

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW025_048_As_Built				Issued on Date	01/03/2022
Assessment Reference	001	Prop Type Ref	GFF			
Property						
SAP Rating	83 B	DER	20.00	TER	21.44	
Environmental	86 B	% DER<TER	6.70			
CO ₂ Emissions (t/year)	1.01	DFEE	53.46	TFEE	61.44	
General Requirements Compliance	Pass	% DFEE<TFEE	13.00			
Assessor Details	Mr. Stephen Smith, Southern Energy Consultants Limited, Tel: 01635261582, info@southernenergyconsultants.co.uk				Assessor ID	d168-0001
Client	Bellway Homes Thames Valley					

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

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DWELLING AS BUILT

Ground-floor flat, total floor area 61 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) 21.44 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.00 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.36 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof (no roof)			
Openings	1.26 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.82 (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	OK
Minimum: 88.0%	

Secondary heating system:	None
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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
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Boiler interlock	Yes	OK
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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
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Based on:

Overshading:	Average
Windows facing North:	9.04 m ² , No overhang
Windows facing West:	2.88 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As 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	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.2410 (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) =	0.2049 (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	0.2612	0.2561	0.2509	0.2253	0.2202	0.1946	0.1946	0.1895	0.2049	0.2202	0.2305	0.2407 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5112	0.5061	0.5009	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)			11.9200	1.2357	14.7300		(27)
Heat Loss Floor			60.9700	0.1000	6.0970		(28a)
WT-E-01	62.2600	11.9200	50.3400	0.2000	10.0680		(29a)
WT-I-01 Common	16.9400	2.0600	14.8800	0.2544	3.7860		(29a)
WT-I-11	6.0000		6.0000	0.3600	2.1600		(29a)
Total net area of external elements Aum(A, m ²)			146.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.9010		(33)
Party Ceilings 1			60.9700				(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)							11.3397 (36)
Total fabric heat loss						(33) + (36) =	50.2407 (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	24.6842	24.4369	24.1896	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441 (38)
Heat transfer coeff	74.9248	74.6776	74.4303	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848 (39)
Average = Sum(39)m / 12 =												74.4580 (39)
HLP	1.2289	1.2248	1.2208	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200 (40)
HLP (average)												1.2212 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)										Total = Sum(45)m =		1288.7936 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0430	17.5298	18.0892	15.7706	15.1322	13.0580	12.1001	13.8851	14.0509	16.3750	17.8746	19.4106 (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	14.0455	12.6688	13.9984	13.5154	13.9430	13.4668	13.8993	13.9276	13.4933	13.9755	13.5611	14.0364	(61)
Total heat required for water heating calculated for each month	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Heat gains from water heating, kWh/month	47.9401	42.0249	43.5972	38.3369	37.0289	32.3119	30.2968	34.2605	34.5195	39.7917	43.0122	46.5360	(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	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7859	14.0209	11.4026	8.6325	6.4529	5.4478	5.8865	7.6515	10.2699	13.0399	15.2195	16.2246	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.3865	177.2065	172.6202	162.8566	150.5319	138.9483	131.2098	129.3899	133.9761	143.7397	156.0644	167.6480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	(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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	(71)
Water heating gains (Table 5)	64.4357	62.5370	58.5984	53.2457	49.7700	44.8776	40.7215	46.0490	47.9437	53.4835	59.7392	62.5484	(72)
Total internal gains	311.7419	309.8982	298.7551	280.8687	262.8886	245.4076	233.9517	239.2243	248.3235	266.3970	287.1571	302.5548	(73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				9.0400	10.6334	0.4500		0.0000		0.7700			33.3076 (74)
West				2.8800	19.6403	0.4500		0.0000		0.7700			19.5994 (80)
Solar gains	52.9070	101.9932	171.3028	265.8228	346.8940	366.0728	343.9029	280.0598	203.4811	121.2644	65.5274	43.8845 (83)	
Total gains	364.6489	411.8914	470.0578	546.6915	609.7826	611.4803	577.8546	519.2841	451.8046	387.6614	352.6844	346.4393 (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	56.5103	56.6975	56.8858	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206		
alpha	4.7674	4.7798	4.7924	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947		
util living area	0.9980	0.9961	0.9894	0.9619	0.8752	0.7107	0.5497	0.6255	0.8756	0.9815	0.9962	0.9985	(86)	
MIT	19.6526	19.7964	20.0660	20.4309	20.7595	20.9369	20.9853	20.9736	20.8211	20.4021	19.9618	19.6254	(87)	
Th 2	19.8970	19.9002	19.9034	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	(88)	
util rest of house	0.9973	0.9947	0.9855	0.9469	0.8277	0.6148	0.4212	0.4926	0.8081	0.9717	0.9946	0.9979	(89)	
MIT 2	18.6746	18.8205	19.0907	19.4464	19.7435	19.8757	19.9004	19.8966	19.8027	19.4243	18.9889	18.6531	(90)	
Living area fraction	19.0102	19.1554	19.4254	19.7842	20.0921	20.2399	20.2727	20.2662	20.1521	19.7598	19.3227	18.9867	(92)	
Temperature adjustment	18.8602	19.0054	19.2754	19.6342	19.9421	20.0899	20.1227	20.1162	20.0021	19.6098	19.1727	18.8367	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9964	0.9931	0.9824	0.9423	0.8297	0.6324	0.4478	0.5199	0.8153	0.9681	0.9931	0.9972	(94)
Ext temp.	363.3395	409.0592	461.7961	515.1432	505.9117	386.6979	258.7702	269.9699	368.3784	375.3024	350.2494	345.4633	(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	1090.9200	1053.3532	950.8736	798.4625	613.0904	408.3616	262.0334	276.4266	439.0275	670.1930	898.0284	1088.7517	(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 m ²	541.3199	432.9656	363.8737	203.9899	79.7409	0.0000	0.0000	0.0000	0.0000	219.3987	394.4009	553.0065	(98)
												2788.6961	(98)
												45.7388	(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													3081.4322 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	541.3199	432.9656	363.8737	203.9899	79.7409	0.0000	0.0000	0.0000	0.0000	219.3987	394.4009	553.0065	(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)	598.1436	478.4150	402.0704	225.4032	88.1115	0.0000	0.0000	0.0000	0.0000	242.4295	435.8021	611.0569	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Efficiency of water heater (217)m	89.7946	89.7425	89.6131	89.2963	88.5837	87.3000	87.3000	87.3000	87.3000	89.3230	89.6724	89.8219	(216)
Fuel for water heating, kWh/month	164.4485	144.3397	150.1933	132.8751	129.6226	115.1431	108.3239	121.9871	122.7560	137.8615	148.0109	159.6944	(219)
Water heating fuel used												1635.2562	(219)
Annual totals kWh/year													
Space heating fuel - main system												3081.4322	(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)													32.8477 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.8477 (231)
Electricity for lighting (calculated in Appendix L)													278.7838 (232)
Total delivered energy for all uses													5103.3198 (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	3081.4322	0.2160	665.5894 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1635.2562	0.2160	353.2153 (264)
Space and water heating			1018.8047 (265)
Pumps and fans	107.8477	0.5190	55.9730 (267)
Energy for lighting	278.7838	0.5190	144.6888 (268)
Total CO2, kg/year			1219.4664 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.0000 (273)

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

DER		20.0000	ZC1
Total Floor Area		60.9700	
Assumed number of occupants		2.0089	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		17.0461	ZC2
CO2 emissions from cooking, equation (L16)		2.7426	ZC3
Total CO2 emissions		39.7887	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		39.7887	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	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1367 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3867 (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) =				0.3287 (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	0.4191	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3698	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5811	0.5654	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			11.9200	1.3258	15.8030		(27)					
Heat Loss Floor			60.9700	0.1300	7.9261		(28a)					
WT-E-01	62.2600	11.9200	50.3400	0.1800	9.0612		(29a)					
WT-I-01 Common	16.9400	2.0600	14.8800	0.1800	2.6784		(29a)					
WT-I-11	6.0000		6.0000	0.1800	1.0800		(29a)					
Total net area of external elements Aum(A, m2)			146.1700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6087		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4740 (36)					
Total fabric heat loss						(33) + (36) =	49.0827 (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	28.3842	28.2195	28.0581	27.3001	27.1583	26.4981	26.4981	26.3758	26.7524	27.1583	27.4452	27.7451 (38)
Heat transfer coeff	77.4669	77.3023	77.1409	76.3828	76.2410	75.5808	75.5808	75.4585	75.8351	76.2410	76.5279	76.8279 (39)
Average = Sum(39)m / 12 =												76.3822 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2706	1.2679	1.2652	1.2528	1.2505	1.2396	1.2396	1.2376	1.2438	1.2505	1.2552	1.2601 (40)
HLP (average)												1.2528 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)											Total = Sum(45)m =	1288.7936 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.0430	17.5298	18.0892	15.7706	15.1322	13.0580	12.1001	13.8851	14.0509	16.3750	17.8746	19.4106 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	45.9156	39.9640	42.5762	39.5870	39.2369	36.3554	37.5673	39.2369	39.5870	42.5762	42.8186	45.9156 (61)
Solar input	179.5359	156.8292	163.1707	144.7242	140.1185	123.4086	118.2348	131.8041	133.2597	151.7428	161.9824	175.3197 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	179.5359	156.8292	163.1707	144.7242	140.1185	123.4086	118.2348	131.8041	133.2597	151.7428	161.9824	175.3197 (64)
	55.9076	48.8487	50.7417	44.8549	43.3524	38.0340	36.2138	40.5878	41.0429	46.9419	50.3266	54.5058 (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	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7859	14.0209	11.4026	8.6325	6.4529	5.4478	5.8865	7.6515	10.2699	13.0399	15.2195	16.2246	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.3865	177.2065	172.6202	162.8566	150.5319	138.9483	131.2098	129.3899	133.9761	143.7397	156.0644	167.6480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	(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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	(71)
Water heating gains (Table 5)	75.1447	72.6915	68.2012	62.2984	58.2693	52.8250	48.6744	54.5535	57.0041	63.0940	69.8981	73.2604	(72)
Total internal gains	322.4509	320.0527	308.3578	289.9214	271.3879	253.3550	241.9046	247.7287	257.3839	276.0075	297.3159	313.2669	(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					9.0400	10.6334	0.6300	0.7000			0.7700	29.3773 (74)
West					2.8800	19.6403	0.6300	0.7000			0.7700	17.2867 (80)
Solar gains	46.6640	89.9580	151.0890	234.4557	305.9605	322.8762	303.3224	247.0127	179.4703	106.9552	57.7952	38.7061 (83)
Total gains	369.1149	410.0107	459.4469	524.3771	577.3484	576.2312	545.2270	494.7415	436.8542	382.9627	355.1111	351.9730 (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	54.6560	54.7724	54.8870	55.4317	55.5348	56.0199	56.0199	56.1106	55.8320	55.5348	55.3266	55.1106	
alpha	4.6437	4.6515	4.6591	4.6954	4.7023	4.7347	4.7347	4.7407	4.7221	4.7023	4.6884	4.6740	
util living area	0.9979	0.9962	0.9906	0.9685	0.8976	0.7465	0.5856	0.6567	0.8906	0.9829	0.9961	0.9983	(86)
MIT	19.6052	19.7391	19.9991	20.3704	20.7113	20.9189	20.9799	20.9663	20.7968	20.3700	19.9269	19.5815	(87)
Th 2	19.8640	19.8661	19.8682	19.8780	19.8798	19.8884	19.8884	19.8900	19.8851	19.8798	19.8761	19.8722	(88)
util rest of house	0.9972	0.9948	0.9870	0.9556	0.8549	0.6508	0.4498	0.5194	0.8270	0.9736	0.9945	0.9977	(89)
MIT 2	18.0148	18.2117	18.5915	19.1307	19.5916	19.8336	19.8811	19.8759	19.7133	19.1384	18.4935	17.9859	(90)
Living area fraction	18.5605	18.7358	19.0745	19.5561	19.9758	20.2060	20.2581	20.2500	20.0851	19.5610	18.9853	18.5334	(91)
MIT	18.5605	18.7358	19.0745	19.5561	19.9758	20.2060	20.2581	20.2500	20.0851	19.5610	18.9853	18.5334	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5605	18.7358	19.0745	19.5561	19.9758	20.2060	20.2581	20.2500	20.0851	19.5610	18.9853	18.5334	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9959	0.9928	0.9836	0.9508	0.8591	0.6805	0.4969	0.5668	0.8406	0.9700	0.9926	0.9967	(94)
Ext temp.	367.5992	407.0739	451.8993	498.5997	496.0213	392.1338	270.8961	280.4305	367.2340	371.4739	352.4663	350.8126	(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	1104.7176	1069.5388	970.0082	813.9418	630.9568	423.7036	276.4815	290.5174	453.8797	683.1942	909.5582	1101.2027	(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	548.4161	445.1764	385.4730	227.0463	100.3920	0.0000	0.0000	0.0000	0.0000	231.9199	401.1062	558.2902	(98)
Space heating per m2												2897.8202	(98)
												47.5286	(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													3102.5912 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.4161	445.1764	385.4730	227.0463	100.3920	0.0000	0.0000	0.0000	0.0000	231.9199	401.1062	558.2902	(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)	587.1693	476.6343	412.7120	243.0903	107.4861	0.0000	0.0000	0.0000	0.0000	248.3082	429.4499	597.7411	(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	179.5359	156.8292	163.1707	144.7242	140.1185	123.4086	118.2348	131.8041	133.2597	151.7428	161.9824	175.3197	(64)
Efficiency of water heater	87.6801	87.5319	87.1403	86.1803	84.2280	80.3000	80.3000	80.3000	80.3000	86.1160	87.2433	87.7620	(217)
Fuel for water heating, kWh/month	204.7624	179.1681	187.2505	167.9318	166.3562	153.6844	147.2413	164.1396	165.9523	176.2074	185.6674	199.7673	(219)
Water heating fuel used												2098.1287	(219)
Annual totals kWh/year													
Space heating fuel - main system												3102.5912	(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)												278.7838	(232)
Total delivered energy for all uses												5554.5037	(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	3102.5912	0.2160	670.1597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2098.1287	0.2160	453.1958 (264)
Space and water heating			1123.3555 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	278.7838	0.5190	144.6888 (268)
Total CO2, kg/m2/year			1306.9693 (272)
Emissions per m2 for space and water heating			18.4247 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3731 (272b)
Emissions per m2 for pumps and fans			0.6384 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.4247 * 1.00) + 2.3731 + 0.6384, rounded to 2 d.p.			21.4400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1367 (8)
Measured/design AP50					Yes
Infiltration rate					4.8200
Number of sides sheltered					0.3777 (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) =				0.3210 (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	0.4093	0.4013	0.3933	0.3531	0.3451	0.3050	0.3050	0.2970	0.3210	0.3451	0.3612	0.3772 (22b)
	0.5838	0.5805	0.5773	0.5624	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (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)			11.9200	1.2357	14.7300		(27)
Heat Loss Floor			60.9700	0.1000	6.0970		(28a)
WT-E-01	62.2600	11.9200	50.3400	0.2000	10.0680		(29a)
WT-I-01 Common	16.9400	2.0600	14.8800	0.2544	3.7860		(29a)
WT-I-11	6.0000		6.0000	0.3600	2.1600		(29a)
Total net area of external elements Aum(A, m ²)			146.1700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 38.9010		(33)
Party Ceilings 1			60.9700				(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)							11.3397 (36)
Total fabric heat loss						(33) + (36) =	50.2407 (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	28.1891	28.0320	27.8781	27.1549	27.0196	26.3898	26.3898	26.2731	26.6324	27.0196	27.2933	27.5795 (38)
Heat transfer coeff	78.4298	78.2727	78.1187	77.3956	77.2603	76.6305	76.6305	76.5138	76.8731	77.2603	77.5340	77.8202 (39)
Average = Sum(39)m / 12 =												77.3950 (39)
HLP	1.2864	1.2838	1.2813	1.2694	1.2672	1.2569	1.2569	1.2549	1.2608	1.2672	1.2717	1.2764 (40)
HLP (average)												1.2694 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy content (annual)	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1288.7936 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	28.3943	24.8339	25.6263	22.3416	21.4373	18.4988	17.1418	19.6705	19.9055	23.1979	25.3223	(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	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7859	14.0209	11.4026	8.6325	6.4529	5.4478	5.8865	7.6515	10.2699	13.0399	15.2195	16.2246	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.3865	177.2065	172.6202	162.8566	150.5319	138.9483	131.2098	129.3899	133.9761	143.7397	156.0644	167.6480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	(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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	(71)
Water heating gains (Table 5)	38.1644	36.9551	34.4440	31.0301	28.8136	25.6928	23.0401	26.4389	27.6465	31.1800	35.1699	36.9602	(72)
Total internal gains	282.4707	281.3163	271.6006	255.6530	238.9322	223.2227	213.2703	216.6141	225.0263	241.0934	259.5877	273.9667	(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				9.0400	10.6334	0.4500	0.0000		0.7700		33.3076 (74)	
West				2.8800	19.6403	0.4500	0.0000		0.7700		19.5994 (80)	
Solar gains	52.9070	101.9932	171.3028	265.8228	346.8940	366.0728	343.9029	280.0598	203.4811	121.2644	65.5274	43.8845 (83)
Total gains	335.3777	383.3095	442.9033	521.4758	585.8262	589.2955	557.1732	496.6739	428.5073	362.3578	325.1151	317.8511 (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	53.9849	54.0933	54.1999	54.7063	54.8021	55.2525	55.2525	55.3368	55.0782	54.8021	54.6087	54.4079		
alpha	4.5990	4.6062	4.6133	4.6471	4.6535	4.6835	4.6835	4.6891	4.6719	4.6535	4.6406	4.6272		
util living area	0.9986	0.9971	0.9920	0.9697	0.8957	0.7410	0.5810	0.6608	0.8990	0.9864	0.9973	0.9989	(86)	
MIT	19.5347	19.6797	19.9569	20.3505	20.7077	20.9188	20.9797	20.9641	20.7808	20.3272	19.8645	19.5095	(87)	
Th 2	19.8515	19.8536	19.8555	19.8649	19.8666	19.8748	19.8748	19.8763	19.8716	19.8666	19.8631	19.8594	(88)	
util rest of house	0.9981	0.9961	0.9889	0.9572	0.8522	0.6442	0.4444	0.5218	0.8377	0.9788	0.9962	0.9985	(89)	
MIT 2	18.5214	18.6676	18.9449	19.3380	19.6680	19.8376	19.8698	19.8660	19.7437	19.3218	18.8599	18.5024	(90)	
Living area fraction									fLA = Living area / (4) =			0.3431	(91)	
MIT	18.8691	19.0149	19.2921	19.6854	20.0247	20.2086	20.2506	20.2428	20.0996	19.6668	19.2046	18.8480	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.8691	19.0149	19.2921	19.6854	20.0247	20.2086	20.2506	20.2428	20.0996	19.6668	19.2046	18.8480	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	334.5330	381.3953	437.0657	497.8324	503.3727	397.9693	274.1076	283.2126	365.3260	354.0160	323.5595	317.2286	(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	1142.6506	1104.8122	999.3028	834.7428	643.1725	429.7886	279.7471	294.0269	461.2039	700.5001	938.5182	1139.9071	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	601.2395	486.1362	418.3044	242.5755	104.0110	0.0000	0.0000	0.0000	0.0000	257.7841	442.7703	612.0728	(98)	
Space heating												3164.8937	(98)	
Space heating per m2												51.9090	(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	720.3263	567.0654	581.5050	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8473	0.9083	0.8696	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	610.3374	515.0823	505.6753	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	763.8160	724.7974	655.2704	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	110.5045	156.0280	111.2987	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												377.8313	(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	27.6261	39.0070	27.8247	0.0000	0.0000	0.0000 (107)
Space cooling											94.4578 (107)
Space cooling per m2											1.5493 (108)
Energy for space heating											51.9090 (99)
Energy for space cooling											1.5493 (108)
Total											53.4583 (109)
Dwelling Fabric Energy Efficiency (DFEE)											53.5 (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	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1367 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3867 (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) =	0.3287 (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	0.4191	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3698	0.3862 (22b)
	0.5878	0.5844	0.5811	0.5654	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600			(26)				
TER Opening Type (Uw = 1.40)			11.9200	1.3258	15.8030			(27)				
Heat Loss Floor			60.9700	0.1300	7.9261			(28a)				
WT-E-01	62.2600	11.9200	50.3400	0.1800	9.0612			(29a)				
WT-I-01 Common	16.9400	2.0600	14.8800	0.1800	2.6784			(29a)				
WT-I-11	6.0000		6.0000	0.1800	1.0800			(29a)				
Total net area of external elements Aum(A, m2)			146.1700					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	38.6087			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.4740 (36)				
Total fabric heat loss						(33) + (36) =		49.0827 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.3842	28.2195	28.0581	27.3001	27.1583	26.4981	26.4981	26.3758	26.7524	27.1583	27.4452	27.7451 (38)
Heat transfer coeff	77.4669	77.3023	77.1409	76.3828	76.2410	75.5808	75.5808	75.4585	75.8351	76.2410	76.5279	76.8279 (39)
Average = Sum(39)m / 12 =												76.3822 (39)
HLP	1.2706	1.2679	1.2652	1.2528	1.2505	1.2396	1.2396	1.2376	1.2438	1.2505	1.2552	1.2601 (40)
HLP (average)												1.2528 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)										Total = Sum(45)m =		1288.7936 (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												

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 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	28.3943	24.8339	25.6263	22.3416	21.4373	18.4988	17.1418	19.6705	19.9055	23.1979	25.3223	27.4984 (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	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462	100.4462 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7859	14.0209	11.4026	8.6325	6.4529	5.4478	5.8865	7.6515	10.2699	13.0399	15.2195	16.2246 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.3865	177.2065	172.6202	162.8566	150.5319	138.9483	131.2098	129.3899	133.9761	143.7397	156.0644	167.6480 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446	33.0446 (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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569 (71)
Water heating gains (Table 5)	38.1644	36.9551	34.4440	31.0301	28.8136	25.6928	23.0401	26.4389	27.6465	31.1800	35.1699	36.9602 (72)
Total internal gains	282.4707	281.3163	271.6006	255.6530	238.9322	223.2227	213.2703	216.6141	225.0263	241.0934	259.5877	273.9667 (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	9.0400				10.6334		0.6300		0.7000		0.7700		29.3773 (74)
West	2.8800				19.6403		0.6300		0.7000		0.7700		17.2867 (80)
Solar gains	46.6640	89.9580	151.0890	234.4557	305.9605	322.8762	303.3224	247.0127	179.4703	106.9552	57.7952	38.7061 (83)	
Total gains	329.1346	371.2743	422.6896	490.1087	544.8927	546.0989	516.5927	463.6268	404.4966	348.0486	317.3829	312.6728 (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	54.6560	54.7724	54.8870	55.4317	55.5348	56.0199	56.0199	56.1106	55.8320	55.5348	55.3266	55.1106
alpha	4.6437	4.6515	4.6591	4.6954	4.7023	4.7347	4.7347	4.7407	4.7221	4.7023	4.6884	4.6740
util living area	0.9987	0.9975	0.9933	0.9754	0.9136	0.7721	0.6128	0.6898	0.9127	0.9882	0.9976	0.9990 (86)
MIT	19.5455	19.6817	19.9459	20.3254	20.6805	20.9059	20.9757	20.9586	20.7666	20.3209	19.8708	19.5226 (87)
Th 2	19.8640	19.8661	19.8682	19.8780	19.8798	19.8884	19.8884	19.8900	19.8851	19.8798	19.8761	19.8722 (88)
util rest of house	0.9982	0.9966	0.9907	0.9650	0.8753	0.6782	0.4732	0.5505	0.8570	0.9816	0.9965	0.9986 (89)
MIT 2	18.5419	18.6794	18.9441	19.3252	19.6580	19.8439	19.8822	19.8777	19.7457	19.3264	18.8764	18.5255 (90)
Living area fraction									fLA = Living area / (4) =			0.3431 (91)
MIT	18.8862	19.0233	19.2878	19.6684	20.0088	20.2083	20.2574	20.2486	20.0960	19.6676	19.2176	18.8676 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8862	19.0233	19.2878	19.6684	20.0088	20.2083	20.2574	20.2486	20.0960	19.6676	19.2176	18.8676 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9956	0.9889	0.9625	0.8805	0.7079	0.5219	0.5990	0.8698	0.9799	0.9957	0.9982 (94)
Useful gains	328.3749	369.6478	417.9928	471.7261	479.7906	386.5665	269.5856	277.7330	351.8292	341.0522	316.0106	312.1081 (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	1129.9515	1091.7641	986.4659	822.5201	633.4728	423.8813	276.4310	290.4093	454.7065	691.3250	927.3343	1126.8833 (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	596.3730	485.2622	422.9440	252.5717	114.3396	0.0000	0.0000	0.0000	0.0000	260.6029	440.1531	606.1928 (98)
Space heating												3178.4392 (98)
Space heating per m ²												52.1312 (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	710.4596	559.2980	573.4849	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8273	0.8944	0.8544	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	587.7490	500.2411	489.9591	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	713.3265	677.3656	616.6440	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	90.4158	131.7806	94.2535	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												316.4499 (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	22.6039	32.9452	23.5634	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											79.1125 (107)
Space cooling per m2											1.2976 (108)
Energy for space heating											52.1312 (99)
Energy for space cooling											1.2976 (108)
Total											53.4288 (109)
Target Fabric Energy Efficiency (TFEE)											61.4 (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	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour			
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							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	4.8200			
Infiltration rate									0.2410	(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) =	0.2049	(21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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	0.2151	0.2049	0.2049	0.1895	0.1895	0.1690	0.1741	0.1639	0.1690	0.1792	0.1792	0.1946 (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)			11.9200	1.2357	14.7300		(27)
Heat Loss Floor			60.9700	0.1000	6.0970		(28a)
WT-E-01	62.2600	11.9200	50.3400	0.2000	10.0680		(29a)
WT-I-01 Common	16.9400	2.0600	14.8800	0.2544	3.7860		(29a)
WT-I-11	6.0000		6.0000	0.3600	2.1600		(29a)
Total net area of external elements Aum(A, m ²)			146.1700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 38.9010		(33)
Party Ceilings 1			60.9700				(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)							11.3397 (36)
Total fabric heat loss						(33) + (36) =	50.2407 (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	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441 (38)
Heat transfer coeff	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848 (39)
Average = Sum(39)m / 12 =												74.3848 (39)
HLP	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200 (40)
HLP (average)												1.2200 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)										Total = Sum(45)m =		1288.7936 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0430	17.5298	18.0892	15.7706	15.1322	13.0580	12.1001	13.8851	14.0509	16.3750	17.8746	19.4106 (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	14.0455	12.6688	13.9984	13.5154	13.9430	13.4668	13.8993	13.9276	13.4933	13.9755	13.5611	14.0364 (61)
Total heat required for water heating calculated for each month	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405 (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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405 (64)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
								Total per year (kWh/year) = Sum(64)m =				1453.3246 (64)
RHI water heating demand												1453 (64)
Heat gains from water heating, kWh/month	47.9401	42.0249	43.5972	38.3369	37.0289	32.3119	30.2968	34.2605	34.5195	39.7917	43.0122	46.5360 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4647	35.0522	28.5064	21.5812	16.1322	13.6195	14.7163	19.1288	25.6747	32.5999	38.0489	40.5616 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.7709	264.4873	257.6421	234.0696	224.6744	207.3856	195.8355	193.1192	199.9643	214.5368	232.9320	250.2209 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625 (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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569 (71)
Water heating gains (Table 5)	64.4357	62.5370	58.5984	53.2457	49.7700	44.8776	40.7215	46.0490	47.9437	53.4835	59.7392	62.5484 (72)
Total internal gains	457.9122	454.3174	436.9879	410.1374	382.8175	358.1236	343.5142	350.5380	365.8236	392.8611	422.9610	445.5717 (73)

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				9.0400	11.9814	0.4500	0.0000	0.7700	37.5302 (74)			
West				2.8800	22.3313	0.4500	0.0000	0.7700	22.2849 (80)			
Solar gains	59.8150	104.3258	174.0940	279.0012	354.2829	399.5990	371.5638	309.9306	224.4715	132.7685	76.0193	49.0564 (83)
Total gains	517.7273	558.6432	611.0818	689.1387	737.1004	757.7226	715.0781	660.4686	590.2952	525.6296	498.9803	494.6281 (84)

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	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206
alpha	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947
util living area	0.9892	0.9834	0.9627	0.8929	0.7289	0.4825	0.3215	0.3587	0.6786	0.9218	0.9793	0.9910 (86)
MIT	19.9801	20.0932	20.3561	20.6801	20.9121	20.9903	20.9990	20.9983	20.9531	20.6735	20.2724	19.9467 (87)
Th 2	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040 (88)
util rest of house	0.9856	0.9778	0.9498	0.8576	0.6541	0.3809	0.2084	0.2368	0.5721	0.8868	0.9711	0.9880 (89)
MIT 2	19.0052	19.1166	19.3722	19.6711	19.8562	19.9013	19.9039	19.9038	19.8855	19.6735	19.2942	19.8724 (90)
Living area fraction									fLA = Living area / (4) =			0.3431 (91)
MIT	19.3397	19.4517	19.7098	20.0173	20.2185	20.2749	20.2796	20.2794	20.2518	20.0166	19.6298	19.3067 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1897	19.3017	19.5598	19.8673	20.0685	20.1249	20.1296	20.1294	20.1018	19.8666	19.4798	19.1567 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (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					4.8200
Number of sides sheltered					0.2410 (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) =	0.2049 (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	0.2612	0.2561	0.2509	0.2253	0.2202	0.1946	0.1946	0.1895	0.2049	0.2202	0.2305	0.2407 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5112	0.5061	0.5009	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)			11.9200	1.2357	14.7300		(27)
Heat Loss Floor			60.9700	0.1000	6.0970		(28a)
WT-E-01	62.2600	11.9200	50.3400	0.2000	10.0680		(29a)
WT-I-01 Common	16.9400	2.0600	14.8800	0.2544	3.7860		(29a)
WT-I-11	6.0000		6.0000	0.3600	2.1600		(29a)
Total net area of external elements Aum(A, m ²)			146.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.9010		(33)
Party Ceilings 1			60.9700				(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)							11.3397 (36)
Total fabric heat loss						(33) + (36) =	50.2407 (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	24.6842	24.4369	24.1896	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441 (38)
Heat transfer coeff	74.9248	74.6776	74.4303	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848 (39)
Average = Sum(39)m / 12 =												74.4580 (39)
HLP	1.2289	1.2248	1.2208	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200 (40)
HLP (average)												1.2212 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)										Total = Sum(45)m =		1288.7936 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0430	17.5298	18.0892	15.7706	15.1322	13.0580	12.1001	13.8851	14.0509	16.3750	17.8746	19.4106 (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	14.0455	12.6688	13.9984	13.5154	13.9430	13.4668	13.8993	13.9276	13.4933	13.9755	13.5611	14.0364	(61)
Total heat required for water heating calculated for each month	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Heat gains from water heating, kWh/month	47.9401	42.0249	43.5972	38.3369	37.0289	32.3119	30.2968	34.2605	34.5195	39.7917	43.0122	46.5360	(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	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4647	35.0522	28.5064	21.5812	16.1322	13.6195	14.7163	19.1288	25.6747	32.5999	38.0489	40.5616	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.7709	264.4873	257.6421	243.0696	224.6744	207.3856	195.8355	193.1192	199.9643	214.5368	232.9320	250.2209	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	(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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	(71)
Water heating gains (Table 5)	64.4357	62.5370	58.5984	53.2457	49.7700	44.8776	40.7215	46.0490	47.9437	53.4835	59.7392	62.5484	(72)
Total internal gains	457.9122	454.3174	436.9879	410.1374	382.8175	358.1236	343.5142	350.5380	365.8236	392.8611	422.9610	445.5717	(73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
North				9.0400	10.6334	0.4500		0.0000			0.7700			33.3076 (74)
West				2.8800	19.6403	0.4500		0.0000			0.7700			19.5994 (80)

Solar gains	52.9070	101.9932	171.3028	265.8228	346.8940	366.0728	343.9029	280.0598	203.4811	121.2644	65.5274			43.8845 (83)
Total gains	510.8192	556.3106	608.2906	675.9603	729.7115	724.1963	687.4172	630.5978	569.3047	514.1256	488.4884			489.4562 (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	56.5103	56.6975	56.8858	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206		
alpha	4.7674	4.7798	4.7924	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947		
util living area	0.9917	0.9863	0.9710	0.9221	0.8046	0.6243	0.4689	0.5290	0.7819	0.9478	0.9853	0.9932	(86)	
MIT	19.8692	20.0068	20.2570	20.5791	20.8409	20.9636	20.9925	20.9869	20.8964	20.5645	20.1595	19.8387	(87)	
Th 2	19.8970	19.9002	19.9034	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	(88)	
util rest of house	0.9890	0.9819	0.9613	0.8962	0.7462	0.5309	0.3559	0.4098	0.6974	0.9247	0.9797	0.9910	(89)	
MIT 2	18.8896	19.0280	19.2756	19.5804	19.8041	19.8887	19.9023	19.9006	19.8513	19.5745	19.1833	18.8650	(90)	
Living area fraction	19.2257	19.3639	19.6123	19.9231	20.1598	20.2575	20.2763	20.2734	20.2099	19.9142	19.5183	19.1991	(92)	
Temperature adjustment	19.0757	19.2139	19.4623	19.7731	20.0098	20.1075	20.1263	20.1234	20.0599	19.7642	19.3683	19.0491	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9864	0.9784	0.9565	0.8925	0.7525	0.5491	0.3792	0.4344	0.7108	0.9210	0.9761	0.9887	(94)
Ext temp.	503.8501	544.2730	581.8160	603.2999	549.0768	397.6469	260.7010	273.9302	404.6841	473.5317	476.8347	483.9025	(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	1107.0668	1068.9240	964.7888	808.7909	618.1233	409.6765	262.3063	276.9615	443.3253	681.6769	912.5728	1104.5481	(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 m ²	448.7932	352.5655	284.9318	147.9536	51.3705	0.0000	0.0000	0.0000	0.0000	154.8600	313.7314	461.7603	(98)
												2215.9664	(98)
												36.3452	(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													2448.5817 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.7932	352.5655	284.9318	147.9536	51.3705	0.0000	0.0000	0.0000	0.0000	154.8600	313.7314	461.7603	(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)	495.9041	389.5751	314.8417	163.4846	56.7630	0.0000	0.0000	0.0000	0.0000	171.1161	346.6646	510.2324	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Efficiency of water heater (217)m	89.6861	89.6174	89.4481	89.0473	88.2647	87.3000	87.3000	87.3000	87.3000	89.0541	89.5244	89.7205	(216)
Fuel for water heating, kWh/month	164.6474	144.5412	150.4702	133.2465	130.0912	115.1431	108.3239	121.9871	122.7560	138.2778	148.2555	159.8748	(219)
Water heating fuel used												1637.6147	(219)
Annual totals kWh/year													
Space heating fuel - main system												2448.5817	(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)													32.8477 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.8477 (231)
Electricity for lighting (calculated in Appendix L)													278.7838 (232)
Total delivered energy for all uses													4472.8279 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2448.5817	3.4800	85.2106 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1637.6147	3.4800	56.9890 (247)
Mechanical ventilation fans	32.8477	13.1900	4.3326 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	278.7838	13.1900	36.7716 (250)
Additional standing charges			120.0000 (251)
Total energy cost			313.1963 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.2413 (257)
SAP value		82.6836
SAP rating (Section 12)		83 (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	2448.5817	0.2160	528.8936 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1637.6147	0.2160	353.7248 (264)
Space and water heating			882.6184 (265)
Pumps and fans	107.8477	0.5190	55.9730 (267)
Energy for lighting	278.7838	0.5190	144.6888 (268)
Total kg/year			1083.2802 (272)
CO2 emissions per m2			17.7700 (273)
EI value			86.3018
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	$3.48 / 0.8863 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8863 = 0.2437$, 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	60.9700 (1b)	x 2.4000 (2b)	= 146.3280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.3280 (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					4.8200
Number of sides sheltered					0.2410 (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) = 0.2049 (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	0.2151	0.2049	0.2049	0.1895	0.1895	0.1690	0.1741	0.1639	0.1690	0.1792	0.1792	0.1946 (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)			11.9200	1.2357	14.7300		(27)
Heat Loss Floor			60.9700	0.1000	6.0970		(28a)
WT-E-01	62.2600	11.9200	50.3400	0.2000	10.0680		(29a)
WT-I-01 Common	16.9400	2.0600	14.8800	0.2544	3.7860		(29a)
WT-I-11	6.0000		6.0000	0.3600	2.1600		(29a)
Total net area of external elements Aum(A, m ²)			146.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.9010		(33)
Party Ceilings 1			60.9700				(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)							11.3397 (36)
Total fabric heat loss						(33) + (36) =	50.2407 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441	24.1441 (38)
Heat transfer coeff	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848	74.3848 (39)
Average = Sum(39)m / 12 =												74.3848 (39)
HLP	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200	1.2200 (40)
HLP (average)												1.2200 (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												2.0089 (42)
Average daily hot water use (litres/day)												81.9119 (43)
Daily hot water use	90.1031	86.8266	83.5502	80.2737	76.9972	73.7207	73.7207	76.9972	80.2737	83.5502	86.8266	90.1031 (44)
Energy conte	133.6203	116.8652	120.5944	105.1371	100.8816	87.0531	80.6675	92.5672	93.6727	109.1665	119.1638	129.4042 (45)
Energy content (annual)										Total = Sum(45)m =		1288.7936 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0430	17.5298	18.0892	15.7706	15.1322	13.0580	12.1001	13.8851	14.0509	16.3750	17.8746	19.4106 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0455	12.6688	13.9984	13.5154	13.9430	13.4668	13.8993	13.9276	13.4933	13.9755	13.5611	14.0364	(61)
Total heat required for water heating calculated for each month	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Heat gains from water heating, kWh/month	47.9401	42.0249	43.5972	38.3369	37.0289	32.3119	30.2968	34.2605	34.5195	39.7917	43.0122	46.5360	(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	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	120.5354	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4647	35.0522	28.5064	21.5812	16.1322	13.6195	14.7163	19.1288	25.6747	32.5999	38.0489	40.5616	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.7709	264.4873	257.6421	243.0696	224.6744	207.3856	195.8355	193.1192	199.9643	214.5368	232.9320	250.2209	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	49.0625	(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)	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	-80.3569	(71)
Water heating gains (Table 5)	64.4357	62.5370	58.5984	53.2457	49.7700	44.8776	40.7215	46.0490	47.9437	53.4835	59.7392	62.5484	(72)
Total internal gains	457.9122	454.3174	436.9879	410.1374	382.8175	358.1236	343.5142	350.5380	365.8236	392.8611	422.9610	445.5717	(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	9.0400				11.9814	0.4500		0.0000		0.7700		37.5302 (74)
West	2.8800				22.3313	0.4500		0.0000		0.7700		22.2849 (80)
Solar gains	59.8150	104.3258	174.0940	279.0012	354.2829	399.5990	371.5638	309.9306	224.4715	132.7685	76.0193	49.0564 (83)
Total gains	517.7273	558.6432	611.0818	689.1387	737.1004	757.7226	715.0781	660.4686	590.2952	525.6296	498.9803	494.6281 (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	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206	56.9206		
alpha	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947	4.7947		
util living area	0.9892	0.9834	0.9627	0.8929	0.7289	0.4825	0.3215	0.3587	0.6786	0.9218	0.9793	0.9910	(86)	
MIT	19.9801	20.0932	20.3561	20.6801	20.9121	20.9903	20.9990	20.9983	20.9531	20.6735	20.2724	19.9467	(87)	
Th 2	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	19.9040	(88)	
util rest of house	0.9856	0.9778	0.9498	0.8576	0.6541	0.3809	0.2084	0.2368	0.5721	0.8868	0.9711	0.9880	(89)	
MIT 2	19.0052	19.1166	19.3722	19.6711	19.8562	19.9013	19.9039	19.9038	19.8855	19.6735	19.2942	18.9724	(90)	
Living area fraction	19.3397	19.4517	19.7098	20.0173	20.2185	20.2749	20.2796	20.2794	20.2518	20.0166	19.6298	19.3067	(92)	
Temperature adjustment	19.1897	19.3017	19.5598	19.8673	20.0685	20.1249	20.1296	20.1294	20.1018	19.8666	19.4798	19.1567	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	508.6685	544.0658	577.3662	590.0555	491.0476	304.4272	165.7363	173.0593	349.8771	465.3874	482.4687	487.3327	(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	1048.0617	1019.1962	904.5015	741.4155	525.7903	306.8335	165.8518	173.2684	364.6185	614.9121	853.9261	1045.6065	(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	401.3086	319.2876	243.3887	108.9792	25.8485	0.0000	0.0000	0.0000	0.0000	111.2464	267.4493	415.3557	(98)
Space heating												1892.8641	(98)
Space heating per m ²												31.0458	(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												2091.5625	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	401.3086	319.2876	243.3887	108.9792	25.8485	0.0000	0.0000	0.0000	0.0000	111.2464	267.4493	415.3557	(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)	443.4349	352.8040	268.9378	120.4190	28.5619	0.0000	0.0000	0.0000	0.0000	122.9242	295.5241	458.9566	(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	147.6658	129.5340	134.5928	118.6525	114.8246	100.5200	94.5668	106.4948	107.1660	123.1420	132.7249	143.4405	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6164	89.5526	89.3340	88.8033	87.8709	87.3000	87.3000	87.3000	87.3000	88.7901	89.4130	89.6564	(217)
Fuel for water heating, kWh/month	164.7754	144.6457	150.6625	133.6127	130.6741	115.1431	108.3239	121.9871	122.7560	138.6888	148.4403	159.9892	(219)
Water heating fuel used												1639.6990	(219)
Annual totals kWh/year													
Space heating fuel - main system												2091.5625	(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)												32.8477	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												107.8477	(231)
Electricity for lighting (calculated in Appendix L)												278.7838	(232)
Total delivered energy for all uses												4117.8930	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2091.5625	3.6300	75.9237	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1639.6990	3.6300	59.5211	(247)
Mechanical ventilation fans	32.8477	19.4400	6.3856	(249)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	278.7838	19.4400	54.1956	(250)
Additional standing charges			95.0000	(251)
Total energy cost			305.6060	(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	2091.5625	0.2160	451.7775	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1639.6990	0.2160	354.1750	(264)
Space and water heating			805.9525	(265)
Pumps and fans	107.8477	0.5190	55.9730	(267)
Energy for lighting	278.7838	0.5190	144.6888	(268)
Total kg/year			1006.6142	(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	2091.5625	1.2200	2551.7063	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1639.6990	1.2200	2000.4328	(264)
Space and water heating			4552.1390	(265)
Pumps and fans	107.8477	3.0700	331.0925	(267)
Energy for lighting	278.7838	3.0700	855.8661	(268)
Primary energy kWh/year			5739.0976	(272)
Primary energy kWh/m2/year			94.1299	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
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 83	
Potential environmental impact rating:			B 86

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£75	£75	£0
Mains gas	£230	£230	£0
Space heating	£192	£192	£0
Water heating	£60	£60	£0
Lighting	£54	£54	£0
Total cost of fuels	£305	£305	£0
Total cost of uses	£306	£306	£0
Delivered energy	68 kWh/m²	68 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	17 kg/m²	17 kg/m²	0 kg/m²
Primary energy	94 kWh/m²	94 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 144.86 (P1)
 Transmission heat loss coefficient 50.24 (37)
 Summer heat loss coefficient 195.11 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
West	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	9.0400	81.1852	0.4500	0.0000	0.9000	297.2352
West	2.8800	117.5071	0.4500	0.0000	0.9000	137.0602
total:						434.2954

	Jun	Jul	Aug	
Solar gains	467	434	362	(P4)
Internal gains	355	341	348	
Total summer gains	822	775	710	(P5)

	4.21	3.97	3.64	
Summer gain/loss ratio	4.21	3.97	3.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	20.46	22.12	21.69	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium