

PREDICTED ENERGY ASSESSMENT

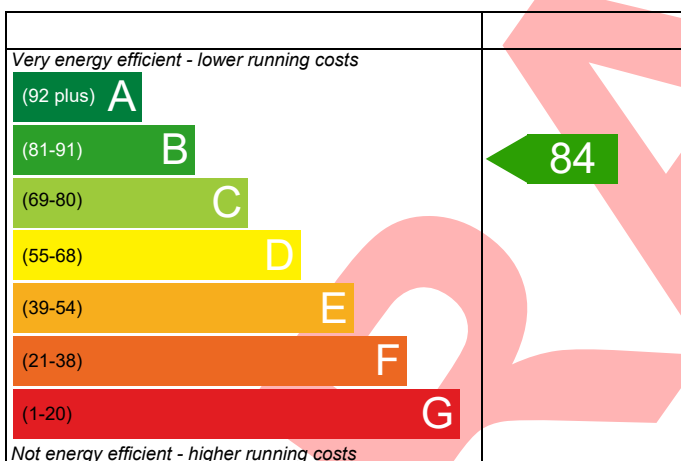
377, 2 Bed,
K, WC, B

Dwelling type: House, Mid-Terrace
Date of assessment: 22/01/2024
Produced by: Katarzyna Gotlib
Total floor area: 76.02 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

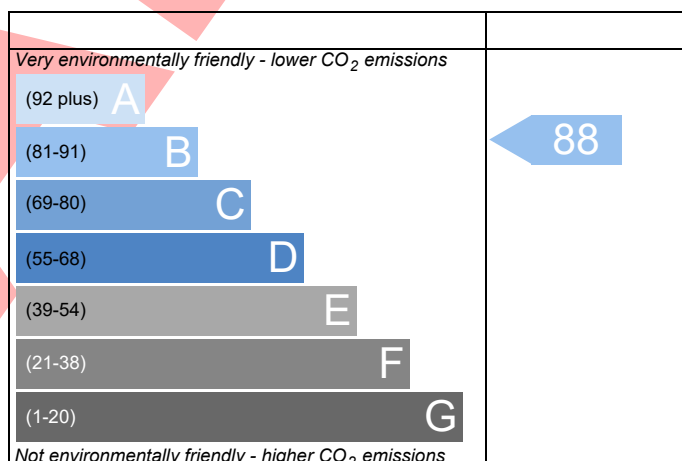


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	4907-Z852-6657-0377	Issued on Date	22/01/2024
Assessment Reference	377	Prop Type Ref	Tavy Mid As
Property	377, 2 Bed, K, WC, B		

SAP Rating	84 B	DER	16.53	TER	17.77
Environmental	88 B	% DER<TER	6.98		
CO ₂ Emissions (t/year)	1.07	DFEE	38.48	TFEE	45.07
General Requirements Compliance	Pass	% DFEE<TFEE	14.62		

Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk	Assessor ID	Z852-0001
Client	Redrow, Redrow		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.77	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.53	kgCO ₂ /m ²	Pass
	-1.24 (-7.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.07	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	38.48	kWh/m ² /yr	
	-6.6 (-14.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.21 (max. 0.35)	Pass
Openings	1.26 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

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%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Severn Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing South East

3.56 m², No overhang

Windows facing North West

3.74 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Door U-value

1.10

W/m²K

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£25	B 86	B 90	Recommended
Photovoltaic	£3,500 - £5,500	£373	A 97	A 100	Recommended
Wind turbine			0	0	Not applicable
Totals	£7,500 - £11,500	£398	A 97	A 100	

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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Environmental	88 B	% DER<TER	6.98			
CO ₂ Emissions (t/year)	1.07	DFEE	38.48	TFEE	45.07	
General Requirements Compliance	Pass	% DFEE<TFEE	14.62			
Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk				Assessor ID	Z852-0001
Client	Redrow, Redrow					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 76 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) 17.77 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.53 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.21 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.50 (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: 5.01 (design value)
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

Not applicable

9 Summertime temperature

Overheating risk (Severn Valley): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 3.56 m², No overhang
Windows facing North West: 3.74 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.10 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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) =		0.3498 (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	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
Effective ac	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11105.5930 (34)
146.0878 (35)
7.0937 (36)
(33) + (36) = 40.5624 (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	36.8452	36.6078	36.3751	35.2820	35.0775	34.1255	34.1255	33.9492	34.4922	35.0775	35.4912	35.9237 (38)
Heat transfer coeff	77.4076	77.1702	76.9375	75.8444	75.6399	74.6879	74.6879	74.5116	75.0546	75.6399	76.0537	76.4862 (39)
Average = Sum(39)m / 12 =												75.8435 (39)
HLP	1.0183	1.0151	1.0121	0.9977	0.9950	0.9825	0.9825	0.9802	0.9873	0.9950	1.0004	1.0061 (40)
HLP (average)												0.9977 (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												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1428.5822 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	19.8133	21.5160 (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	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179 (61)
Total heat required for water heating calculated for each month											
162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (64)
Heat gains from water heating, kWh/month											
52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240	51.2189 (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	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8975	19.4492	15.8171	11.9746	8.9511	7.5569	8.1655	10.6139	14.2459	18.0884	21.1119	22.5061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0316	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426	(72)
Total internal gains	365.4996	363.1347	349.6202	328.1013	306.4023	285.6534	272.3480	278.5142	289.7625	311.4888	336.2699	354.7094	(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
Southeast					3.5600	36.7938	0.5200	0.0000			0.7700	52.4468 (77)
Northwest					3.7400	11.2829	0.5200	0.0000			0.7700	16.8962 (81)
Solar gains	69.3430	123.7289	184.1984	253.2173	306.4310	314.2469	298.7927	257.5592	207.8582	140.7662	84.0789	58.6818 (83)
Total gains	434.8426	486.8636	533.8187	581.3186	612.8333	599.9003	571.1407	536.0734	497.6207	452.2550	420.3489	413.3912 (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	39.8525	39.9751	40.0960	40.6739	40.7838	41.3037	41.3037	41.4014	41.1019	40.7838	40.5620	40.3326
alpha	3.6568	3.6650	3.6731	3.7116	3.7189	3.7536	3.7536	3.7601	3.7401	3.7189	3.7041	3.6888
util living area	0.9876	0.9801	0.9641	0.9238	0.8388	0.6923	0.5423	0.5907	0.8045	0.9414	0.9800	0.9896 (86)
MIT	19.3527	19.5384	19.8512	20.2693	20.6361	20.8791	20.9636	20.9497	20.7737	20.3068	19.7626	19.3229 (87)
Th 2	20.0681	20.0707	20.0733	20.0853	20.0875	20.0980	20.0980	20.0999	20.0939	20.0875	20.0830	20.0782 (88)
util rest of house	0.9851	0.9762	0.9565	0.9069	0.8015	0.6222	0.4439	0.4929	0.7475	0.9251	0.9753	0.9875 (89)
MIT 2	18.5564	18.7425	19.0532	19.4689	19.8124	20.0259	20.0831	20.0778	19.9440	19.5127	18.9755	18.5345 (90)
Living area fraction	18.7653	18.9513	19.2625	19.6789	20.0284	20.2497	20.3140	20.3065	20.1616	19.7210	19.1820	18.7413 (91)
MIT	18.7653	18.9513	19.2625	19.6789	20.0284	20.2497	20.3140	20.3065	20.1616	19.7210	19.1820	18.7413 (92)
Temperature adjustment	18.6153	18.8013	19.1125	19.5289	19.8784	20.0997	20.1640	20.1565	20.0116	19.5710	19.0320	-0.1500
adjusted MIT	18.6153	18.8013	19.1125	19.5289	19.8784	20.0997	20.1640	20.1565	20.0116	19.5710	19.0320	18.5913 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9799	0.9690	0.9466	0.8945	0.7918	0.6223	0.4515	0.4994	0.7416	0.9135	0.9681	0.9830	(94)	
Useful gains	426.0938	471.7868	505.3335	520.0076	485.2248	373.3235	257.8762	267.7305	369.0435	413.1311	406.9459	406.3551	(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	1108.1134	1072.7626	970.3736	806.1403	618.6174	410.7600	266.1912	279.9005	443.6961	678.5665	907.4695	1100.7364	(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	507.4226	403.8558	345.9898	206.0156	99.2440	0.0000	0.0000	0.0000	0.0000	197.4839	360.3769	516.6196	(98)	
Space heating												2637.0083	(98)	
Space heating per m2												(98) / (4) =	34.6883	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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												2913.8213 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	507.4226	403.8558	345.9898	206.0156	99.2440	0.0000	0.0000	0.0000	0.0000	197.4839	360.3769	516.6196 (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)	560.6879	446.2495	382.3092	227.6415	109.6619	0.0000	0.0000	0.0000	0.0000	218.2143	398.2066	570.8504 (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	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (64)
Efficiency of water heater (217)m	89.7034	89.6440	89.5182	89.2339	88.6828	87.3000	87.3000	87.3000	87.3000	89.1726	89.5549	87.3000 (216)
Fuel for water heating, kWh/month	180.8459	158.7004	165.0261	145.7993	141.8644	125.9993	118.3838	133.5328	134.4415	151.4285	162.7011	175.5688 (219)
Water heating fuel used												1794.2918 (219)
Annual totals kWh/year												
Space heating fuel - main system												2913.8213 (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)												386.7166 (232)
Total delivered energy for all uses												5169.8297 (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	2913.8213	0.2160	629.3854 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1794.2918	0.2160	387.5670 (264)
Space and water heating			1016.9524 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7166	0.5190	200.7059 (268)
Total CO2, kg/year			1256.5833 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5300 (273)

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

DER		16.5300 ZC1
Total Floor Area	TFA	76.0200
Assumed number of occupants	N	2.3830
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.4415 ZC2
CO2 emissions from cooking, equation (L16)		2.3177 ZC3
Total CO2 emissions		35.2892 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.2892 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (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) =					0.3494 (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	0.4455	0.4368	0.4280	0.3844	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3931	0.4106	(22b)				
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5773	0.5843	(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 Semi-glazed door			1.9100	1.2000	2.2920		(26a)					
TER Opening Type (Uw = 1.40)			7.3000	1.3258	9.6780		(27)					
Jetfloor 80mm			38.0100	0.1300	4.9413		(28a)					
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.1800	6.1038		(29a)					
Sloping	5.6300		5.6300	0.1300	0.7319		(30)					
400mm Plane Ceiling	33.4000		33.4000	0.1300	4.3420		(30)					
Total net area of external elements Aum(A, m2)			122.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.1490		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2811 (36)					
Total fabric heat loss						(33) + (36) =	38.4301 (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	36.8304	36.5935	36.3614	35.2709	35.0669	34.1172	34.1172	33.9413	34.4830	35.0669	35.4796	35.9111 (38)
Heat transfer coeff	75.2605	75.0236	74.7915	73.7011	73.4971	72.5474	72.5474	72.3715	72.9132	73.4971	73.9098	74.3413 (39)
Average = Sum(39)m / 12 =												73.7001 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9900	0.9869	0.9838	0.9695	0.9668	0.9543	0.9543	0.9520	0.9591	0.9668	0.9722	0.9779 (40)
HLP (average)												0.9695 (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												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)
Energy content (annual)										Total = Sum(45)m =		1428.5822 (45)
Distribution loss (46)m = 0.15 x (45)m												
22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	19.8133	21.5160 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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)
Combi loss	50.8958	44.2987	47.1943	43.8808	43.4928	40.2987	41.6420	43.4928	43.8808	47.1943	47.4629	50.8958 (61)
Total heat required for water heating calculated for each month	199.0092	173.8397	180.8689	160.4216	155.3164	136.7940	131.0591	146.1002	147.7137	168.2015	179.5518	194.3357 (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	199.0092	173.8397	180.8689	160.4216	155.3164	136.7940	131.0591	146.1002	147.7137	168.2015	179.5518	194.3357 (64)
Heat gains from water heating, kWh/month	61.9717	54.1470	56.2454	49.7200	48.0546	42.1594	40.1417	44.9902	45.4946	52.0335	55.7853	60.4177 (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	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8975	19.4492	15.8171	11.9746	8.9511	7.5569	8.1655	10.6139	14.2459	18.0884	21.1119	22.5061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0316	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	83.2952	80.5760	75.5986	69.0556	64.5895	58.5547	53.9539	60.4706	63.1870	69.9375	77.4795	81.2066	(72)
Total internal gains	377.8599	374.8810	360.7562	338.6288	316.3173	294.9578	281.6592	288.4355	300.2994	322.6342	348.0217	367.0735	(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
Southeast					3.5600	36.7938	0.6300	0.7000			0.7700	40.0310
Northwest					3.7400	11.2829	0.6300	0.7000			0.7700	12.8963 (77)
Solar gains	52.9274	94.4385	140.5930	193.2730	233.8894	239.8550	228.0593	196.5870	158.6518	107.4425	64.1749	44.7900 (83)
Total gains	430.7873	469.3195	501.3492	531.9017	550.2067	534.8128	509.7185	485.0226	458.9512	430.0767	412.1965	411.8635 (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	70.1453	70.3667	70.5851	71.6294	71.8283	72.7686	72.7686	72.9454	72.4035	71.8283	71.4272	71.0126	
alpha	5.6764	5.6911	5.7057	5.7753	5.7886	5.8512	5.8512	5.8630	5.8269	5.7886	5.7618	5.7342	
util living area	0.9985	0.9972	0.9934	0.9790	0.9279	0.7875	0.6105	0.6607	0.8897	0.9840	0.9969	0.9988	(86)
MIT	19.9480	20.0579	20.2529	20.5260	20.7789	20.9447	20.9897	20.9841	20.8787	20.5640	20.2130	19.9318	(87)
Th 2	20.0917	20.0943	20.0968	20.1088	20.1111	20.1216	20.1216	20.1235	20.1175	20.1111	20.1065	20.1018	(88)
util rest of house	0.9980	0.9962	0.9910	0.9705	0.8975	0.7088	0.4968	0.5476	0.8336	0.9760	0.9956	0.9985	(89)
MIT 2	18.6779	18.8404	19.1263	19.5290	19.8782	20.0812	20.1173	20.1162	20.0123	19.5883	19.0763	18.6617	(90)
Living area fraction									fLA = Living area / (4) =			0.2623	(91)
MIT	19.0110	19.1597	19.4218	19.7905	20.1145	20.3077	20.3462	20.3439	20.2395	19.8442	19.3745	18.9948	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0110	19.1597	19.4218	19.7905	20.1145	20.3077	20.3462	20.3439	20.2395	19.8442	19.3745	18.9948	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	429.5455	466.8878	495.5743	514.1409	493.8806	388.7778	268.5294	280.0358	386.7456	418.3664	409.7971	410.9399	(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	1107.1599	1069.8182	966.4430	802.6439	618.4406	414.0805	271.7737	285.4229	447.6522	679.4219	907.2038	1099.8667	(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	504.1451	405.1692	350.3263	207.7221	92.6727	0.0000	0.0000	0.0000	0.0000	194.2253	358.1328	512.5616	(98)
Space heating												2624.9551	(98)
Space heating per m2												34.5298	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2810.4444 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	504.1451	405.1692	350.3263	207.7221	92.6727	0.0000	0.0000	0.0000	0.0000	194.2253	358.1328	512.5616	(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)	539.7699	433.8000	375.0817	222.4006	99.2213	0.0000	0.0000	0.0000	0.0000	207.9500	383.4398	548.7811	(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	199.0092	173.8397	180.8689	160.4216	155.3164	136.7940	131.0591	146.1002	147.7137	168.2015	179.5518	194.3357	(64)
Efficiency of water heater (217)m	87.2925	87.1104	86.6875	85.7027	83.7987	80.3000	80.3000	80.3000	80.3000	85.4141	86.7561	87.3786	(216)
Fuel for water heating, kWh/month	227.9796	199.5624	208.6449	187.1838	185.3446	170.3537	163.2118	181.9430	183.9523	196.9248	206.9616	222.4065	(219)
Water heating fuel used												2334.4690	(219)
Annual totals kWh/year													
Space heating fuel - main system												2810.4444	(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)												386.7166	(232)
Total delivered energy for all uses												5606.6300	(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	2810.4444	0.2160	607.0560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2334.4690	0.2160	504.2453 (264)
Space and water heating			1111.3013 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7166	0.5190	200.7059 (268)
Total CO2, kg/m2/year			1350.9322 (272)
Emissions per m2 for space and water heating			14.6185 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6402 (272b)
Emissions per m2 for pumps and fans			0.5120 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6185 * 1.00) + 2.6402 + 0.5120, rounded to 2 d.p.			17.7700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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) =	0.3498 (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	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	33.4687	(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			9.0000	342.0900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10763.5030 (34)
141.5878 (35)
7.0937 (36)
(33) + (36) = 40.5624 (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	36.8452	36.6078	36.3751	35.2820	35.0775	34.1255	34.1255	33.9492	34.4922	35.0775	35.4912	35.9237 (38)
Heat transfer coeff	77.4076	77.1702	76.9375	75.8444	75.6399	74.6879	74.6879	74.5116	75.0546	75.6399	76.0537	76.4862 (39)
Average = Sum(39)m / 12 =												75.8435 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0183	1.0151	1.0121	0.9977	0.9950	0.9825	0.9825	0.9802	0.9873	0.9950	1.0004	1.0061 (40)
HLP (average)												0.9977 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1428.5822 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.4741	27.5274	28.4059	24.7649	23.7625	20.5053	19.0011	21.8041	22.0645	25.7140	28.0689	30.4810 (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	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8975	19.4492	15.8171	11.9746	8.9511	7.5569	8.1655	10.6139	14.2459	18.0884	21.1119	22.5061	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0316	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	42.3039	40.9635	38.1799	34.3957	31.9389	28.4795	25.5392	29.3066	30.6451	34.5619	38.9846	40.9691	(72)
Total internal gains	333.8686	332.2685	320.3375	300.9689	280.6667	261.8826	250.2444	254.2715	264.7575	284.2586	306.5267	323.8359	(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
Southeast					3.5600	36.7938	0.5200	0.0000			0.7700	52.4468 (77)
Northwest					3.7400	11.2829	0.5200	0.0000			0.7700	16.8962 (81)
Solar gains	69.3430	123.7289	184.1984	253.2173	306.4310	314.2469	298.7927	257.5592	207.8582	140.7662	84.0789	58.6818 (83)
Total gains	403.2116	455.9975	504.5359	554.1862	587.0977	576.1295	549.0372	511.8307	472.6157	425.0248	390.6056	382.5177 (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	38.6249	38.7437	38.8609	39.4210	39.5276	40.0314	40.0314	40.1261	39.8358	39.5276	39.3125	39.0902	
alpha	3.5750	3.5829	3.5907	3.6281	3.6352	3.6688	3.6688	3.6751	3.6557	3.6352	3.6208	3.6060	
util living area	0.9893	0.9824	0.9674	0.9296	0.8489	0.7072	0.5583	0.6098	0.8196	0.9480	0.9827	0.9911	(86)
MIT	19.2561	19.4485	19.7735	20.2100	20.5972	20.8609	20.9565	20.9396	20.7430	20.2462	19.6796	19.2264	(87)
Th 2	20.0681	20.0707	20.0733	20.0853	20.0875	20.0980	20.0980	20.0999	20.0939	20.0875	20.0830	20.0782	(88)
util rest of house	0.9871	0.9789	0.9607	0.9140	0.8136	0.6383	0.4590	0.5116	0.7654	0.9334	0.9787	0.9893	(89)
MIT 2	18.4633	18.6562	18.9795	19.4144	19.7795	20.0134	20.0797	20.0726	19.9205	19.4571	18.8962	18.4413	(90)
Living area fraction	18.6712	18.8640	19.1878	19.6231	19.9940	20.2357	20.3097	20.3000	20.1362	19.6641	19.1017	18.6473	(91)
MIT	18.6712	18.8640	19.1878	19.6231	19.9940	20.2357	20.3097	20.3000	20.1362	19.6641	19.1017	18.6473	(92)
Temperature adjustment	18.6712	18.8640	19.1878	19.6231	19.9940	20.2357	20.3097	20.3000	20.1362	19.6641	19.1017	18.6473	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	396.3157	443.6855	480.5882	501.3273	475.2422	374.3057	265.4254	273.7095	363.1138	393.1445	380.0583	377.0215	(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	1112.4428	1077.6056	976.1663	813.2866	627.3596	420.9212	277.0674	290.5935	453.0466	685.6092	912.7720	1105.0153	(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	532.7985	425.9943	368.7101	224.6107	113.1754	0.0000	0.0000	0.0000	0.0000	217.5937	383.5539	541.6273	(98)
Space heating												2808.0641	(98)
Space heating per m2												36.9385	(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	702.0664	552.6905	566.2882	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8174	0.8797	0.8555	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	573.8939	486.1894	484.4357	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	763.4192	730.0468	688.4733	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	136.4582	181.4299	151.8040	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												469.6921 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.1146	45.3575	37.9510	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												117.4230 (107)
Space cooling per m2												1.5446 (108)
Energy for space heating												36.9385 (99)
Energy for space cooling												1.5446 (108)
Total												38.4831 (109)
Dwelling Fabric Energy Efficiency (DFEE)												38.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4111 (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) =	0.3494 (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	0.4455	0.4368	0.4280	0.3844	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5773	0.5843 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0600	1.0000	2.0600		(26)
TER Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			7.3000	1.3258	9.6780		(27)
Jetfloor 80mm			38.0100	0.1300	4.9413		(28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.1800	6.1038		(29a)
Sloping	5.6300		5.6300	0.1300	0.7319		(30)
400mm Plane Ceiling	33.4000		33.4000	0.1300	4.3420		(30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.1490		(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)							8.2811 (36)
Total fabric heat loss						(33) + (36) =	38.4301 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.8304	36.5935	36.3614	35.2709	35.0669	34.1172	34.1172	33.9413	34.4830	35.0669	35.4796	35.9111 (38)
Average = Sum(39)m / 12 =	75.2605	75.0236	74.7915	73.7011	73.4971	72.5474	72.5474	72.3715	72.9132	73.4971	73.9098	74.3413 (39)
												73.7001 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9900	0.9869	0.9838	0.9695	0.9668	0.9543	0.9543	0.9520	0.9591	0.9668	0.9722	0.9779 (40)
Days in month												0.9695 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy content (annual)	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1428.5822 (45)
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET 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)
	31.4741	27.5274	28.4059	24.7649	23.7625	20.5053	19.0011	21.8041	22.0645	25.7140	28.0689	30.4810 (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	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8975	19.4492	15.8171	11.9746	8.9511	7.5569	8.1655	10.6139	14.2459	18.0884	21.1119	22.5061 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0316	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150 (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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204 (71)
Water heating gains (Table 5)	42.3039	40.9635	38.1799	34.3957	31.9389	28.4795	25.5392	29.3066	30.6451	34.5619	38.9846	40.9691 (72)
Total internal gains	333.8686	332.2685	320.3375	300.9689	280.6667	261.8826	250.2444	254.2715	264.7575	284.2586	306.5267	323.8359 (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
Southeast												3.5600	36.7938	0.6300	0.7000	0.7700	40.0310 (77)
Northwest												3.7400	11.2829	0.6300	0.7000	0.7700	12.8963 (81)
Solar gains	52.9274	94.4385	140.5930	193.2730	233.8894	239.8550	228.0593	196.5870	158.6518	107.4425	64.1749	44.7900 (83)					
Total gains	386.7959	426.7070	460.9305	494.2419	514.5561	501.7376	478.3037	450.8585	423.4093	391.7011	370.7015	368.6259 (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	70.1453	70.3667	70.5851	71.6294	71.8283	72.7686	72.7686	72.9454	72.4035	71.8283	71.4272	71.0126
alpha	5.6764	5.6911	5.7057	5.7753	5.7886	5.8512	5.8512	5.8630	5.8269	5.7886	5.7618	5.7342
util living area	0.9991	0.9983	0.9956	0.9850	0.9441	0.8190	0.6452	0.7011	0.9162	0.9897	0.9982	0.9994 (86)
MIT	19.8924	20.0044	20.2031	20.4827	20.7473	20.9316	20.9864	20.9785	20.8526	20.5186	20.1608	19.8770 (87)
Th 2	20.0917	20.0943	20.0968	20.1088	20.1111	20.1216	20.1216	20.1235	20.1175	20.1111	20.1065	20.1018 (88)
util rest of house	0.9988	0.9977	0.9940	0.9787	0.9186	0.7435	0.5277	0.5856	0.8683	0.9843	0.9975	0.9991 (89)
MIT 2	19.0710	19.1849	19.3850	19.6714	19.9251	20.0863	20.1176	20.1165	20.0265	19.7104	19.3513	19.0638 (90)
Living area fraction	19.2864	19.3999	19.5996	19.8842	20.1408	20.3080	20.3455	20.3426	20.2432	19.9224	19.5636	19.2771 (92)
MIT	19.2864	19.3999	19.5996	19.8842	20.1408	20.3080	20.3455	20.3426	20.2432	19.9224	19.5636	19.2771 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2864	19.3999	19.5996	19.8842	20.1408	20.3080	20.3455	20.3426	20.2432	19.9224	19.5636	19.2771 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9985	0.9970	0.9928	0.9766	0.9196	0.7613	0.5589	0.6163	0.8764	0.9828	0.9968	0.9989 (94)
Useful gains	386.2109	425.4434	457.6050	482.6973	473.2102	381.9488	267.3440	277.8422	371.0823	384.9578	369.5305	368.2050 (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	1127.8857	1087.8326	979.7350	809.5496	620.3720	414.1035	271.7266	285.3321	447.9187	685.1695	921.1821	1120.8501 (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	551.8060	445.1255	388.4647	235.3337	109.4884	0.0000	0.0000	0.0000	0.0000	223.3575	397.1892	559.9680 (98)
Space heating												2910.7331 (98)
Space heating per m2										(98) / (4) =		38.2890 (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	681.9451	536.8504	550.0232	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8506	0.9210	0.8987	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	580.0454	494.4377	494.2890	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	676.4676	647.3714	617.2071	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	69.4240	113.7827	91.4511	0.0000	0.0000	0.0000	0.0000 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											274.6578 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	17.3560	28.4457	22.8628	0.0000	0.0000	0.0000 (107)
Space cooling											68.6644 (107)
Space cooling per m2											0.9032 (108)
Energy for space heating											38.2890 (99)
Energy for space cooling											0.9032 (108)
Total											39.1923 (109)
Target Fabric Energy Efficiency (TFEE)											45.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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)	=	0.3498 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000 (22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500 (22a)
Adj infilt rate	0.4286	0.4023	0.4111	0.3761	0.3761	0.3323	0.3323	0.3236	0.3323	0.3761	0.3761	0.4023 (22b)
Effective ac	0.5918	0.5809	0.5845	0.5707	0.5707	0.5552	0.5552	0.5524	0.5552	0.5707	0.5707	0.5809 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11105.5930 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 146.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.0937 (36)
Total fabric heat loss (33) + (36) = 40.5624 (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	36.3751	35.7051	35.9237	35.0775	35.0775	34.1255	34.1255	33.9492	34.1255	35.0775	35.0775	35.7051 (38)
Heat transfer coeff	76.9375	76.2676	76.4862	75.6399	75.6399	74.6879	74.6879	74.5116	74.6879	75.6399	75.6399	76.2676 (39)
Average = Sum(39)m / 12 =												75.5912 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0121	1.0033	1.0061	0.9950	0.9950	0.9825	0.9825	0.9802	0.9825	0.9950	0.9950	1.0033 (40)
HLP (average)												0.9944 (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												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1428.5822 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	19.8133	21.5160 (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	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179	14.1004 (61)
Total heat required for water heating calculated for each month	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (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	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240	51.2189 (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	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7437	48.6229	39.5428	29.9364	22.3778	18.8923	20.4138	26.5346	35.6147	45.2211	52.7797	56.2652	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.8090	318.0758	309.8437	292.3186	270.1963	249.4045	235.5143	232.2476	240.4797	258.0047	280.1270	300.9188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426	(72)
Total internal gains	542.8290	537.8695	516.1904	483.1244	449.5899	419.8884	402.9121	411.6728	431.0858	464.3592	500.9758	528.3679	(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
Southeast				3.5600				43.0593	0.5200	0.0000	0.7700	61.3777
Northwest				3.7400				13.7804	0.5200	0.0000	0.7700	20.6361
Solar gains	82.0138	130.4462	196.1574	277.5686	318.2225	353.2273	323.5798	283.6485	229.8145	152.7492	9.8031	67.0796
Total gains	624.8428	668.3157	712.3479	760.6930	767.8124	773.1157	726.4919	695.3212	660.9002	617.1083	510.7789	595.4475
												(83)
												(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	40.0960	40.4482	40.3326	40.7838	40.7838	41.3037	41.3037	41.4014	41.3037	40.7838	40.7838	40.4482
alpha	3.6731	3.6965	3.6888	3.7189	3.7189	3.7536	3.7536	3.7601	3.7536	3.7189	3.7189	3.6965
util living area	0.9582	0.9453	0.9127	0.8433	0.7286	0.5456	0.4303	0.4470	0.6620	0.8569	0.9578	0.9633 (86)
MIT	19.7766	19.9160	20.1945	20.5323	20.7960	20.9493	20.9835	20.9814	20.8932	20.5774	20.0219	19.7461 (87)
Th 2	20.0733	20.0806	20.0782	20.0875	20.0875	20.0980	20.0980	20.0999	20.0980	20.0875	20.0875	20.0806 (88)
util rest of house	0.9505	0.9355	0.8967	0.8148	0.6796	0.4744	0.3449	0.3591	0.5938	0.8244	0.9483	0.9565 (89)
MIT 2	18.9771	19.1185	19.3859	19.7107	19.9438	20.0709	20.0918	20.0929	20.0341	19.7590	19.2327	18.9534 (90)
Living area fraction	19.1868	19.3277	19.5980	19.9262	20.1673	20.3013	20.3257	20.3259	20.2594	19.9736	19.4397	19.1613 (91)
MIT	19.1868	19.3277	19.5980	19.9262	20.1673	20.3013	20.3257	20.3259	20.2594	19.9736	19.4397	19.1613 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0368	19.1777	19.4480	19.7762	20.0173	20.1513	20.1757	20.1759	20.1094	19.8236	19.2897	19.0113 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	587.3138	617.4241	629.5944	611.5081	518.6757	370.1343	256.0603	254.9966	393.0597	502.1059	479.0190	563.6453	(94)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	1087.6514	1058.4193	952.1025	792.4211	591.3028	384.7426	259.5915	258.9981	426.4259	659.8552	869.0793	1076.2358	(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	372.2512	296.3487	239.9460	130.2574	54.0346	0.0000	0.0000	0.0000	0.0000	117.3655	280.8434	381.3674	(98)
Space heating												1872.4142	(98)
RHI space heating demand												1872	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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) =		0.3498 (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	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11105.5930 (34)
146.0878 (35)
7.0937 (36)
(33) + (36) = 40.5624 (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	36.8452	36.6078	36.3751	35.2820	35.0775	34.1255	34.1255	33.9492	34.4922	35.0775	35.4912	35.9237 (38)
Heat transfer coeff	77.4076	77.1702	76.9375	75.8444	75.6399	74.6879	74.6879	74.5116	75.0546	75.6399	76.0537	76.4862 (39)
Average = Sum(39)m / 12 =												75.8435 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0183	1.0151	1.0121	0.9977	0.9950	0.9825	0.9825	0.9802	0.9873	0.9950	1.0004	1.0061 (40)
HLP (average)												0.9977 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.3830 (42)
90.7965 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1428.5822 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	19.8133	21.5160 (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	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179 (61)
Total heat required for water heating calculated for each month											
162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (64)
Heat gains from water heating, kWh/month											
52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240	51.2189 (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	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7437	48.6229	39.5428	29.9364	22.3778	18.8923	20.4138	26.5346	35.6147	45.2211	52.7797	56.2652 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.8090	318.0758	309.8437	292.3186	270.1963	249.4045	235.5143	232.2476	240.4797	258.0047	280.1270	300.9188 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811 (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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204 (71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426 (72)
Total internal gains	542.8290	537.8695	516.1904	483.1244	449.5899	419.8884	402.9121	411.6728	431.0858	464.3592	500.9758	528.3679 (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
Southeast					3.5600	36.7938	0.5200	0.0000			0.7700	52.4468 (77)
Northwest					3.7400	11.2829	0.5200	0.0000			0.7700	16.8962 (81)
Solar gains	69.3430	123.7289	184.1984	253.2173	306.4310	314.2469	298.7927	257.5592	207.8582	140.7662	84.0789	58.6818 (83)
Total gains	612.1720	661.5985	700.3889	736.3417	756.0209	734.1353	701.7048	669.2320	638.9440	605.1253	585.0547	587.0497 (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	39.8525	39.9751	40.0960	40.6739	40.7838	41.3037	41.3037	41.4014	41.1019	40.7838	40.5620	40.3326
alpha	3.6568	3.6650	3.6731	3.7116	3.7189	3.7536	3.7536	3.7601	3.7401	3.7189	3.7041	3.6888
util living area	0.9647	0.9510	0.9240	0.8648	0.7588	0.5989	0.4535	0.4911	0.6995	0.8775	0.9468	0.9690 (86)
MIT	19.6602	19.8287	20.1046	20.4608	20.7507	20.9262	20.9799	20.9728	20.8635	20.5089	20.0349	19.6288 (87)
Th 2	20.0681	20.0707	20.0733	20.0853	20.0875	20.0980	20.0980	20.0999	20.0939	20.0875	20.0830	20.0782 (88)
util rest of house	0.9584	0.9423	0.9102	0.8397	0.7142	0.5296	0.3665	0.4032	0.6349	0.8496	0.9359	0.9634 (89)
MIT 2	18.8585	19.0254	19.2956	19.6437	19.9061	20.0559	20.0901	20.0886	20.0088	19.6966	19.2394	18.8358 (90)
Living area fraction	19.0688	19.2361	19.5078	19.8580	20.1276	20.2842	20.3235	20.3205	20.2330	19.9096	19.4481	19.0438 (92)
MIT	18.9188	19.0861	19.3578	19.7080	19.9776	20.1342	20.1735	20.1705	20.0830	19.7596	19.2981	18.8938 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.8938 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9485	0.9309	0.8974	0.8278	0.7084	0.5326	0.3740	0.4103	0.6340	0.8379	0.9244	0.9543 (94)
Useful gains	580.6532	615.9036	628.5539	609.5636	535.5503	390.9688	262.4622	274.6114	405.1088	507.0253	540.8217	560.2235 (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	1131.6070	1094.7462	989.2506	819.7283	626.1202	413.3363	266.8995	280.9480	449.0504	692.8347	927.7079	1123.8722 (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	409.9096	321.7822	268.3583	151.3186	67.3840	0.0000	0.0000	0.0000	0.0000	138.2422	278.5581	419.3546 (98)
Space heating												2054.9076 (98)
Space heating per m2												(98) / (4) = 27.0311 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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													2270.6162 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	409.9096	321.7822	268.3583	151.3186	67.3840	0.0000	0.0000	0.0000	0.0000	138.2422	278.5581	419.3546	(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)	452.9388	355.5605	296.5285	167.2029	74.4574	0.0000	0.0000	0.0000	0.0000	152.7538	307.7990	463.3753	(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	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403	(64)
Efficiency of water heater (217)m	89.5691	89.4943	89.3374	88.9920	88.3901	87.3000	87.3000	87.3000	87.3000	88.8900	89.3749	87.3000	(216)
Fuel for water heating, kWh/month	181.1172	158.9659	165.3601	146.1958	142.3341	125.9993	118.3838	133.5328	134.4415	151.9100	163.0287	175.8202	(219)
Water heating fuel used												1797.0894	(219)
Annual totals kWh/year													
Space heating fuel - main system												2270.6162	(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)												386.7166	(232)
Total delivered energy for all uses												4529.4221	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2270.6162	3.4800	79.0174 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1797.0894	3.4800	62.5387 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	386.7166	13.1900	51.0079 (250)
Additional standing charges			120.0000 (251)
Total energy cost			322.4566 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1191 (257)
SAP value		84.3888
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2270.6162	0.2160	490.4531 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1797.0894	0.2160	388.1713 (264)
Space and water heating			878.6244 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7166	0.5190	200.7059 (268)
Total kg/year			1118.2553 (272)
CO2 emissions per m2			14.7100 (273)
EI value			87.6181
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8857 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8857 = 0.2439$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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)	=	0.3498 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000 (22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500 (22a)
Adj infilt rate	0.4286	0.4023	0.4111	0.3761	0.3761	0.3323	0.3323	0.3236	0.3323	0.3761	0.3761	0.4023 (22b)
Effective ac	0.5918	0.5809	0.5845	0.5707	0.5707	0.5552	0.5552	0.5524	0.5552	0.5707	0.5707	0.5809 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11105.5930 (34)
146.0878 (35)
7.0937 (36)
(33) + (36) = 40.5624 (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	36.3751	35.7051	35.9237	35.0775	35.0775	34.1255	34.1255	33.9492	34.1255	35.0775	35.0775	35.7051 (38)
Heat transfer coeff	76.9375	76.2676	76.4862	75.6399	75.6399	74.6879	74.6879	74.5116	74.6879	75.6399	75.6399	76.2676 (39)
Average = Sum(39)m / 12 =												75.5912 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0121	1.0033	1.0061	0.9950	0.9950	0.9825	0.9825	0.9802	0.9825	0.9950	0.9950	1.0033 (40)
HLP (average)												0.9944 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.3830 (42)
90.7965 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1428.5822 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	19.8133	21.5160 (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	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179	14.1004 (61)	
Total heat required for water heating calculated for each month	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (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	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403 (64)	
								Total per year (kWh/year) = Sum(64)m =					1593.6983 (64)
Heat gains from water heating, kWh/month	52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240	51.2189 (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	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7437	48.6229	39.5428	29.9364	22.3778	18.8923	20.4138	26.5346	35.6147	45.2211	52.7797	56.2652	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.8090	318.0758	309.8437	292.3186	270.1963	249.4045	235.5143	232.2476	240.4797	258.0047	280.1270	300.9188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426	(72)
Total internal gains	542.8290	537.8695	516.1904	483.1244	449.5899	419.8884	402.9121	411.6728	431.0858	464.3592	500.9758	528.3679	(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
Southeast												3.5600	43.0593		0.5200	0.0000	0.7700		61.3777
Northwest												3.7400	13.7804		0.5200	0.0000	0.7700		20.6361 (77)
Solar gains	82.0138	130.4462	196.1574	277.5686	318.2225	353.2273	323.5798	283.6485	229.8145	152.7492	9.8031			67.0796	(83)				
Total gains	624.8428	668.3157	712.3479	760.6930	767.8124	773.1157	726.4919	695.3212	660.9002	617.1083	510.7789			595.4475	(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	40.0960	40.4482	40.3326	40.7838	40.7838	41.3037	41.3037	41.4014	41.3037	40.7838	40.7838	40.4482
alpha	3.6731	3.6965	3.6888	3.7189	3.7189	3.7536	3.7536	3.7601	3.7536	3.7189	3.7189	3.6965
util living area	0.9582	0.9453	0.9127	0.8433	0.7286	0.5456	0.4303	0.4470	0.6620	0.8569	0.9578	0.9633 (86)
MIT	19.7766	19.9160	20.1945	20.5323	20.7960	20.9493	20.9835	20.9814	20.8932	20.5774	20.0219	19.7461 (87)
Th 2	20.0733	20.0806	20.0782	20.0875	20.0875	20.0980	20.0980	20.0999	20.0980	20.0875	20.0875	20.0806 (88)
util rest of house	0.9505	0.9355	0.8967	0.8148	0.6796	0.4744	0.3449	0.3591	0.5938	0.8244	0.9483	0.9565 (89)
MIT 2	18.9771	19.1185	19.3859	19.7107	19.9438	20.0709	20.0918	20.0929	20.0341	19.7590	19.2327	18.9534 (90)
Living area fraction	19.1868	19.3277	19.5980	19.9262	20.1673	20.3013	20.3257	20.3259	20.2594	19.9736	19.4397	19.1613 (91)
MIT	19.1868	19.3277	19.5980	19.9262	20.1673	20.3013	20.3257	20.3259	20.2594	19.9736	19.4397	19.1613 (92)
Temperature adjustment	19.0368	19.1777	19.4480	19.7762	20.0173	20.1513	20.1757	20.1759	20.1094	19.8236	19.2897	-0.1500
adjusted MIT	19.0368	19.1777	19.4480	19.7762	20.0173	20.1513	20.1757	20.1759	20.1094	19.8236	19.2897	19.0113 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	587.3138	617.4241	629.5944	611.5081	518.6757	370.1343	256.0603	254.9966	393.0597	502.1059	479.0190	563.6453	(94)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	1087.6514	1058.4193	952.1025	792.4211	591.3028	384.7426	259.5915	258.9981	426.4259	659.8552	869.0793	1076.2358	(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	372.2512	296.3487	239.9460	130.2574	54.0346	0.0000	0.0000	0.0000	0.0000	117.3655	280.8434	381.3674	(98)
Space heating												1872.4142	(98)
Space heating per m2												(98) / (4) =	24.6305 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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													2068.9659 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.2512	296.3487	239.9460	130.2574	54.0346	0.0000	0.0000	0.0000	0.0000	117.3655	280.8434	381.3674	(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)	411.3273	327.4572	265.1337	143.9308	59.7067	0.0000	0.0000	0.0000	0.0000	129.6856	310.3242	421.4004	(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	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068	157.5403	(64)
Efficiency of water heater (217)m	89.5042	89.4367	89.2533	88.8722	88.2374	87.3000	87.3000	87.3000	87.3000	88.7594	89.3808	87.3000	(216)
Fuel for water heating, kWh/month	181.2485	159.0684	165.5158	146.3928	142.5804	125.9993	118.3838	133.5328	134.4415	152.1335	163.0179	175.9430	(219)
Water heating fuel used												1798.2577	(219)
Annual totals kWh/year													
Space heating fuel - main system												2068.9659	(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)												386.7166	(232)
Total delivered energy for all uses												4328.9402	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2068.9659	3.7400	77.3793 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1798.2577	3.7400	67.2548 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	386.7166	20.4300	79.0062 (250)
Additional standing charges			95.0000 (251)
Total energy cost			333.9629 (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	2068.9659	0.2160	446.8966 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1798.2577	0.2160	388.4237 (264)
Space and water heating			835.3203 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	386.7166	0.5190	200.7059 (268)
Total kg/year			1074.9512 (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	2068.9659	1.2200	2524.1384 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1798.2577	1.2200	2193.8743 (264)
Space and water heating			4718.0128 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	386.7166	3.0700	1187.2199 (268)
Primary energy kWh/year			6135.4827 (272)
Primary energy kWh/m2/year			80.7088 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E	Low energy lighting
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2	Wind turbine
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 25	-178 kg (16.5%)
U Solar photovoltaic panels	+ 11.0	-£ 373	-946 kg (105.5%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£25	2.34 kg/m²	B 86	B 90
Solar photovoltaic panels	£373	12.45 kg/m²	A 97	A 100
Total Savings	£398	14.79 kg/m²		

Potential energy efficiency rating: A 97
 Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 506 TEST (30 Sep 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Severn Valley):			
	Current	Potential	Saving
Electricity	£94	£105	-£10
Mains gas	£240	£204	£35
Space heating	£188	£188	£0
Water heating	£67	£42	£25
Lighting	£79	£79	£0
Generated (PV)	-£0	-£373	£373
Total cost of fuels	£334	-£64	£398
Total cost of uses	£334	-£64	£398
Delivered energy	57 kWh/m²	21 kWh/m²	36 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	-1 kg/m²	15 kg/m²
Primary energy	81 kWh/m²	-6 kWh/m²	87 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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) =		0.3498 (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	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11105.5930 (34)
146.0878 (35)
7.0937 (36)
(33) + (36) = 40.5624 (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	36.8452	36.6078	36.3751	35.2820	35.0775	34.1255	34.1255	33.9492	34.4922	35.0775	35.4912	35.9237 (38)
Heat transfer coeff	77.4076	77.1702	76.9375	75.8444	75.6399	74.6879	74.6879	74.5116	75.0546	75.6399	76.0537	76.4862 (39)
Average = Sum(39)m / 12 =												75.8435 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0183	1.0151	1.0121	0.9977	0.9950	0.9825	0.9825	0.9802	0.9873	0.9950	1.0004	1.0061 (40)
HLP (average)												0.9977 (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												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
Energy conte	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1428.5822 (45)										
Distribution loss (46)m = 0.15 x (45)m											
	22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	21.5160 (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 (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 (57)
Combi loss	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179 (61)
Total heat required for water heating calculated for each month	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068 (62)
Aperture area of solar collector											157.5403 (H1)
Zero-loss collector efficiency											3.0000 (H2)
Collector heat loss coefficient											1.8000 (H3)
Collector 2nd order heat loss coefficient											0.0050 (H3a)
Collector effective heat loss coefficient											1.8063 (H3b)
Collector performance ratio											2.5804 (H4)
Annual solar radiation per m2											1079.5246 (H5)
Overshading factor											0.8000 (H6)
Solar energy available											1813.6014 (H7)
Adjustment factor for showers											1.0000 (H7a)
Solar-to-load ratio											1.2695 (H8)
Utilisation factor											0.5451 (H9)
Collector performance factor											0.8793 (H10)
Dedicated solar storage volume											75.0000 (H11)
Effective solar volume											75.0000 (H13)
Daily hot water demand											90.7965 (H14)
Volume ratio Veff/V											0.8260 (H15)
Solar storage volume factor											0.9618 (H16)
Solar input	-24.2439	-40.4561	-68.9014	-92.3414	-114.0801	-112.1589	-110.6766	-96.6987	-75.7345	-51.7178	-28.7568 (H17)
Solar input											-836.0542 (63)
Output from w/h	137.9811	101.8093	78.8269	37.7610	11.7292	0.0000	0.0000	19.8754	41.6329	83.3150	116.9500 (64)
Heat gains from water heating, kWh/month	52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240 (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	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7437	48.6229	39.5428	29.9364	22.3778	18.8923	20.4138	26.5346	35.6147	45.2211	52.7797	56.2652	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.8090	318.0758	309.8437	292.3186	270.1963	249.4045	235.5143	232.2476	240.4797	258.0047	280.1270	300.9188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426	(72)
Total internal gains	542.8290	537.8695	516.1904	483.1244	449.5899	419.8884	402.9121	411.6728	431.0858	464.3592	500.9758	528.3679	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W	
Southeast				3.5600	36.7938	0.5200		0.0000	0.7700		52.4468 (77)	
Northwest				3.7400	11.2829	0.5200		0.0000	0.7700		16.8962 (81)	

Solar gains	69.3430	123.7289	184.1984	253.2173	306.4310	314.2469	298.7927	257.5592	207.8582	140.7662	84.0789	58.6818 (83)
Total gains	612.1720	661.5985	700.3889	736.3417	756.0209	734.1353	701.7048	669.2320	638.9440	605.1253	585.0547	587.0497 (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	39.8525	39.9751	40.0960	40.6739	40.7838	41.3037	41.3037	41.4014	41.1019	40.7838	40.5620	40.3326
alpha	3.6568	3.6650	3.6731	3.7116	3.7189	3.7536	3.7536	3.7601	3.7401	3.7189	3.7041	3.6888
util living area	0.9647	0.9510	0.9240	0.8648	0.7588	0.5989	0.4535	0.4911	0.6995	0.8775	0.9468	0.9690 (86)
MIT	19.6602	19.8287	20.1046	20.4608	20.7507	20.9262	20.9799	20.9728	20.8635	20.5089	20.0349	19.6288 (87)
Th 2	20.0681	20.0707	20.0733	20.0853	20.0875	20.0980	20.0980	20.0999	20.0939	20.0875	20.0830	20.0782 (88)
util rest of house	0.9584	0.9423	0.9102	0.8397	0.7142	0.5296	0.3665	0.4032	0.6349	0.8496	0.9359	0.9634 (89)
MIT 2	18.5855	19.0254	19.2956	19.6437	19.9061	20.0559	20.0901	20.0886	20.0088	19.6966	19.2394	18.8358 (90)
Living area fraction	19.0688	19.2361	19.5078	19.8580	20.1276	20.2842	20.3235	20.3205	20.2330	19.9096	19.4481	19.0438 (91)
MIT	18.9188	19.0861	19.3578	19.7080	19.9776	20.1342	20.1735	20.1705	20.0830	19.7596	19.2981	18.8938 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9485	0.9309	0.8974	0.8278	0.7084	0.5326	0.3740	0.4103	0.6340	0.8379	0.9244	0.9543	(94)
Useful gains	580.6532	615.9036	628.5539	609.5636	535.5503	390.9688	262.4622	274.6114	405.1088	507.0253	540.8217	560.2235	(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	1131.6070	1094.7462	989.2506	819.7283	626.1202	413.3363	266.8995	280.9480	449.0504	692.8347	927.7079	1123.8722	(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	409.9096	321.7822	268.3583	151.3186	67.3840	0.0000	0.0000	0.0000	0.0000	138.2422	278.5581	419.3546	(98)
Space heating												2054.9076	(98)
Space heating per m2												27.0311	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
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													2270.6162	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	409.9096	321.7822	268.3583	151.3186	67.3840	0.0000	0.0000	0.0000	0.0000	138.2422	278.5581	419.3546	(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)	452.9388	355.5605	296.5285	167.2029	74.4574	0.0000	0.0000	0.0000	0.0000	152.7538	307.7990	463.3753	(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	137.9811	101.8093	78.8269	37.7610	11.7292	0.0000	0.0000	19.8754	41.6329	83.3150	116.9500	137.2523	(64)	
Efficiency of water heater	89.6722	89.7097	89.7530	89.8423	90.0108	87.3000	87.3000	87.3000	87.3000	89.2695	89.5296	89.6893	(217)	
Fuel for water heating, kWh/month	153.8728	113.4876	87.8265	42.0303	13.0309	0.0000	0.0000	22.7668	47.6895	93.3297	130.6272	153.0308	(219)	
Water heating fuel used												857.6921	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2270.6162	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													386.7166	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394				-1727.2394	(233)
Total delivered energy for all uses													1912.7854	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2270.6162	3.4800	79.0174	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	857.6921	3.4800	29.8477	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	386.7166	13.1900	51.0079	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			68.5377	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.2379	(257)
SAP value			96.6819	
SAP rating (Section 12)			97	(258)
SAP band			A	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2270.6162	0.2160	490.4531 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	857.6921	0.2160	185.2615 (264)
Space and water heating			675.7146 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	386.7166	0.5190	200.7059 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			44.8582 (272)
CO2 emissions per m2			0.5900 (273)
EI value			99.5033
EI rating			100 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) - (3b)
First floor	38.0100 (1c)	x 2.5900 (2c)	= 98.4459 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2490 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4116 (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) =		0.3498 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000 (22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500 (22a)
Adj infilt rate	0.4286	0.4023	0.4111	0.3761	0.3761	0.3323	0.3323	0.3236	0.3323	0.3761	0.3761	0.4023 (22b)
Effective ac	0.5918	0.5809	0.5845	0.5707	0.5707	0.5552	0.5552	0.5524	0.5552	0.5707	0.5707	0.5809 (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
Door			2.0600	1.1000	2.2660		(26)
Semi Glaze			1.9100	1.5000	2.8650		(26a)
Window (Uw = 1.24)			7.3000	1.1814	8.6242		(27)
Jetfloor 80mm			38.0100	0.1500	5.7015	75.0000	2850.7500 (28a)
90mm Supafil 34 FF	45.1800	11.2700	33.9100	0.2700	9.1557	52.3000	1773.4930 (29a)
Sloping	5.6300		5.6300	0.2100	1.1823	9.0000	50.6700 (30)
400mm Plane Ceiling	33.4000		33.4000	0.1100	3.6740	9.0000	300.6000 (30)
Total net area of external elements Aum(A, m ²)			122.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4687		(33)
E-WM-23/24			80.7600	0.0000	0.0000	45.0000	3634.2000 (32)
Timber			125.2800			9.0000	1127.5200 (32c)
1F Internal			38.0100			18.0000	684.1800 (32d)
GF Internal			38.0100			18.0000	684.1800 (32e)

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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.3751	35.7051	35.9237	35.0775	35.0775	34.1255	34.1255	33.9492	34.1255	35.0775	35.0775	35.7051 (38)
Average = Sum(39)m / 12 =	76.9375	76.2676	76.4862	75.6399	75.6399	74.6879	74.6879	74.5116	74.6879	75.6399	75.6399	76.2676 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0121	1.0033	1.0061	0.9950	0.9950	0.9825	0.9825	0.9802	0.9825	0.9950	0.9950	1.0033 (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												2.3830 (42)
Average daily hot water use (litres/day)												90.7965 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	99.8761	96.2443	92.6124	88.9806	85.3487	81.7168	81.7168	85.3487	88.9806	92.6124	96.2443	99.8761 (44)
	148.1134	129.5409	133.6746	116.5408	111.8237	96.4953	89.4171	102.6074	103.8329	121.0072	132.0888	143.4399 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1428.5822 (45)										
Distribution loss (46)m = 0.15 x (45)m											
	22.2170	19.4311	20.0512	17.4811	16.7736	14.4743	13.4126	15.3911	15.5749	18.1511	21.5160 (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 (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 (57)
Combi loss	14.1116	12.7245	14.0537	13.5617	13.9856	13.5020	13.9319	13.9667	13.5345	14.0255	13.6179 (61)
Total heat required for water heating calculated for each month	162.2250	142.2654	147.7283	130.1025	125.8093	109.9974	103.3490	116.5742	117.3674	135.0327	145.7068 (62)
Aperture area of solar collector											3.0000 (H1)
Zero-loss collector efficiency											0.7000 (H2)
Collector heat loss coefficient											1.8000 (H3)
Collector 2nd order heat loss coefficient											0.0050 (H3a)
Collector effective heat loss coefficient											1.8063 (H3b)
Collector performance ratio											2.5804 (H4)
Annual solar radiation per m2											1139.7099 (H5)
Overshading factor											0.8000 (H6)
Solar energy available											1914.7126 (H7)
Adjustment factor for showers											1.0000 (H7a)
Solar-to-load ratio											1.3403 (H8)
Utilisation factor											0.5258 (H9)
Collector performance factor											0.8793 (H10)
Dedicated solar storage volume											75.0000 (H11)
Effective solar volume											75.0000 (H13)
Daily hot water demand											90.7965 (H14)
Volume ratio Veff/V											0.8260 (H15)
Solar storage volume factor											0.9618 (H16)
Solar input	-27.9195	-41.4527	-71.0123	-97.4829	-113.7956	-121.0216	-115.0827	-102.4238	-80.8712	-54.4661	-3.2633 (H17)
Solar input											-851.3805 (H17)
Output from w/h	134.3055	100.8127	76.7160	32.6196	12.0136	0.0000	0.0000	14.1504	36.4962	80.5666	142.4435 (64)
Heat gains from water heating, kWh/month	52.7756	46.2535	47.9602	42.1402	40.6778	35.4602	33.2142	37.6087	37.9081	43.7413	47.3240 (65)
											51.2189 (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	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	142.9806	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7437	48.6229	39.5428	29.9364	22.3778	18.8923	20.4138	26.5346	35.6147	45.2211	52.7797	56.2652	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.8090	318.0758	309.8437	292.3186	270.1963	249.4045	235.5143	232.2476	240.4797	258.0047	280.1270	300.9188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	51.6811	(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)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Water heating gains (Table 5)	70.9350	68.8296	64.4627	58.5281	54.6744	49.2503	44.6427	50.5493	52.6501	58.7920	65.7278	68.8426	(72)
Total internal gains	542.8290	537.8695	516.1904	483.1244	449.5899	419.8884	402.9121	411.6728	431.0858	464.3592	500.9758	528.3679	(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
Southeast				3.5600	43.0593		0.5200	0.0000		0.7700		61.3777 (77)
Northwest				3.7400	13.7804		0.5200	0.0000		0.7700		20.6361 (81)
Solar gains	82.0138	130.4462	196.1574	277.5686	318.2225	353.2273	323.5798	283.6485	229.8145	152.7492	9.8031	67.0796 (83)
Total gains	624.8428	668.3157	712.3479	760.6930	767.8124	773.1157	726.4919	695.3212	660.9002	617.1083	510.7789	595.4475 (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	40.0960	40.4482	40.3326	40.7838	40.7838	41.3037	41.3037	41.4014	41.3037	40.7838	40.7838	40.4482
alpha	3.6731	3.6965	3.6888	3.7189	3.7189	3.7536	3.7536	3.7601	3.7536	3.7189	3.7189	3.6965
util living area	0.9582	0.9453	0.9127	0.8433	0.7286	0.5456	0.4303	0.4470	0.6620	0.8569	0.9578	0.9633 (86)
MIT	19.7766	19.9160	20.1945	20.5323	20.7960	20.9493	20.9835	20.9814	20.8932	20.5774	20.0219	19.7461 (87)
Th 2	20.0733	20.0806	20.0782	20.0875	20.0875	20.0980	20.0980	20.0999	20.0980	20.0875	20.0875	20.0806 (88)
util rest of house	0.9505	0.9355	0.8967	0.8148	0.6796	0.4744	0.3449	0.3591	0.5938	0.8244	0.9483	0.9565 (89)
MIT 2	18.9771	19.1185	19.3859	19.7107	19.9438	20.0709	20.0918	20.0929	20.0341	19.7590	19.2327	18.9534 (90)
Living area fraction	19.1868	19.3277	19.5980	19.9262	20.1673	20.3013	20.3257	20.3259	fLA = Living area / (4) =	19.9736	19.4397	0.2623 (91)
MIT	19.0368	19.1777	19.4480	19.7762	20.0173	20.1513	20.1757	20.1759	20.2594	19.9736	19.4397	19.1613 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0368	19.1777	19.4480	19.7762	20.0173	20.1513	20.1757	20.1759	20.1094	19.8236	19.2897	19.0113 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9399	0.9239	0.8838	0.8039	0.6755	0.4788	0.3525	0.3667	0.5947	0.8136	0.9378	0.9466	(94)
Useful gains	587.3138	617.4241	629.5944	611.5081	518.6757	370.1343	256.0603	254.9966	393.0597	502.1059	479.0190	563.6453	(95)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	1087.6514	1058.4193	952.1025	792.4211	591.3028	384.7426	259.5915	258.9981	426.4259	659.8552	869.0793	1076.2358	(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	372.2512	296.3487	239.9460	130.2574	54.0346	0.0000	0.0000	0.0000	0.0000	117.3655	280.8434	381.3674	(98)
Space heating												1872.4142	(98)
Space heating per m2												24.6305	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
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													2068.9659	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	372.2512	296.3487	239.9460	130.2574	54.0346	0.0000	0.0000	0.0000	0.0000	117.3655	280.8434	381.3674	(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)	411.3273	327.4572	265.1337	143.9308	59.7067	0.0000	0.0000	0.0000	0.0000	129.6856	310.3242	421.4004	(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	134.3055	100.8127	76.7160	32.6196	12.0136	0.0000	0.0000	14.1504	36.4962	80.5666	142.4435	134.9516	(64)	
Efficiency of water heater	89.6289	89.6657	89.7034	89.8405	89.9006	87.3000	87.3000	87.3000	87.3000	89.1696	89.3973	89.6412	(217)	
Fuel for water heating, kWh/month	149.8462	112.4318	85.5218	36.3083	13.3632	0.0000	0.0000	16.2089	41.8055	90.3521	159.3376	150.5464	(219)	
Water heating fuel used												855.7219	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2068.9659	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													386.7166	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =										-1823.5358			-1823.5358	(233)
Total delivered energy for all uses													1612.8686	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2068.9659	3.7400	77.3793	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	855.7219	3.7400	32.0040	(247)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	386.7166	20.4300	79.0062	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1823.5358	20.4300	-372.5484	(252)
Total energy cost			-63.6213	(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	2068.9659	0.2160	446.8966	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	855.7219	0.2160	184.8359	(264)
Space and water heating			631.7326	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	386.7166	0.5190	200.7059	(268)
Energy saving/generation technologies				
PV Unit	-1823.5358	0.5190	-946.4151	(269)
Total kg/year			-49.1016	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	2068.9659	1.2200	2524.1384 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	855.7219	1.2200	1043.9807 (264)
Space and water heating			3568.1191 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	386.7166	3.0700	1187.2199 (268)
Energy saving/generation technologies			
PV Unit	-1823.5358	3.0700	-5598.2549 (269)
Primary energy kWh/year			-459.1659 (272)
Primary energy kWh/m2/year			-6.0401 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	146.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	245.85 (P1)
Transmission heat loss coefficient	40.56 (37)
Summer heat loss coefficient	286.41 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Shading	Gains W
South East	3.5600	121.5729	0.5200	0.0000	0.9000	202.5501
North West	3.7400	100.3588	0.5200	0.0000	0.9000	175.6600
total:						378.2102

Solar gains	Jun	Jul	Aug	(P4)
Internal gains	413	378	332	
Total summer gains	417	400	409	(P5)
Summer gain/loss ratio	2.90	2.72	2.58	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 146.1)	0.98	0.98	0.98	
Threshold temperature	18.87	20.39	20.26	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	4907-Z852-6657-0377	Issued on Date	22/01/2024
Assessment Reference	377	Prop Type Ref	Tavy Mid As
Property	377, 2 Bed, K, WC, B		
SAP Rating	84 B	DER	16.53
Environmental	88 B	TER	17.77
CO ₂ Emissions (t/year)	1.07	% DER<TER	6.98
General Requirements Compliance	Pass	DfEE	38.48
		TfEE	45.07
		% DfEE<TfEE	14.62
Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk		Assessor ID
			Z852-0001
Client	Redrow, Redrow		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	9.22 m	38.01 m ²	2.31 m
	1st Storey:	9.22 m	38.01 m ²	2.59 m

7.0 Living Area	19.94	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	146.09	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
90mm Supafil 34 FF	Cavity Wall	Other	0.27	52.30	45.18	33.91

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
E-WM-23/24	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	80.76

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Timber	Plasterboard on timber frame		9.00	125.28

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Sloping	External Slope Roof	Plasterboard, insulated slope	0.21	9.00	5.63	5.63
400mm Plane Ceiling	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	33.40	33.40

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
GF Internal	Plasterboard ceiling, carpeted chipboard floor	9.00	38.01

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Jetfloor 80mm	Ground Floor - Solid	Suspended concrete floor, carpeted	0.15	75.00	38.01

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
1F Internal	Plasterboard ceiling, carpeted chipboard floor	18.00	38.01

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.10
Semi Glaze	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Window	BFRC data	Window	Double Low-E Hard 0.2			0.52			1.24

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front	Solid Door	[1] 90mm Supafil 34 FF	South East							2.06	
Rear	Window	[1] 90mm Supafil 34 FF	North West	None	0.00					3.74	
Front	Window	[1] 90mm Supafil 34 FF	South East	None	0.00					3.56	
Rear	Half Glazed Door	[1] 90mm Supafil 34 FF	North West							1.91	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	9.38	0.199	No	Redrow EF Series E2 - FF
Independently assessed	E3 Sill	7.49	0.008	No	Redrow EF Series E3 - FF
Independently assessed	E4 Jamb	20.10	0.003	No	Redrow EF Series E4 - FF
Independently assessed	E5 Ground floor (normal)	9.22	0.059	No	E5 - Jetfloor - BT02 - Average
Independently assessed	E6 Intermediate floor within a dwelling	9.22	-0.002	No	Redrow EF Series E6 - FF
Independently assessed	E11 Eaves (insulation at rafter level)	9.22	0.017	No	Redrow EF Series E11
Independently assessed	E18 Party wall between dwellings	13.71	0.041	No	Redrow EF Series E18 - FF
Table K1 - Default	P1 Party wall - Ground floor	16.48	0.160	No	P1 - Default
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	13.48	0.035	No	Redrow EF Series P4 - FF
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	3.46	0.058	No	Redrow EF Series P5 - FF
Table K1 - Default	R6 Flat ceiling	9.22	0.060	No	R6 - Default

Y-value	0.058	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Database		
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£25	B 86	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£373	A 97	