	18.9000	8.9371 (249)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	369.8568	18.9000	69.9029 (250)
Additional standing charges			93.0000 (251)
Total energy cost			368.1827 (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	2820.9000	0.2160	609.3144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1886.2751	0.2160	407.4354 (264)
Space and water heating			1016.7498 (265)
Pumps and fans	122.2863	0.5190	63.4666 (267)
Energy for lighting	369.8568	0.5190	191.9557 (268)
Total kg/year			1272.1721 (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	2820.9000	1.2200	3441.4979 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1886.2751	1.2200	2301.2556 (264)
Space and water heating			5742.7536 (265)
Pumps and fans	122.2863	3.0700	375.4188 (267)
Energy for lighting	369.8568	3.0700	1135.4603 (268)
Primary energy kWh/year			7253.6327 (272)
Primary energy kWh/m2/year			82.6436 (273)

SAP 2012 EPC IMPROVEMENTS

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

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 86

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	£93	£93	£0
Mains gas	£275	£275	£0
Space heating	£225	£225	£0
Water heating	£73	£73	£0
Lighting	£70	£70	£0
Total cost of fuels	£368	£368	£0
Total cost of uses	£368	£368	£0
Delivered energy	59 kWh/m²	59 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	83 kWh/m²	83 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)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	208.54 (P1)
Transmission heat loss coefficient	77.64 (37)
Summer heat loss coefficient	286.18 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
South	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)
South	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.2400	81.1852	0.4500	0.0000	0.9000	172.2912
East	4.9800	117.5071	0.4500	0.0000	0.9000	237.0000
South	10.2200	112.2060	0.4500	0.0000	0.9000	464.4318
total:						873.7230

	Jun	Jul	Aug	
Solar gains	919	874	807	(P4)
Internal gains	453	434	442	
Total summer gains	1372	1307	1249	(P5)
Summer gain/loss ratio	4.79	4.57	4.36	(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	21.04	22.72	22.41	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			