

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	SECPMW027_146_As_Built				Issued on Date	28/06/2021
Assessment Reference	001	Prop Type Ref	TFF			
Property						
SAP Rating	83 B	DER	18.00	TER	19.45	
Environmental	87 B	% DER<TER	7.46			
CO ₂ Emissions (t/year)	1.07	DFEE	45.29	TFEE	53.39	
General Requirements Compliance	Pass	% DFEE<TFEE	15.17			
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 69 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.45 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.00 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.36 (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	1.26 (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: 3.85 (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): Slight OK
Based on:
Overshading: Average
Windows facing North: 12.85 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.9 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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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					3.8500
Infiltration rate					0.1925 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1492 (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	0.1902	0.1865	0.1828	0.1641	0.1604	0.1417	0.1417	0.1380	0.1492	0.1604	0.1678	0.1753 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1600	2.5600		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1584	1.9755		(29a)
WT-I-11	7.9200		7.9200	0.3600	2.8512		(29a)
Flat Roof	68.9600		68.9600	0.1500	10.3440		(30)
Total net area of external elements Aum(A, m2)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7300		(33)
Party Wall 1			36.9600	0.0000	0.0000		(32)
Party Floor 1			68.9600				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4278 (36)
Total fabric heat loss							(33) + (36) = 48.1578 (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	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082 (38)
Heat transfer coeff	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659 (39)
Average = Sum(39)m / 12 =												75.4659 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335	(44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m = 1367.8978 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.2733	18.6057	19.1994	16.7385	16.0610	13.8594	12.8428	14.7373	14.9133	17.3800	18.9717	20.6020 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0821	12.6996	14.0290	13.5410	13.9666	13.4863	13.9173	13.9493	13.5161	14.0032	13.5925	14.0718 (61)
Total heat required for water heating calculated for each month	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (64)
								Total per year (kWh/year) = Sum(64)m =				1532.7526 (64)
Heat gains from water heating, kWh/month	50.6762	44.4176	46.0660	40.4890	39.0936	34.0934	31.9476	36.1550	36.4369	42.0266	45.4520	49.1858 (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	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	17.6496	15.6762	12.7487	9.6516	7.2147	6.0909	6.5815	8.5549	11.4823	14.5794	17.0164	18.1401 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	194.8577	196.8797	191.7843	180.9368	167.2437	154.3742	145.7766	143.7545	148.8500	159.6975	173.3905	186.2601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031 (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)												
	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245 (71)
Water heating gains (Table 5)												
	68.1132	66.0976	61.9167	56.2347	52.5452	47.3519	42.9403	48.5955	50.6068	56.4873	63.1278	66.1099 (72)
Total internal gains	339.9297	337.9627	325.7589	306.1323	286.3128	267.1262	254.6075	260.2141	270.2483	290.0734	312.8439	329.8192 (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				12.8500	10.6334	0.4500	0.0000			0.7700			47.3454 (74)

Solar gains	47.3454	90.4796	153.7469	246.9569	332.6736	356.1370	332.4994	263.7958	184.8536	107.7041	58.4067	39.4695	(83)
Total gains	387.2751	428.4423	479.5058	553.0893	618.9864	623.2632	587.1069	524.0099	455.1019	397.7775	371.2506	369.2887	(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	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831
alpha	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922
util living area	0.9707	0.9600	0.9360	0.8787	0.7732	0.6310	0.5052	0.5680	0.7762	0.9138	0.9597	0.9741 (86)
MIT	18.6638	18.8769	19.2950	19.8717	20.4103	20.7630	20.9064	20.8693	20.5576	19.8870	19.1701	18.6011 (87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055 (88)
util rest of house	0.9663	0.9540	0.9259	0.8584	0.7337	0.5632	0.4098	0.4723	0.7215	0.8952	0.9525	0.9702 (89)
MIT 2	17.8631	18.0738	18.4859	19.0457	19.5494	19.8551	19.9621	19.9405	19.6955	19.0711	18.3668	17.8010 (90)
Living area fraction									fLA = Living area / (4) =			0.4147 (91)
MIT	18.1952	18.4069	18.8214	19.3882	19.9064	20.2316	20.3538	20.3257	20.0531	19.4094	18.7000	18.1328 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0452	18.2569	18.6714	19.2382	19.7564	20.0816	20.2038	20.1757	19.9031	19.2594	18.5500	17.9828 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9546	0.9400	0.9087	0.8397	0.7226	0.5688	0.4300	0.4900	0.7150	0.8776	0.9386	0.9594 (94)
Useful gains	369.7088	402.7354	435.7047	464.4295	447.2732	354.5055	252.4333	256.7516	325.3946	349.0914	348.4628	354.3006 (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	1037.2922	1007.9890	918.5279	780.1855	607.9871	413.6766	271.9608	284.9354	437.9344	653.4931	864.0842	1040.1347 (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	496.6821	406.7304	359.2204	227.3443	119.5712	0.0000	0.0000	0.0000	0.0000	226.4749	371.2474	510.2606 (98)
Space heating												2717.5312 (98)
Space heating per m2										(98) / (4) =		39.4074 (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													3002.7969 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	496.6821	406.7304	359.2204	227.3443	119.5712	0.0000	0.0000	0.0000	0.0000	226.4749	371.2474	510.2606	(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)	548.8199	449.4259	396.9286	251.2092	132.1228	0.0000	0.0000	0.0000	0.0000	250.2485	410.2181	563.8238	(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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186	(64)
Efficiency of water heater (217)m	89.7144	89.6730	89.5697	89.3375	88.8614	87.3000	87.3000	87.3000	87.3000	89.3069	89.6003	89.7472	(216)
Fuel for water heating, kWh/month	173.7780	152.4850	158.5639	140.0658	136.2122	121.2860	114.0162	128.5201	129.3680	145.4200	156.3281	168.7168	(219)
Water heating fuel used												1724.7601	(219)
Annual totals kWh/year													
Space heating fuel - main system													3002.7969 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													37.1523 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													112.1523 (231)
Electricity for lighting (calculated in Appendix L)													311.6969 (232)
Total delivered energy for all uses													5151.4062 (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	3002.7969	0.2160	648.6041 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1724.7601	0.2160	372.5482 (264)
Space and water heating			1021.1523 (265)
Pumps and fans	112.1523	0.5190	58.2071 (267)
Energy for lighting	311.6969	0.5190	161.7707 (268)
Total CO2, kg/year			1241.1300 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0000 (273)

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

DER			18.0000 ZC1
Total Floor Area		TFA	68.9600
Assumed number of occupants		N	2.2206
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.7443 ZC2
CO2 emissions from cooking, equation (L16)			2.4985 ZC3
Total CO2 emissions			37.2428 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			37.2428 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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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				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) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3708 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2874 (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	0.3664	0.3593	0.3521	0.3161	0.3090	0.2730	0.2730	0.2658	0.2874	0.3090	0.3233	0.3377 (22b)
	0.5671	0.5645	0.5620	0.5500	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5523	0.5570 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			12.8500	1.3258	17.0360		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1800	2.8800		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1800	2.2446		(29a)
WT-I-11	7.9200		7.9200	0.1800	1.4256		(29a)
Flat Roof	68.9600		68.9600	0.1300	8.9648		(30)
Total net area of external elements Aum(A, m ²)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	34.6710	(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)							10.5625 (36)
Total fabric heat loss						(33) + (36) =	45.2335 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.9750	30.8326	30.6931	30.0375	29.9149	29.3439	29.3439
Heat transfer coeff	76.2085	76.0661	75.9266	75.2710	75.1484	74.5774	74.5774
Average = Sum(39)m / 12 =							
HLP	1.1051	1.1030	1.1010	1.0915	1.0897	1.0815	1.0815
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
Daily hot water use	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m												1367.8978 (45)
Water storage loss:	21.2733	18.6057	19.1994	16.7385	16.0610	13.8594	12.8428	14.7373	14.9133	17.3800	18.9717	20.6020 (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)
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	48.7338	42.4170	45.1895	42.0168	41.6452	38.5869	39.8731	41.6452	42.0168	45.1895	45.4468	48.7338 (61)
Solar input	190.5555	166.4552	173.1858	153.6071	148.7188	130.9832	125.4919	139.8940	141.4390	161.0565	171.9246	186.0806 (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	190.5555	166.4552	173.1858	153.6071	148.7188	130.9832	125.4919	139.8940	141.4390	161.0565	171.9246	186.0806 (64)
	59.3392	51.8469	53.8562	47.6080	46.0133	40.3685	38.4365	43.0790	43.5621	49.8232	53.4156	57.8513 (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	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6496	15.6762	12.7487	9.6516	7.2147	6.0909	6.5815	8.5549	11.4823	14.5794	17.0164	18.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.8577	196.8797	191.7843	180.9368	167.2437	154.3742	145.7766	143.7545	148.8500	159.6975	173.3905	186.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	(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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	(71)
Water heating gains (Table 5)	79.7570	77.1532	72.3873	66.1222	61.8458	56.0674	51.6620	57.9019	60.5029	66.9666	74.1883	77.7571	(72)
Total internal gains	351.5734	349.0183	336.2295	316.0198	295.6134	275.8417	263.3292	269.5205	280.1444	300.5527	323.9044	341.4664	(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					12.8500	10.6334		0.6300	0.7000	0.7700		41.7587 (74)

Solar gains	41.7587	79.8030	135.6048	217.8160	293.4181	314.1128	293.2644	232.6679	163.0409	94.9950	51.5147	34.8121 (83)
Total gains	393.3321	428.8213	471.8343	533.8358	589.0315	589.9545	556.5937	502.1885	443.1852	395.5477	375.4191	376.2785 (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	62.8393	62.9569	63.0726	63.6220	63.7258	64.2137	64.2137	64.3049	64.0249	63.7258	63.5161	63.2983	
alpha	5.1893	5.1971	5.2048	5.2415	5.2484	5.2809	5.2809	5.2870	5.2683	5.2484	5.2344	5.2199	
util living area	0.9984	0.9972	0.9930	0.9739	0.9024	0.7405	0.5741	0.6506	0.8970	0.9860	0.9970	0.9988	(86)
MIT	19.7917	19.9052	20.1310	20.4619	20.7696	20.9442	20.9882	20.9781	20.8366	20.4608	20.0729	19.7690	(87)
Th 2	19.9967	19.9983	20.0000	20.0078	20.0092	20.0160	20.0160	20.0173	20.0134	20.0092	20.0063	20.0032	(88)
util rest of house	0.9979	0.9962	0.9904	0.9633	0.8634	0.6525	0.4537	0.5270	0.8396	0.9785	0.9958	0.9984	(89)
MIT 2	18.3803	18.5472	18.8775	19.3589	19.7756	19.9777	20.0115	20.0077	19.8717	19.3638	18.7985	18.3518	(90)
Living area fraction													(91)
MIT	18.9657	19.1104	19.3974	19.8164	20.1878	20.3785	20.4165	20.4102	20.2719	19.8188	19.3270	18.9395	(92)
Temperature adjustment													(93)
adjusted MIT	18.9657	19.1104	19.3974	19.8164	20.1878	20.3785	20.4165	20.4102	20.2719	19.8188	19.3270	18.9395	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9950	0.9883	0.9608	0.8714	0.6869	0.5040	0.5786	0.8571	0.9766	0.9946	0.9977	(94)
Useful gains	392.2010	426.6958	466.3074	512.9128	513.2998	405.2559	280.5386	290.5817	379.8552	386.3100	373.3925	375.4187	(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	1117.6477	1080.9314	979.2547	821.6869	637.8464	430.9468	284.6275	298.6444	461.6397	692.7749	921.8757	1115.1316	(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	539.7323	439.6463	381.6328	222.3173	92.6627	0.0000	0.0000	0.0000	0.0000	228.0099	394.9079	550.3464	(98)
Space heating												2849.2556	(98)
Space heating per m2												41.3175	(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	3050.5949	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	539.7323 439.6463 381.6328 222.3173 92.6627 0.0000 0.0000 0.0000 0.0000 228.0099 394.9079 550.3464	(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)	577.8719 470.7134 408.6004 238.0271 99.2106 0.0000 0.0000 0.0000 0.0000 244.1219 422.8136 589.2360	(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	190.5555 166.4552 173.1858 153.6071 148.7188 130.9832 125.4919 139.8940 141.4390 161.0565 171.9246 186.0806	(64)
Efficiency of water heater	87.5274 87.3916 86.9848 85.9810 83.8984 80.3000 80.3000 80.3000 80.3000 85.9261 87.0780 87.6154	(216)
Fuel for water heating, kWh/month	217.7096 190.4923 199.0989 178.6523 177.2606 163.1173 156.2788 174.2142 176.1383 187.4361 197.4375 212.3833	(219)
Water heating fuel used		2230.2191 (219)
Annual totals kWh/year		
Space heating fuel - main system		3050.5949 (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)		311.6969 (232)
Total delivered energy for all uses		5667.5109 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3050.5949	0.2160	658.9285 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2230.2191	0.2160	481.7273 (264)
Space and water heating			1140.6558 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	311.6969	0.5190	161.7707 (268)
Total CO ₂ , kg/m ² /year			1341.3515 (272)
Emissions per m ² for space and water heating			16.5408 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m ² for lighting			2.3459 (272b)
Emissions per m ² for pumps and fans			0.5645 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5408 * 1.00) + 2.3459 + 0.5645, rounded to 2 d.p.			19.4500 (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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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) = 0.1208 (8)
Measured/design AP50					Yes
Infiltration rate					3.8500
Number of sides sheltered					0.3133 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2428 (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												
	0.3096	0.3036	0.2975	0.2671	0.2611	0.2307	0.2307	0.2246	0.2428	0.2611	0.2732	0.2853 (22b)
Effective ac	0.5479	0.5461	0.5442	0.5357	0.5341	0.5266	0.5266	0.5252	0.5295	0.5341	0.5373	0.5407 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1600	2.5600		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1584	1.9755		(29a)
WT-I-11	7.9200		7.9200	0.3600	2.8512		(29a)
Flat Roof	68.9600		68.9600	0.1500	10.3440		(30)
Total net area of external elements Aum(A, m ²)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7300		(33)
Party Wall 1			36.9600	0.0000	0.0000		(32)
Party Floor 1			68.9600				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4278 (36)
Total fabric heat loss						(33) + (36) =	48.1578 (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	29.9261	29.8244	29.7248	29.2568	29.1692	28.7616	28.7616	28.6861	28.9186	29.1692	29.3463	29.5315 (38)
Heat transfer coeff	78.0838	77.9822	77.8825	77.4145	77.3270	76.9193	76.9193	76.8438	77.0763	77.3270	77.5041	77.6893 (39)
Average = Sum(39)m / 12 =												77.4141 (39)
HLP	1.1323	1.1308	1.1294	1.1226	1.1213	1.1154	1.1154	1.1143	1.1177	1.1213	1.1239	1.1266 (40)
HLP (average)												1.1226 (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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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CALCULATION 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 (56)
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)
	30.1371	26.3581	27.1992	23.7129	22.7531	19.6342	18.1940	20.8779	21.1272	24.6217	26.8765	29.1862 (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	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6496	15.6762	12.7487	9.6516	7.2147	6.0909	6.5815	8.5549	11.4823	14.5794	17.0164	18.1401 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.8577	196.8797	191.7843	180.9368	167.2437	154.3742	145.7766	143.7545	148.8500	159.6975	173.3905	186.2601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031 (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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245 (71)
Water heating gains (Table 5)	40.5069	39.2234	36.5581	32.9346	30.5822	27.2697	24.4543	28.0617	29.3434	33.0937	37.3285	39.2288 (72)
Total internal gains	309.3233	308.0885	297.4003	279.8322	261.3498	244.0441	233.1215	236.6803	245.9848	263.6798	284.0446	299.9381 (73)

6. Solar gains

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
North	12.8500				10.6334		0.4500		0.0000		0.7700		47.3454 (74)
Solar gains	47.3454	90.4796	153.7469	246.9569	332.6736	356.1370	332.4994	263.7958	184.8536	107.7041	58.4067	39.4695	(83)
Total gains	356.6688	398.5680	451.1472	526.7892	594.0234	600.1811	565.6209	500.4761	430.8384	371.3839	342.4513	339.4076	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	24.5320	24.5640	24.5954	24.7441	24.7722	24.9034	24.9034	24.9279	24.8527	24.7722	24.7155	24.6566
alpha	2.6355	2.6376	2.6397	2.6496	2.6515	2.6602	2.6602	2.6619	2.6568	2.6515	2.6477	2.6438
util living area	0.9759	0.9664	0.9448	0.8915	0.7914	0.6515	0.5260	0.5921	0.7979	0.9262	0.9667	0.9788 (86)
MIT	18.5082	18.7301	19.1654	19.7783	20.3483	20.7345	20.8927	20.8501	20.5073	19.7957	19.0490	18.4587 (87)
Th 2	19.9745	19.9757	19.9769	19.9824	19.9835	19.9883	19.9883	19.9892	19.9864	19.9835	19.9814	19.9792 (88)
util rest of house	0.9722	0.9611	0.9356	0.8725	0.7529	0.5830	0.4272	0.4940	0.7450	0.9095	0.9605	0.9755 (89)
MIT 2	17.6880	17.9087	18.3395	18.9406	19.4777	19.8190	19.9384	19.9142	19.6387	18.9686	18.2313	17.6421 (90)
Living area fraction									fLA = Living area / (4) =			0.4147 (91)
MIT	18.0282	18.2493	18.6820	19.2880	19.8388	20.1987	20.3342	20.3024	19.9989	19.3117	18.5704	17.9808 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0282	18.2493	18.6820	19.2880	19.8388	20.1987	20.3342	20.3024	19.9989	19.3117	18.5704	17.9808 (93)

8. Space heating requirement

Utilisation	Jan 0.9626	Feb 0.9494	Mar 0.9210	Apr 0.8570	May 0.7468	Jun 0.5984	Jul 0.4628	Aug 0.5266	Sep 0.7458	Oct 0.8956	Nov 0.9493	Dec 0.9667 (94)
Useful gains	343.3312	378.4054	415.5111	451.4663	443.5935	359.1213	261.7963	263.5630	321.3167	332.6143	325.0747	328.1156 (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	1071.9473	1041.0111	948.7687	804.1830	629.3449	430.6474	287.2321	299.8726	454.6683	673.6456	889.0022	1070.6180 (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	542.0904	445.2710	396.7437	253.9560	138.1991	0.0000	0.0000	0.0000	0.0000	253.7273	406.0278	552.4218 (98)
Space heating												2988.4371 (98)
Space heating per m2										(98) / (4) =		43.3358 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	723.0416	569.2030	584.0131	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7556	0.8148	0.7734	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	546.3037	463.7873	451.6759	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	784.1269	742.0771	667.2972	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	171.2327	207.0476	160.4222	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												538.7026 (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	42.8082	51.7619	40.1056	0.0000	0.0000	0.0000 (107)
Space cooling											134.6757 (107)
Space cooling per m2											1.9530 (108)
Energy for space heating											43.3358 (99)
Energy for space cooling											1.9530 (108)
Total											45.2888 (109)
Dwelling Fabric Energy Efficiency (DFEE)											45.3 (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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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) = 0.1208 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3708 (18)
					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2874 (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	0.3664	0.3593	0.3521	0.3161	0.3090	0.2730	0.2730	0.2658	0.2874	0.3090	0.3233	0.3377 (22b)
	0.5671	0.5645	0.5620	0.5500	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5523	0.5570 (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			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			12.8500	1.3258	17.0360			(27)					
WT-E-03	28.8500	12.8500	16.0000	0.1800	2.8800			(29a)					
WT-I-02	14.5900	2.1200	12.4700	0.1800	2.2446			(29a)					
WT-I-11	7.9200		7.9200	0.1800	1.4256			(29a)					
Flat Roof	68.9600		68.9600	0.1300	8.9648			(30)					
Total net area of external elements Aum(A, m2)			120.3200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) =	34.6710		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.5625 (36)					
Total fabric heat loss						(33) + (36) =	45.2335	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 30.9750	Feb 30.8326	Mar 30.6931	Apr 30.0375	May 29.9149	Jun 29.3439	Jul 29.3439	Aug 29.2382	Sep 29.5638	Oct 29.9149	Nov 30.1630	Dec 30.4224	(38)
Heat transfer coeff	76.2085	76.0661	75.9266	75.2710	75.1484	74.5774	74.5774	74.4717	74.7973	75.1484	75.3965	75.6559	(39)
Average = Sum(39)m / 12 =												75.2704	(39)
HLP	Jan 1.1051	Feb 1.1030	Mar 1.1010	Apr 1.0915	May 1.0897	Jun 1.0815	Jul 1.0815	Aug 1.0799	Sep 1.0846	Oct 1.0897	Nov 1.0933	Dec 1.0971	(40)
HLP (average)												1.0915	(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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
Daily hot water use	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m = 1367.8978 (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												

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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)
	30.1371	26.3581	27.1992	23.7129	22.7531	19.6342	18.1940	20.8779	21.1272	24.6217	26.8765	29.1862 (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	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	111.0307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6496	15.6762	12.7487	9.6516	7.2147	6.0909	6.5815	8.5549	11.4823	14.5794	17.0164	18.1401	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.8577	196.8797	191.7843	180.9368	167.2437	154.3742	145.7766	143.7545	148.8500	159.6975	173.3905	186.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	34.1031	(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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	(71)
Water heating gains (Table 5)	40.5069	39.2234	36.5581	32.9346	30.5822	27.2697	24.4543	28.0617	29.3434	33.0937	37.3285	39.2288	(72)
Total internal gains	309.3233	308.0885	297.4003	279.8322	261.3498	244.0441	233.1215	236.6803	245.9848	263.6798	284.0446	299.9381	(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				12.8500	10.6334		0.6300		0.7000		0.7700	41.7587 (74)			
Solar gains				41.7587	79.8030	135.6048	217.8160	293.4181	314.1128	293.2644	232.6679	163.0409	94.9950	51.5147	34.8121 (83)
Total gains				351.0820	387.8915	433.0051	497.6482	554.7679	558.1569	526.3860	469.3482	409.0257	358.6749	335.5593	334.7502 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8393	62.9569	63.0726	63.6220	63.7258	64.2137	64.2137	64.3049	64.0249	63.7258	63.5161	63.2983	
alpha	5.1893	5.1971	5.2048	5.2415	5.2484	5.2809	5.2809	5.2870	5.2683	5.2484	5.2344	5.2199	
util living area	0.9991	0.9983	0.9953	0.9805	0.9197	0.7685	0.6030	0.6866	0.9206	0.9909	0.9982	0.9993	(86)
MIT	19.7341	19.8497	20.0793	20.4179	20.7402	20.9333	20.9852	20.9720	20.8076	20.4132	20.0188	19.7122	(87)
Th 2	19.9967	19.9983	20.0000	20.0078	20.0092	20.0160	20.0160	20.0173	20.0134	20.0092	20.0063	20.0032	(88)
util rest of house	0.9988	0.9976	0.9935	0.9722	0.8852	0.6819	0.4785	0.5606	0.8714	0.9858	0.9975	0.9991	(89)
MIT 2	18.8356	18.9523	19.1826	19.5229	19.8256	19.9839	20.0120	20.0086	19.8950	19.5225	19.1278	18.8190	(90)
Living area fraction									fLA = Living area / (4) =			0.4147	(91)
MIT	19.2082	19.3245	19.5545	19.8941	20.2049	20.3777	20.4156	20.4081	20.2735	19.8919	19.4973	19.1894	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2082	19.3245	19.5545	19.8941	20.2049	20.3777	20.4156	20.4081	20.2735	19.8919	19.4973	19.1894	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9984	0.9971	0.9924	0.9711	0.8930	0.7161	0.5307	0.6135	0.8868	0.9850	0.9970	0.9988	(94)
Ext temp.	350.5343	386.7616	429.7114	483.2467	495.4333	399.6962	279.3733	287.9523	362.7108	353.3048	334.5489	334.3457	(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	1136.1347	1097.2142	991.1843	827.5346	639.1309	430.8825	284.5601	298.4925	461.7629	698.2687	934.7158	1134.0375	(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	584.4866	477.4242	417.7359	247.8873	106.9110	0.0000	0.0000	0.0000	0.0000	256.6532	432.1202	594.9707	(98)
Space heating												3118.1891	(98)
Space heating per m2										(98) / (4) =		45.2174	(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	701.0275	551.8727	565.9846	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9208	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	602.8809	508.1731	499.6882	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	735.0078	696.2181	630.9139	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	95.1313	139.9055	97.6319	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												332.6688	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
													fC = cooled area / (4) =

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	23.7828	34.9764	24.4080	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												83.1672 (107)
Energy for space heating												1.2060 (108)
Energy for space cooling												45.2174 (99)
Total												1.2060 (108)
Target Fabric Energy Efficiency (TFEE)												46.4234 (109)
												53.4 (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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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					3.8500
Infiltration rate					0.1925 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1492 (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	0.1566	0.1492	0.1492	0.1380	0.1380	0.1231	0.1268	0.1194	0.1231	0.1305	0.1305	0.1417 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1600	2.5600		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1584	1.9755		(29a)
WT-I-11	7.9200		7.9200	0.3600	2.8512		(29a)
Flat Roof	68.9600		68.9600	0.1500	10.3440		(30)
Total net area of external elements Aum(A, m ²)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7300		(33)
Party Wall 1			36.9600	0.0000	0.0000		(32)
Party Floor 1			68.9600				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4278 (36)
Total fabric heat loss							(33) + (36) = 48.1578 (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	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082 (38)
Heat transfer coeff	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659 (39)
Average = Sum(39)m / 12 =												75.4659 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m = 1367.8978 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.2733	18.6057	19.1994	16.7385	16.0610	13.8594	12.8428	14.7373	14.9133	17.3800	18.9717	20.6020 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0821	12.6996	14.0290	13.5410	13.9666	13.4863	13.9173	13.9493	13.5161	14.0032	13.5925	14.0718 (61)
Total heat required for water heating calculated for each month	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	50.6762	44.4176	46.0660	40.4890	39.0936	34.0934	31.9476	36.1550	36.4369	42.0266	45.4520	49.1858 (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	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.1239	39.1905	31.8718	24.1290	18.0367	15.2274	16.4537	21.3872	28.7058	36.4486	42.5409	45.3503 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.8324	293.8503	286.2452	270.0549	249.6175	230.4092	217.5770	214.5590	222.1641	238.3544	258.7918	278.0001 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443 (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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245 (71)
Water heating gains (Table 5)	68.1132	66.0976	61.9167	56.2347	52.5452	47.3519	42.9403	48.5955	50.6068	56.4873	63.1278	66.1099 (72)
Total internal gains	501.0261	497.0950	477.9903	448.3752	418.1559	390.9451	374.9275	382.4982	399.4333	429.2469	462.4171	487.4168 (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				12.8500	11.9814	0.4500	0.0000			0.7700			53.3477 (74)

Solar gains	53.3477	92.5546	156.9551	260.9369	341.9636	391.0745	361.4790	293.9115	205.0975	118.1430	67.5949	43.9348 (83)	
Total gains	554.3737	589.6495	634.9454	709.3121	760.1195	782.0196	736.4065	676.4097	604.5308	547.3899	530.0120	531.3516 (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	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831
alpha	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922
util living area	0.9286	0.9137	0.8739	0.7866	0.6408	0.4449	0.3076	0.3423	0.6038	0.8155	0.9023	0.9346 (86)
MIT	19.1901	19.3531	19.7546	20.2611	20.6919	20.9222	20.9805	20.9738	20.8079	20.3053	19.6717	19.1421 (87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055 (88)
util rest of house	0.9185	0.9016	0.8555	0.7550	0.5876	0.3676	0.2130	0.2418	0.5284	0.7804	0.8863	0.9253 (89)
MIT 2	18.3791	18.5380	18.9275	19.4056	19.7888	19.9664	20.0001	19.9978	19.8913	19.4583	18.8530	18.3327 (90)
Living area fraction									fLA = Living area / (4) =			0.4147 (91)
MIT	18.7155	18.8760	19.2705	19.7604	20.1633	20.3628	20.4067	20.4026	20.2715	19.8096	19.1926	18.6684 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5655	18.7260	19.1205	19.6104	20.0133	20.2128	20.2567	20.2526	20.1215	19.6596	19.0426	18.5184 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9005	0.8826	0.8363	0.7409	0.5881	0.3844	0.2375	0.2675	0.5379	0.7663	0.8674	0.9077 (94)
Useful gains	499.1903	520.3965	530.9832	525.5473	446.9884	300.5733	174.8933	180.9470	325.1645	419.4901	459.7452	482.3222 (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	1016.1846	990.5677	884.4994	732.8027	529.2665	317.9225	177.8517	185.0861	371.4030	608.2235	833.3372	1012.6303 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	384.6437	315.9550	263.0160	149.2239	61.2149	0.0000	0.0000	0.0000	0.0000	140.4177	268.9863	394.5493 (98)
Space heating												1978.0067 (98)
RHI space heating demand												1978 (98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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					3.8500
Infiltration rate					0.1925 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1492 (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	0.1902	0.1865	0.1828	0.1641	0.1604	0.1417	0.1417	0.1380	0.1492	0.1604	0.1678	0.1753 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1600	2.5600		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1584	1.9755		(29a)
WT-I-11	7.9200		7.9200	0.3600	2.8512		(29a)
Flat Roof	68.9600		68.9600	0.1500	10.3440		(30)
Total net area of external elements Aum(A, m ²)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7300		(33)
Party Wall 1			36.9600	0.0000	0.0000		(32)
Party Floor 1			68.9600				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4278 (36)
Total fabric heat loss							(33) + (36) = 48.1578 (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	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082 (38)
Heat transfer coeff	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659 (39)
Average = Sum(39)m / 12 =												75.4659 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m = 1367.8978 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.2733	18.6057	19.1994	16.7385	16.0610	13.8594	12.8428	14.7373	14.9133	17.3800	18.9717	20.6020 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0821	12.6996	14.0290	13.5410	13.9666	13.4863	13.9173	13.9493	13.5161	14.0032	13.5925	14.0718 (61)
Total heat required for water heating calculated for each month	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (64)
Heat gains from water heating, kWh/month	50.6762	44.4176	46.0660	40.4890	39.0936	34.0934	31.9476	36.1550	36.4369	42.0266	45.4520	49.1858 (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	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.1239	39.1905	31.8718	24.1290	18.0367	15.2274	16.4537	21.3872	28.7058	36.4486	42.5409	45.3503	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.8324	293.8503	286.2452	270.0549	249.6175	230.4092	217.5770	214.5590	222.1641	238.3544	258.7918	278.0001	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	(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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	(71)
Water heating gains (Table 5)	68.1132	66.0976	61.9167	56.2347	52.5452	47.3519	42.9403	48.5955	50.6068	56.4873	63.1278	66.1099	(72)
Total internal gains	501.0261	497.0950	477.9903	448.3752	418.1559	390.9451	374.9275	382.4982	399.4333	429.2469	462.4171	487.4168	(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					12.8500	10.6334	0.4500	0.0000	0.7700	47.3454 (74)			
-----					-----					-----			
Solar gains	47.3454	90.4796	153.7469	246.9569	332.6736	356.1370	332.4994	263.7958	184.8536	107.7041	58.4067	39.4695	(83)
Total gains	548.3715	587.5745	631.7372	695.3322	750.8296	747.0820	707.4269	646.2940	584.2869	536.9510	520.8238	526.8863	(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	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	
alpha	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	
util living area	0.9370	0.9216	0.8891	0.8195	0.7041	0.5582	0.4347	0.4852	0.6859	0.8492	0.9173	0.9428	(86)
MIT	19.0280	19.2208	19.5931	20.0930	20.5426	20.8258	20.9353	20.9114	20.6832	20.1312	19.4910	18.9631	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9284	0.9109	0.8735	0.7932	0.6605	0.4916	0.3478	0.3962	0.6247	0.8214	0.9042	0.9349	(89)
MIT 2	18.2193	18.4080	18.7707	19.2484	19.6597	19.8980	19.9765	19.9632	19.7923	19.2955	18.6768	18.1558	(90)
Living area fraction	18.5547	18.7451	19.1118	19.5987	20.0259	20.2828	20.3741	20.3565	20.1618	19.6421	19.0145	18.4906	(91)
MIT	18.4047	18.5951	18.9618	19.4487	19.8759	20.1328	20.2241	20.2065	20.0118	19.4921	18.8645	18.3406	(92)
Temperature adjustment												-0.1500	
adjusted MIT													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	499.5700	524.2757	539.4504	539.8652	491.2617	373.9978	260.1087	268.3250	365.2308	431.9906	461.2982	483.8097	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1064.4263	1033.5140	940.4408	796.0675	617.0001	417.5379	273.4975	287.2579	446.1385	671.0506	887.8164	1067.1347	(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	420.2531	342.2081	298.3369	184.4656	93.5494	0.0000	0.0000	0.0000	0.0000	177.8607	307.0931	433.9938	(98)
Space heating												2257.7607	(98)
Space heating per m2												32.7401	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

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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													2494.7632 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	420.2531	342.2081	298.3369	184.4656	93.5494	0.0000	0.0000	0.0000	0.0000	177.8607	307.0931	433.9938	(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)	464.3681	378.1305	329.6540	203.8294	103.3695	0.0000	0.0000	0.0000	0.0000	196.5311	339.3294	479.5512	(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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186	(64)
Efficiency of water heater (217)m	89.6112	89.5627	89.4426	89.1788	88.6668	87.3000	87.3000	87.3000	87.3000	89.1213	89.4727	89.6500	(217)
Fuel for water heating, kWh/month	173.9781	152.6727	158.7893	140.3150	136.5112	121.2860	114.0162	128.5201	129.3680	145.7228	156.5510	168.8996	(219)
Water heating fuel used												1726.6302	(219)
Annual totals kWh/year													
Space heating fuel - main system												2494.7632	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)												37.1523	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												112.1523	(231)
Electricity for lighting (calculated in Appendix L)												311.6969	(232)
Total delivered energy for all uses												4645.2426	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2494.7632	3.4800	86.8178	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1726.6302	3.4800	60.0867	(247)
Mechanical ventilation fans	37.1523	13.1900	4.9004	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	311.6969	13.1900	41.1128	(250)
Additional standing charges			120.0000	(251)
Total energy cost			322.8102	(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] =	1.1897 (257)
SAP value	83.4034	
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	2494.7632	0.2160	538.8689	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1726.6302	0.2160	372.9521	(264)
Space and water heating			911.8210	(265)
Pumps and fans	112.1523	0.5190	58.2071	(267)
Energy for lighting	311.6969	0.5190	161.7707	(268)
Total kg/year			1131.7987	(272)
CO2 emissions per m2			16.4100	(273)
EI value			86.6917	
EI rating			87	(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	$3.48 / 0.8866 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8866 = 0.2436$, 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	68.9600 (1b)	x 2.4000 (2b)	= 165.5040 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.5040 (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					3.8500
Infiltration rate					0.1925 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1492 (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	0.1566	0.1492	0.1492	0.1380	0.1380	0.1231	0.1268	0.1194	0.1231	0.1305	0.1305	0.1417 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1200	1.0000	2.1200		(26)
Opening Type 2 (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
WT-E-03	28.8500	12.8500	16.0000	0.1600	2.5600		(29a)
WT-I-02	14.5900	2.1200	12.4700	0.1584	1.9755		(29a)
WT-I-11	7.9200		7.9200	0.3600	2.8512		(29a)
Flat Roof	68.9600		68.9600	0.1500	10.3440		(30)
Total net area of external elements Aum(A, m ²)			120.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7300		(33)
Party Wall 1			36.9600	0.0000	0.0000		(32)
Party Floor 1			68.9600				(32d)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4278 (36)
Total fabric heat loss							(33) + (36) = 48.1578 (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	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082	27.3082 (38)
Heat transfer coeff	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659	75.4659 (39)
Average = Sum(39)m / 12 =												75.4659 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (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												2.2206 (42)
Average daily hot water use (litres/day)												86.9396 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.6335	92.1559	88.6784	85.2008	81.7232	78.2456	78.2456	81.7232	85.2008	88.6784	92.1559	95.6335 (44)
Energy conte	141.8217	124.0382	127.9963	111.5903	107.0735	92.3963	85.6188	98.2488	99.4222	115.8670	126.4779	137.3468 (45)
Energy content (annual)												Total = Sum(45)m = 1367.8978 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	21.2733	18.6057	19.1994	16.7385	16.0610	13.8594	12.8428	14.7373	14.9133	17.3800	18.9717	20.6020 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0821	12.6996	14.0290	13.5410	13.9666	13.4863	13.9173	13.9493	13.5161	14.0032	13.5925	14.0718 (61)
Total heat required for water heating calculated for each month	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186 (64)
								Total per year (kWh/year) = Sum(64)m =				1532.7526 (64)
Heat gains from water heating, kWh/month	50.6762	44.4176	46.0660	40.4890	39.0936	34.0934	31.9476	36.1550	36.4369	42.0266	45.4520	49.1858 (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	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368	133.2368 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.1239	39.1905	31.8718	24.1290	18.0367	15.2274	16.4537	21.3872	28.7058	36.4486	42.5409	45.3503 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.8324	293.8503	286.2452	270.0549	249.6175	230.4092	217.5770	214.5590	222.1641	238.3544	258.7918	278.0001 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443	50.5443 (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)	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245	-88.8245 (71)
Water heating gains (Table 5)	68.1132	66.0976	61.9167	56.2347	52.5452	47.3519	42.9403	48.5955	50.6068	56.4873	63.1278	66.1099 (72)
Total internal gains	501.0261	497.0950	477.9903	448.3752	418.1559	390.9451	374.9275	382.4982	399.4333	429.2469	462.4171	487.4168 (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				12.8500	11.9814		0.4500		0.0000		0.7700		53.3477 (74)

Solar gains	53.3477	92.5546	156.9551	260.9369	341.9636	391.0745	361.4790	293.9115	205.0975	118.1430	67.5949		43.9348 (83)
Total gains	554.3737	589.6495	634.9454	709.3121	760.1195	782.0196	736.4065	676.4097	604.5308	547.3899	530.0120		531.3516 (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	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	25.3831	
alpha	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	2.6922	
util living area	0.9286	0.9137	0.8739	0.7866	0.6408	0.4449	0.3076	0.3423	0.6038	0.8155	0.9023	0.9346 (86)	
MIT	19.1901	19.3531	19.7546	20.2611	20.6919	20.9222	20.9805	20.9738	20.8079	20.3053	19.6717	19.1421 (87)	
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055 (88)	
util rest of house	0.9185	0.9016	0.8555	0.7550	0.5876	0.3676	0.2130	0.2418	0.5284	0.7804	0.8863	0.9253 (89)	
MIT 2	18.3791	18.5380	18.9275	19.4056	19.7888	19.9664	20.0001	19.9978	19.8913	19.4583	18.8530	18.3327 (90)	
Living area fraction									fLA = Living area / (4) =				0.4147 (91)
MIT	18.7155	18.8760	19.2705	19.7604	20.1633	20.3628	20.4067	20.4026	20.2715	19.8096	19.1926	18.6684 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.5655	18.7260	19.1205	19.6104	20.0133	20.2128	20.2567	20.2526	20.1215	19.6596	19.0426	18.5184 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9005	0.8826	0.8363	0.7409	0.5881	0.3844	0.2375	0.2675	0.5379	0.7663	0.8674	0.9077 (94)
Useful gains	499.1903	520.3965	530.9832	525.5473	446.9884	300.5733	174.8933	180.9470	325.1645	419.4901	459.7452	482.3222 (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	1016.1846	990.5677	884.4994	732.8027	529.2665	317.9225	177.8517	185.0861	371.4030	608.2235	833.3372	1012.6303 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	384.6437	315.9550	263.0160	149.2239	61.2149	0.0000	0.0000	0.0000	0.0000	140.4177	268.9863	394.5493 (98)
Space heating												1978.0067 (98)
Space heating per m2												28.6834 (99)
										(98) / (4) =		

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													2185.6428 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	384.6437	315.9550	263.0160	149.2239	61.2149	0.0000	0.0000	0.0000	0.0000	140.4177	268.9863	394.5493	(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)	425.0207	349.1216	290.6254	164.8882	67.6408	0.0000	0.0000	0.0000	0.0000	155.1576	297.2224	435.9660	(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	155.9038	136.7378	142.0253	125.1313	121.0401	105.8826	99.5361	112.1981	112.9383	129.8701	140.0704	151.4186	(64)
Efficiency of water heater (217)m	89.5532	89.5090	89.3516	89.0119	88.3493	87.3000	87.3000	87.3000	87.3000	88.9337	89.3782	89.5892	(216)
Fuel for water heating, kWh/month	174.0906	152.7644	158.9511	140.5782	137.0018	121.2860	114.0162	128.5201	129.3680	146.0304	156.7166	169.0143	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2185.6428 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.2560, total flow = 34.0000, SFP = 0.1840)													
mechanical ventilation fans (SFP = 0.1840)													37.1523 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													112.1523 (231)
Electricity for lighting (calculated in Appendix L)													311.6969 (232)
Total delivered energy for all uses													4337.8296 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2185.6428	3.8700	84.5844 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1728.3376	3.8700	66.8867 (247)
Mechanical ventilation fans	37.1523	18.9000	7.0218 (249)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	311.6969	18.9000	58.9107 (250)
Additional standing charges			93.0000 (251)
Total energy cost			324.5785 (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	2185.6428	0.2160	472.0988 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1728.3376	0.2160	373.3209 (264)
Space and water heating			845.4198 (265)
Pumps and fans	112.1523	0.5190	58.2071 (267)
Energy for lighting	311.6969	0.5190	161.7707 (268)
Total kg/year			1065.3975 (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	2185.6428	1.2200	2666.4842 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1728.3376	1.2200	2108.5719 (264)
Space and water heating			4775.0560 (265)
Pumps and fans	112.1523	3.0700	344.3077 (267)
Energy for lighting	311.6969	3.0700	956.9094 (268)
Primary energy kWh/year			6076.2731 (272)
Primary energy kWh/m2/year			88.1130 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 87

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 87

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	£80	£80	£0
Mains gas	£244	£244	£0
Space heating	£199	£199	£0
Water heating	£67	£67	£0
Lighting	£59	£59	£0
Total cost of fuels	£324	£324	£0
Total cost of uses	£325	£325	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	88 kWh/m²	88 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	327.70 (P1)
Transmission heat loss coefficient	48.16 (37)
Summer heat loss coefficient	375.86 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	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)
[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b
			FF Specific data or Table 6c
North	12.8500	81.1852	0.4500 0.0000
total:			0.9000 422.5079

	Jun	Jul	Aug	
Solar gains	457	423	344	(P4)
Internal gains	388	372	379	
Total summer gains	845	794	723	(P5)
Summer gain/loss ratio	2.25	2.11	1.92	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.55	21.31	21.02	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			