

PREDICTED ENERGY ASSESSMENT

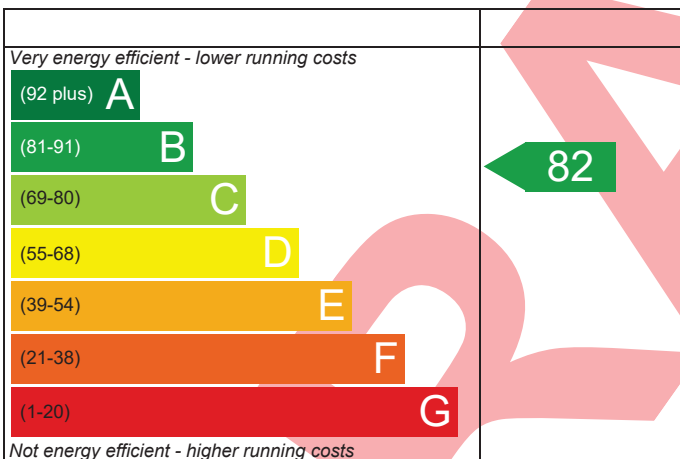
Cublean, Plot 80, Phase 4A ,
Tarland Road,
Aboyne

Dwelling type: House, Detached
Date of assessment: 31/01/2023
Produced by: Northern Energy
Total floor area: 137.38 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.

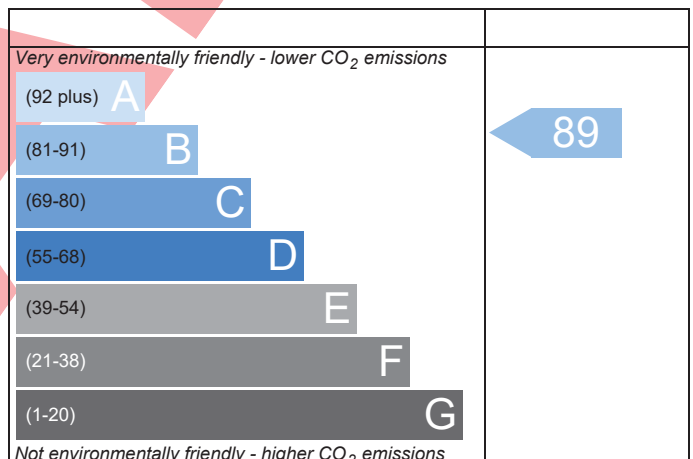
Energy Efficiency Rating



Scotland 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



Scotland 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	ajc 4A 80 cublean		Issued on Date	31/01/2023	
Assessment Reference	1-07-22 ajc	Prop Type Ref			
Property	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		
Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			Assessor ID	1910-0001
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

6.1 Carbon Dioxide Emissions

1a TER and DER

Fuel for main heating	Bulk LPG		
Fuel package for TER	LPG		
Target Carbon Dioxide Emission Rate (TER)	12.72	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.88	kgCO ₂ /m ²	Pass
	-0.84 (-6.6%)	kgCO ₂ /m ²	

6.2 Building insulation envelope

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.22)	0.16 (max. 0.70)	Pass
Floor	0.12 (max. 0.18)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.15)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 1.60)	1.40 (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	4.00 (design value)
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6.3 Heating System

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Bulk LPG Data from database Baxi ASSURE 18 SYSTEM LPG Efficiency: 90.2% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	Pass
Boiler interlock	Yes	Pass

6.4 Insulation of pipes, ducts and vessels

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.20 kWh/day Permitted by DBSCG 2.56	Pass
Primary pipework insulated	Yes	Pass

6.5 Artificial and display lighting

7 Low energy lights

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

6.6 Mechanical ventilation and air conditioning

8 Mechanical ventilation

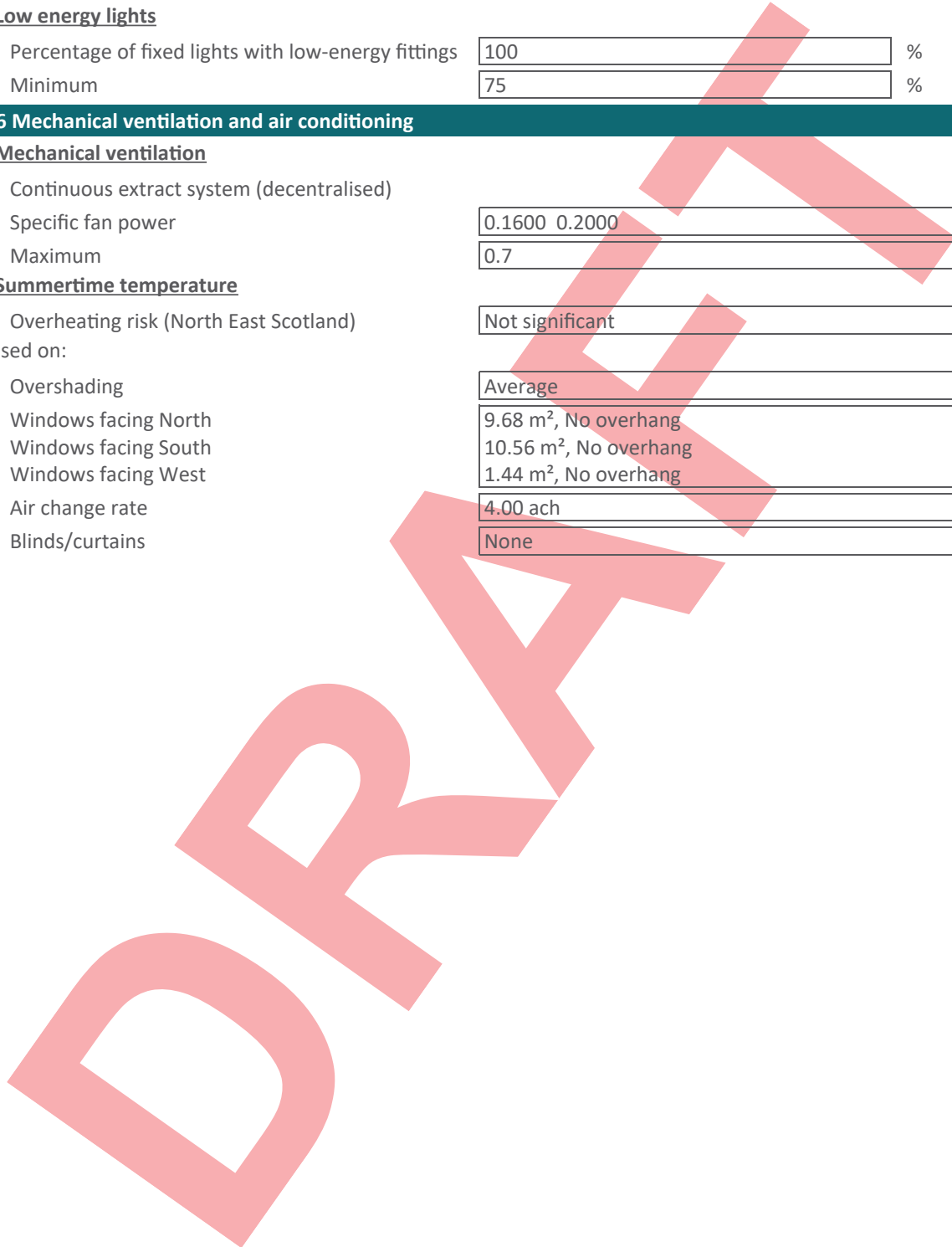
Continuous extract system (decentralised)			
Specific fan power	0.1600 0.2000		
Maximum	0.7		Pass

9 Summertime temperature

Overheating risk (North East Scotland)	Not significant	Pass
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Based on:

Overshading	Average
Windows facing North	9.68 m ² , No overhang
Windows facing South	10.56 m ² , No overhang
Windows facing West	1.44 m ² , No overhang
Air change rate	4.00 ach
Blinds/curtains	None



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	£100	B 85	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£100	B 85	B 91	

DRAFT

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

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Property	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		
Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			Assessor ID	1910-0001
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Scotland ACD 2015	0.037	18.05	0.67	
External wall	E3 Sill	Scotland ACD 2015	0.033	14.25	0.47	
External wall	E4 Jamb	Scotland ACD 2015	0.031	51.30	1.59	
External wall	E5 Ground floor (normal)	Scotland ACD 2015	0.173	34.68	6.00	
External wall	E6 Intermediate floor within a dwelling	Scotland ACD 2015	0.065	34.68	2.25	
External wall	E10 Eaves (insulation at ceiling level)	Scotland ACD 2015	0.043	13.55	0.58	
External wall	E12 Gable (insulation at ceiling level)	Scotland ACD 2015	0.051	21.13	1.08	
External wall	E16 Corner (normal)	Scotland ACD 2015	0.038	29.52	1.12	
External wall	E17 Corner (inverted – internal area greater than external area)	Scotland ACD 2015	0.003	9.90	0.03	

Total: **13.79** W/mK:
 Y-Value: **0.041** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 80 cublean			Issued on Date	31/01/2023
Assessment Reference	1-07-22 ajc	Prop Type Ref			
Property	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		
Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			Assessor ID	1910-0001
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Domestic Handbook Section 6, 2015 Edition

REGULATIONS COMPLIANCE REPORT - Domestic Handbook Section 6, 2015 Edition

Detached House, total floor area 137 m²

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

1 TER and DER

Fuel for main heating: Bulk LPG
Fuel package for TER: LPG
Target Carbon Dioxide Emission Rate (TER) 12.72 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.88 kgCO₂/m² OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.22)	0.16 (max. 0.70)	OK
Floor	0.12 (max. 0.18)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.15)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 1.60)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Bulk LPG
Data from database
Baxi ASSURE 18 SYSTEM LPG

Efficiency: 90.2% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.20 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock: Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.2000
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (North East Scotland): Not significant OK

Based on:

Overshading: Average
Windows facing North: 9.68 m², No overhang
Windows facing South: 10.56 m², No overhang
Windows facing West: 1.44 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Photovoltaic array 1.34 kW

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	68.6900 (1b)	2.5100 (2b)	172.4119 (1b) - (3b)
First floor	68.6900 (1c)	2.6800 (2c)	184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 356.5011 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes	4.0000							
Measured/design AP50					0.2000 (18)							
Infiltration rate					2 (19)							
Number of sides sheltered												
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	76.6600	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	237.5693	209.4994	220.2678	197.7986	194.0846	173.7788	167.2356	183.0411	182.5712	205.0889	216.4292	231.9692 (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)
FGHRS	-34.6304	-29.8634	-30.0854	-25.6947	-23.6989	-10.1876	-9.8808	-10.7090	-10.6484	-26.1603	-29.9760	-34.2123 eq. (G6)
Output from w/h	202.9389	179.6360	190.1825	172.1039	170.3857	163.5912	157.3548	172.3321	171.9228	178.9286	186.4532	197.7569 (64)
Heat gains from water heating, kWh/month	107.0840	95.0322	101.3313	92.9541	92.6254	84.9675	83.6981	88.9534	87.8910	96.2843	99.1488	105.2220 (65)
											Total per year (kWh/year) = Sum(63)m =	2143.5866 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5774	25.3822	20.6422	15.6275	11.6817	9.8622	10.6564	13.8517	18.5917	23.6064	27.5521	29.3717 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.4129	309.5925	301.5800	284.5223	262.9901	242.7528	229.2331	226.0534	234.0660	251.1236	272.6559	292.8932 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	143.9302	141.4170	136.1980	129.1029	124.4965	118.0104	112.4975	119.5611	122.0708	129.4144	137.7066	141.4275 (72)
Total internal gains	548.5994	546.0706	528.0991	498.9316	468.8472	440.3043	422.0658	429.1450	444.4073	473.8233	507.5935	533.3712 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	9.6800	10.6334	0.6300	0.7000	0.7700	31.4571 (74)						
South	10.5600	46.7521	0.6300	0.7000	0.7700	150.8817 (78)						
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)						
Solar gains	190.9822	324.1297	444.7658	560.4499	641.5245	644.3400	618.0074	555.4590	484.0180	358.1497	228.4299	163.7077 (83)
Total gains	739.5815	870.2003	972.8649	1059.3814	1110.3717	1084.6443	1040.0732	984.6040	928.4252	831.9731	736.0234	697.0789 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640 (85)	
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	
util living area	0.9734	0.9581	0.9332	0.8866	0.8056	0.6822	0.5494	0.5893	0.7667	0.9046	0.9600	0.9772 (86)	
MIT	18.6425	18.9130	19.3291	19.8472	20.3435	20.7136	20.8865	20.8585	20.5770	19.9365	19.1805	18.5711 (87)	
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118 (88)	
util rest of house	0.9694	0.9519	0.9227	0.8673	0.7692	0.6158	0.4507	0.4931	0.7113	0.8845	0.9529	0.9737 (89)	
MIT 2	16.8403	17.2317	17.8320	18.5708	19.2587	19.7393	19.9328	19.9074	19.5792	18.7088	17.6240	16.7369 (90)	
Living area fraction												fLA = Living area / (4) =	0.1565 (91)
MIT	17.1224	17.4948	18.0663	18.7706	19.4285	19.8918	20.0820	20.0562	19.7353	18.9010	17.8676	17.0239 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	16.9724	17.3448	17.9163	18.6206	19.2785	19.7418	19.9320	19.9062	19.5853	18.7510	17.7176	16.8739 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9504	0.9272	0.8923	0.8325	0.7368	0.5952	0.4419	0.4817	0.6827	0.8502	0.9285	0.9565 (94)	
Ext temp.	702.9156	806.8872	868.0509	881.9247	818.1419	645.5933	459.6329	474.2740	633.8605	707.3818	683.4228	666.7435 (95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Month fracti	1891.6904	1857.7178	1704.1847	1451.0537	1131.2930	767.5500	497.3942	523.3975	818.8326	1216.7476	1584.9641	1891.9225 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating	884.4484	706.1581	622.0836	409.7729	232.9844	0.0000	0.0000	0.0000	0.0000	378.9682	649.1098	911.5332 (98)	
Space heating per m ²												(98) / (4) =	34.9036 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	884.4484	706.1581	622.0836	409.7729	232.9844	0.0000	0.0000	0.0000	0.0000	378.9682	649.1098	911.5332	(98)
Space heating efficiency (main heating system 1)	91.2000	91.2000	91.2000	91.2000	91.2000	0.0000	0.0000	0.0000	0.0000	91.2000	91.2000	91.2000	(210)
Space heating fuel (main heating system)	969.7899	774.2962	682.1092	449.3124	255.4654	0.0000	0.0000	0.0000	0.0000	415.5353	711.7432	999.4882	(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	202.9389	179.6360	190.1825	172.1039	170.3857	163.5912	157.3548	172.3321	171.9228	178.9286	186.4532	197.7569	(64)
Efficiency of water heater (217)m	88.9924	88.8062	88.4474	87.7502	86.3517	80.5000	80.5000	80.5000	80.5000	87.4711	88.5729	89.0890	(216)
Fuel for water heating, kWh/month	228.0407	202.2787	215.0233	196.1294	197.3160	203.2189	195.4718	214.0771	213.5687	204.5573	210.5082	221.9769	(219)
Water heating fuel used													2502.1671 (219)
Annual totals kWh/year													
Space heating fuel - main system													5257.7397 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 13.1040, total flow = 53.0000, SFP = 0.2472)													107.5347 (230a)
mechanical ventilation fans (SFP = 0.2472)													30.0000 (230c)
central heating pump													45.0000 (230e)
main heating flue fan													182.5347 (231)
Total electricity for the above, kWh/year													504.6859 (232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.34 + 1068 * 1.00) =										-1144.9716			-1144.9716 (233)
Total delivered energy for all uses													7302.1558 (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	5257.7397	0.2410	1267.1153	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2502.1671	0.2410	603.0223	(264)
Space and water heating			1870.1375	(265)
Pumps and fans	182.5347	0.5190	94.7355	(267)
Energy for lighting	504.6859	0.5190	261.9320	(268)
Energy saving/generation technologies				
PV Unit	-1144.9716	0.5190	-594.2402	(269)
Total CO2, kg/year			1632.5648	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.8800	(273)

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

DER			11.8800	ZC1
Total Floor Area		TFA	137.3800	
Assumed number of occupants		N	2.9119	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.2169	ZC2
CO2 emissions from cooking, equation (L16)			1.3749	ZC3
Total CO2 emissions			26.4718	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			26.4718	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	68.6900 (1b)	x 2.5100 (2b)	= 172.4119 (1b) - (3b)
First floor	68.6900 (1c)	x 2.6800 (2c)	= 184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.5011 (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	1	+	0	=	1 * 20 = 20.0000 (6b)							
Number of intermittent fans					4 * 10 = 40.0000 (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)					60.0000 / (5) = 0.1683 (8)							
Pressure test					Yes							
Measured/design AP50					7.0000							
Infiltration rate					0.5183 (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) =	0.4406 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.5617	0.5507	0.5397	0.4846	0.4736	0.4185	0.4185	0.4075	0.4406	0.4736	0.4956	0.5177 (22b)
Effective ac	0.6578	0.6516	0.6456	0.6174	0.6121	0.5876	0.5876	0.5830	0.5970	0.6121	0.6228	0.6340 (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			1.8500	1.4000	2.5900		(26)					
TER Opening Type (Uw = 1.40)			32.5000	1.3258	43.0871		(27)					
Insulated slab			79.0000	0.1500	11.8500		(28a)					
Main T/Frame ACDS	179.9900	34.3500	145.6400	0.1700	24.7588		(29a)					
Horizontal ceiling	79.0000		79.0000	0.1100	8.6900		(30)					
Total net area of external elements Aum(A, m ²)			337.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9759	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (User defined value 0.080 * total exposed area)							27.0392 (36)					
Total fabric heat loss						(33) + (36) =	118.0151 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 77.3823	Feb 76.6616	Mar 75.9552	Apr 72.6372	May 72.0164	Jun 69.1265	Jul 69.1265	Aug 68.5913	Sep 70.2396	Oct 72.0164	Nov 73.2722	Dec 74.5852 (38)
Heat transfer coeff	195.3974	194.6767	193.9703	190.6523	190.0315	187.1416	187.1416	186.6064	188.2547	190.0315	191.2873	192.6003 (39)
Average = Sum(39)m / 12 =												190.6493 (39)
HLP	Jan 1.4223	Feb 1.4171	Mar 1.4119	Apr 1.3878	May 1.3833	Jun 1.3622	Jul 1.3622	Aug 1.3583	Sep 1.3703	Oct 1.3833	Nov 1.3924	Dec 1.4020 (40)
HLP (average)												1.3878 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Water storage loss:												150.0000 (47)
Store volume												1.8900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												1.0206 (55)
Total storage loss												
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386 (56)
If cylinder contains dedicated solar storage												
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	232.3799	204.8122	215.0784	192.7766	188.8952	168.7568	162.0462	177.8517	177.5492	199.8995	211.4072	226.7798 (62)
WWHRS	-43.4813	-38.2569	-39.0467	-32.1341	-29.8411	-24.6202	-20.8419	-25.2331	-25.9669	-32.0948	-37.1700	-42.0250 eq. (G10)
Total of WWHRS savings												-390.7120
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	188.8986	166.5553	176.0317	160.6425	159.0541	144.1366	141.2043	152.6187	151.5822	167.8047	174.2372	184.7548 (64)
Heat gains from water heating, kWh/month	102.9325	91.2824	97.1798	88.9365	88.4739	80.9499	79.5466	84.8019	83.8734	92.1328	95.1312	101.0705 (65)
											Total per year (kWh/year) = Sum(64)m =	1967.5207 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.3169	24.2627	19.7317	14.9382	11.1665	9.4272	10.1864	13.2407	17.7716	22.5652	26.3369	28.0762 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.4129	309.5925	301.5800	284.5223	262.9901	242.7528	229.2331	226.0534	234.0660	251.1236	272.6559	292.8932 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	138.3502	135.8370	130.6180	123.5229	118.9165	112.4304	106.9175	113.9811	116.4908	123.8344	132.1266	135.8475 (72)
Total internal gains	541.7589	539.3710	521.6086	492.6623	462.7519	434.2893	416.0158	422.9541	438.0072	467.2021	500.7983	526.4957 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
East	32.5000	19.6403	0.6300	0.7000	0.7700	195.0754 (76)						
Solar gains	195.0754	381.6089	628.4554	916.5648	1123.2846	1149.8816	1094.7342	940.3605	730.9197	452.8111	243.2361	160.4205 (83)
Total gains	736.8343	920.9799	1150.0641	1409.2271	1586.0365	1584.1709	1510.7500	1363.3146	1168.9269	920.0132	744.0344	686.9162 (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	19.5300	19.6023	19.6737	20.0161	20.0815	20.3916	20.3916	20.4501	20.2710	20.0815	19.9496	19.8136	
alpha	2.3020	2.3068	2.3116	2.3344	2.3388	2.3594	2.3594	2.3633	2.3514	2.3388	2.3300	2.3209	
util living area	0.9746	0.9574	0.9211	0.8473	0.7374	0.5995	0.4770	0.5306	0.7377	0.9031	0.9624	0.9783 (86)	
MIT	17.9757	18.3187	18.9097	19.6630	20.2808	20.6996	20.8754	20.8362	20.4724	19.6217	18.6692	17.9337 (87)	
Th 2	19.7463	19.7503	19.7542	19.7727	19.7762	19.7924	19.7924	19.7954	19.7862	19.7762	19.7692	19.7618 (88)	
util rest of house	0.9703	0.9502	0.9075	0.8203	0.6889	0.5206	0.3674	0.4207	0.6702	0.8799	0.9549	0.9746 (89)	
MIT 2	15.7379	16.2360	17.0874	18.1592	18.9970	19.5315	19.7173	19.6888	19.2782	18.1298	16.7592	15.6842 (90)	
Living area fraction												fLA = Living area / (4) =	0.1565 (91)
MIT	16.0881	16.5620	17.3726	18.3946	19.1979	19.7143	19.8985	19.8684	19.4651	18.3633	17.0581	16.0362 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	15.9381	16.4120	17.2226	18.2446	19.0479	19.5643	19.7485	19.7184	19.3151	18.2133	16.9081	15.8862 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9483	0.9201	0.8678	0.7771	0.6548	0.5038	0.3631	0.4129	0.6384	0.8380	0.9267	0.9549 (94)	
Useful gains	698.7036	847.3505	997.9854	1095.0979	1038.4594	798.1754	548.5252	562.9283	746.2223	770.9307	689.4897	655.9400 (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	2274.0591	2241.1091	2079.8583	1781.5651	1396.3400	929.0337	589.2215	619.2327	981.7619	1446.7636	1876.1693	2250.7669 (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	1172.0645	936.6058	804.9134	494.2564	266.2632	0.0000	0.0000	0.0000	0.0000	502.8196	854.4093	1186.5512 (98)	
Space heating												6217.8834 (98)	
Space heating per m ²												(98) / (4) =	45.2605 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													92.0000 (206)
Efficiency of secondary/supplementary heating system, %													60.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1172.0645	936.6058	804.9134	494.2564	266.2632	0.0000	0.0000	0.0000	0.0000	502.8196	854.4093	1186.5512	(98)
Space heating efficiency (main heating system 1)	92.0000	92.0000	92.0000	92.0000	92.0000	0.0000	0.0000	0.0000	0.0000	92.0000	92.0000	92.0000	(210)
Space heating fuel (main heating system)	1146.5848	916.2448	787.4153	483.5117	260.4748	0.0000	0.0000	0.0000	0.0000	491.8888	835.8352	1160.7566	(211)
Water heating requirement	195.3441	156.1010	134.1522	82.3761	44.3772	0.0000	0.0000	0.0000	0.0000	83.8033	142.4015	197.7585	(215)
Water heating requirement	188.8986	166.5553	176.0317	160.6425	159.0541	144.1366	141.2043	152.6187	151.5822	167.8047	174.2372	184.7548	(64)
Efficiency of water heater (217)m	88.5995	88.4392	88.0684	87.2312	85.6728	79.3000	79.3000	79.3000	79.3000	87.1697	88.1989	88.6533	(217)
Fuel for water heating, kWh/month	213.2050	188.3275	199.8807	184.1570	185.6530	181.7612	178.0634	192.4573	191.1504	192.5035	197.5504	208.4016	(219)
Water heating fuel used													2313.1111 (219)
Annual totals kWh/year													
Space heating fuel - main system													6082.7120 (211)
Space heating fuel - secondary													1036.3139 (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)													482.4256 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.37 * 1029 * 1.00) =										-1127.9886			-1127.9886 (233)
Total delivered energy for all uses													8861.5740 (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	6082.7120	0.2410	1465.9336 (261)
Space heating - secondary	1036.3139	0.0190	19.6900 (263)
Water heating (other fuel)	2313.1111	0.2410	557.4598 (264)
Space and water heating			2043.0833 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	482.4256	0.5190	250.3789 (268)
Energy saving/generation technologies			
PV Unit	-1127.9886	0.5190	-585.4261 (269)
Total CO2, kg/m2/year			1746.9611 (272)
Target Carbon Dioxide Emission Rate (TER) = 1746.9611 / 137.38, rounded to 2 d.p.			12.7200 (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	68.6900 (1b)	x 2.5100 (2b)	= 172.4119 (1b) - (3b)
First floor	68.6900 (1c)	x 2.6800 (2c)	= 184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.5011 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1122 (8)							
Pressure test					Yes							
Measured/design AP50					4.0000							
Infiltration rate					0.3122 (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) =	0.2654 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.3383	0.3317	0.3251	0.2919	0.2853	0.2521	0.2521	0.2455	0.2654	0.2853	0.2985	0.3118 (22b)
	0.5572	0.5550	0.5528	0.5426	0.5407	0.5318	0.5318	0.5301	0.5352	0.5407	0.5446	0.5486 (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					
Part glazed door			4.2000	1.4000	5.8800		(26a)					
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)					
Insulated slab			79.0000	0.1200	9.4800		(28a)					
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)					
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)					
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)					
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)					
Total net area of external elements Aum(A, m ²)			337.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 76.6600		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7940 (36)					
Total fabric heat loss							(33) + (36) = 90.4540 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 65.5567	Feb 65.2952	Mar 65.0389	Apr 63.8350	May 63.6098	Jun 62.5612	Jul 62.5612	Aug 62.3670	Sep 62.9651	Oct 63.6098	Nov 64.0654	Dec 64.5418 (38)
Heat transfer coeff	156.0107	155.7492	155.4929	154.2890	154.0638	153.0152	153.0152	152.8210	153.4191	154.0638	154.5194	154.9958 (39)
Average = Sum(39)m / 12 =												154.2879 (39)
HLP	Jan 1.1356	Feb 1.1337	Mar 1.1318	Apr 1.1231	May 1.1214	Jun 1.1138	Jul 1.1138	Aug 1.1124	Sep 1.1167	Oct 1.1214	Nov 1.1248	Dec 1.1282 (40)
HLP (average)												1.1231 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												

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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	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	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	37.7143	32.9851	34.0377	29.6749	28.4738	24.5707	22.7684	26.1270	26.4391	30.8122	33.6339	36.5242			(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	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	145.5962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.5774	25.3822	20.6422	15.6275	11.6817	9.8622	10.6564	13.8517	18.5917	23.6064	27.5521	29.3717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.4129	309.5925	301.5800	284.5223	262.9901	242.7528	229.2331	226.0534	234.0660	251.1236	272.6559	292.8932	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	37.5596	(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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	(71)
Water heating gains (Table 5)	50.6912	49.0850	45.7496	41.2151	38.2712	34.1260	30.6026	35.1170	36.7209	41.4142	46.7138	49.0917	(72)
Total internal gains	452.3604	450.7386	434.6507	408.0438	379.6219	353.4198	337.1710	341.7009	356.0574	382.8231	413.6007	438.0354	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	9.6800	10.6334	0.6300	0.7000	0.7700	31.4571 (74)							
South	10.5600	46.7521	0.6300	0.7000	0.7700	150.8817 (78)							
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)							
Solar gains	190.9822	324.1297	444.7658	560.4499	641.5245	644.3400	618.0074	555.4590	484.0180	358.1497	228.4299	163.7077	(83)
Total gains	643.3426	774.8683	879.4165	968.4937	1021.1464	997.7598	955.1784	897.1599	840.0754	740.9729	642.0306	601.7432	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	24.4606	24.5016	24.5420	24.7335	24.7697	24.9394	24.9394	24.9711	24.8738	24.7697	24.6966	24.6207	21.0000 (85)
tau	2.6307	2.6334	2.6361	2.6489	2.6513	2.6626	2.6626	2.6647	2.6583	2.6513	2.6464	2.6414	
alpha	0.9809	0.9682	0.9473	0.9069	0.8351	0.7201	0.5914	0.6337	0.8044	0.9260	0.9709	0.9839	(86)
util living area	18.4196	18.7017	19.1396	19.7023	20.2381	20.6566	20.8572	20.8229	20.4963	19.7967	19.0000	18.3637	(87)
MIT	19.9719	19.9734	19.9749	19.9820	19.9834	19.9896	19.9896	19.9907	19.9872	19.9834	19.9807	19.9778	(88)
Th 2	0.9778	0.9632	0.9385	0.8900	0.8013	0.6547	0.4883	0.5349	0.7524	0.9092	0.9655	0.9813	(89)
util rest of house	17.5985	17.8791	18.3130	18.8690	19.3819	19.7637	19.9208	19.9000	19.6305	18.9695	18.1828	17.5472	(90)
Living area fraction	17.7270	18.0078	18.4424	18.9994	19.5159	19.9035	20.0674	20.0444	19.6305	18.9695	18.1828	17.5472	(91)
MIT 2	17.7270	18.0078	18.4424	18.9994	19.5159	19.9035	20.0674	20.0444	19.7660	19.0989	18.3107	17.6749	(92)
Temperature adjustment	17.7270	18.0078	18.4424	18.9994	19.5159	19.9035	20.0674	20.0444	19.7660	19.0989	18.3107	17.6749	(93)
adjusted MIT	17.7270	18.0078	18.4424	18.9994	19.5159	19.9035	20.0674	20.0444	19.7660	19.0989	18.3107	17.6749	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	623.0949	736.2301	810.3157	842.2262	799.4860	646.8844	474.7984	485.1490	620.7632	659.7173	612.0052	585.5614	(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	2094.7601	2041.5356	1856.9550	1558.2268	1204.1483	811.5101	530.5595	556.9437	869.2714	1309.3780	1732.2656	2088.5604	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1094.9189	877.1653	778.6996	515.5204	301.0687	0.0000	0.0000	0.0000	0.0000	483.3476	806.5875	1118.2312	(98)
Space heating												5975.5392	(98)
Space heating per m2												43.4964	(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	1438.3430	1132.3126	1161.4399	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6857	0.7578	0.7298	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	986.2469	858.0823	847.6111	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1287.8457	1235.3509	1169.9990	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	217.1512	280.6878	239.8566	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												737.6956 (104)
Intermittency factor (Table 10b)												FC = cooled area / (4) =
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	1.0000 (105)
Space cooling kWh												0.0000 (106)
	0.0000	0.0000	0.0000	0.0000	0.0000	54.2878	70.1720	59.9642	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												184.4239 (107)
Space cooling per m2												1.3424 (108)
Energy for space heating												43.4964 (99)
Energy for space cooling												1.3424 (108)
Total												44.8389 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.8 (109)

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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	68.6900 (1b)	2.5100 (2b)	172.4119 (1b) - (3b)
First floor	68.6900 (1c)	2.6800 (2c)	184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 356.5011 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes	4.0000							
Measured/design AP50					0.2000 (18)							
Infiltration rate					2 (19)							
Number of sides sheltered												
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 5.7000	Feb 5.8000	Mar 5.7000	Apr 5.0000	May 4.6000	Jun 4.4000	Jul 4.0000	Aug 4.1000	Sep 4.6000	Oct 5.2000	Nov 5.3000	Dec 5.1000 (22)
Wind factor	1.4250	1.4500	1.4250	1.2500	1.1500	1.1000	1.0000	1.0250	1.1500	1.3000	1.3250	1.2750 (22a)
Adj infilt rate	0.2423	0.2465	0.2423	0.2125	0.1955	0.1870	0.1700	0.1743	0.1955	0.2210	0.2253	0.2168 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	76.6600	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	237.5693	209.4994	220.2678	197.7986	194.0846	173.7788	167.2356	183.0411	182.5712	205.0889	216.4292	231.9692 (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	237.5693	209.4994	220.2678	197.7986	194.0846	173.7788	167.2356	183.0411	182.5712	205.0889	216.4292	231.9692 (64)
RHI water heating demand												2419.3338 (64)
Heat gains from water heating, kWh/month	107.0840	95.0322	101.3313	92.9541	92.6254	84.9675	83.6981	88.9534	87.8910	96.2843	99.1488	105.2220 (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	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4435	63.4555	51.6055	39.0687	29.2043	24.6555	26.6411	34.6291	46.4792	59.0160	68.8803	73.4291 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	457.3327	462.0784	450.1194	424.6602	392.5225	362.3176	342.1389	337.3932	349.3522	374.8114	406.9491	437.1540 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	143.9302	141.4170	136.1980	129.1029	124.4965	118.0104	112.4975	119.5611	122.0708	129.4144	137.7066	141.4275 (72)
Total internal gains	789.3284	783.5728	754.5449	709.4537	662.8452	621.6055	597.8994	608.2054	634.5241	679.8637	730.1580	768.6325 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data FF or Table 6c	Access factor Table 6d	Gains W					
North	9.6800	8.2005	0.6300	0.7000	0.7700	24.2599 (74)						
South	10.5600	38.1750	0.6300	0.7000	0.7700	123.2011 (78)						
West	1.4400	14.7869	0.6300	0.7000	0.7700	6.5075 (80)						
Solar gains	153.9684	297.4240	448.8809	568.5499	675.4112	625.1698	599.8258	537.2164	459.0254	321.7057	190.8999	120.3701 (83)
Total gains	943.2968	1080.9968	1203.4258	1278.0036	1338.2564	1246.7753	1197.7253	1145.4218	1093.5495	1001.5694	921.0579	889.0027 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640 (85)
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043
util living area	0.9594	0.9433	0.9156	0.8758	0.8185	0.7488	0.6785	0.7011	0.8001	0.8997	0.9470	0.9662 (86)
MIT	18.6901	18.9021	19.2893	19.7293	20.1342	20.4947	20.6912	20.6586	20.3771	19.7766	19.1229	18.5495 (87)
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118 (88)
util rest of house	0.9539	0.9358	0.9043	0.8581	0.7913	0.7052	0.6182	0.6427	0.7618	0.8823	0.9388	0.9617 (89)
MIT 2	16.9058	17.2106	17.7669	18.3939	18.9601	19.4530	19.7061	19.6686	19.3051	18.4732	17.5352	16.7021 (90)
Living area fraction												fLA = Living area / (4) = 0.1565 (91)
MIT	17.1851	17.4753	18.0051	18.6029	19.1438	19.6161	19.8603	19.8236	19.4729	18.6772	17.7836	16.9912 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0351	17.3253	17.8551	18.4529	18.9938	19.4661	19.7103	19.6736	19.3229	18.5272	17.6336	16.8412 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	877.1710	981.0270	1048.9492	1052.0890	1014.2682	844.5869	715.6486	710.0612	798.1840	849.2877	839.2210	835.6691 (95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000 (96)
Heat loss rate W	2050.3253	2048.8718	1918.9741	1694.7221	1447.0626	1084.6538	852.4101	861.8573	1093.1331	1452.0452	1781.4130	2081.1003 (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	872.8268	717.5917	647.2985	462.6958	321.9990	0.0000	0.0000	0.0000	0.0000	448.4515	678.3783	926.6008 (98)
Space heating												5075.8423 (98)
RHI space heating demand												5076 (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	68.6900 (1b)	x 2.5100 (2b)	= 172.4119 (1b) - (3b)
First floor	68.6900 (1c)	x 2.6800 (2c)	= 184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 356.5011 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					0 * 10 = 0.0000 (7a)							
Number of passive vents					0 * 10 = 0.0000 (7b)							
Number of flueless gas fires					0 * 40 = 0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					4.0000							
Infiltration rate					0.2000 (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) =	0.1700 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	76.6600	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	237.5693	209.4994	220.2678	197.7986	194.0846	173.7788	167.2356	183.0411	182.5712	205.0889	216.4292	231.9692 (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)
FGHRS	-33.6337	-29.0957	-29.3552	-25.1945	-23.0604	-10.1876	-9.8808	-10.7090	-10.6484	-25.6206	-29.1992	-33.2298 eq. (G6)
Output from w/h	203.9356	180.4037	190.9126	172.6041	171.0243	163.5912	157.3548	172.3321	171.9228	179.4683	187.2301	198.7395 (64)
Heat gains from water heating, kWh/month	107.0840	95.0322	101.3313	92.9541	92.6254	84.9675	83.6981	88.9534	87.8910	96.2843	99.1488	105.2220 (65)
												Total per year (kWh/year) = Sum(64)m = 2149.5189 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4435	63.4555	51.6055	39.0687	29.2043	24.6555	26.6411	34.6291	46.4792	59.0160	68.8803	73.4291 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	457.3327	462.0784	450.1194	424.6602	392.5225	362.3176	342.1389	337.3932	349.3522	374.8114	406.9491	437.1540 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	143.9302	141.4170	136.1980	129.1029	124.4965	118.0104	112.4975	119.5611	122.0708	129.4144	137.7066	141.4275 (72)
Total internal gains	789.3284	783.5728	754.5449	709.4537	662.8452	621.6055	597.8994	608.2054	634.5241	679.8637	730.1580	768.6325 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	9.6800	10.6334	0.6300	0.7000	0.7700	31.4571 (74)						
South	10.5600	46.7521	0.6300	0.7000	0.7700	150.8817 (78)						
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)						
Solar gains	190.9822	324.1297	444.7658	560.4499	641.5245	644.3400	618.0074	555.4590	484.0180	358.1497	228.4299	163.7077 (83)
Total gains	980.3105	1107.7025	1199.3107	1269.9036	1304.3698	1265.9455	1215.9068	1163.6643	1118.5420	1038.0135	958.5879	932.3403 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640 (85)
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043
util living area	0.9498	0.9296	0.8983	0.8429	0.7524	0.6211	0.4879	0.5224	0.6993	0.8560	0.9293	0.9556 (86)
MIT	18.9233	19.1736	19.5543	20.0215	20.4590	20.7752	20.9154	20.8953	20.6705	20.1172	19.4255	18.8501 (87)
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118 (88)
util rest of house	0.9427	0.9199	0.8837	0.8188	0.7115	0.5536	0.3948	0.4304	0.6389	0.8291	0.9178	0.9493 (89)
MIT 2	17.2439	17.6030	18.1476	18.8064	19.4029	19.8034	19.9547	19.9371	19.6849	18.9517	17.9715	17.1387 (90)
Living area fraction	fLA = Living area / (4) = 0.1565 (91)											
MIT	17.5068	17.8488	18.3678	18.9966	19.5682	19.9554	20.1051	20.0871	19.8391	19.1341	18.1991	17.4065 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.3568	17.6988	18.2178	18.8466	19.4182	19.8054	19.9551	19.9371	19.6891	18.9841	18.0491	17.2565 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	897.8792	984.8003	1018.8534	995.9634	891.2929	681.1490	473.0372	492.0381	689.4796	824.4034	849.8947	861.5196 (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	1949.0691	1910.5583	1749.1886	1484.7926	1152.1461	777.0511	500.8348	528.0004	834.3244	1251.5545	1634.4389	1949.0385 (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	782.0853	622.1094	543.3694	351.9570	194.0748	0.0000	0.0000	0.0000	0.0000	317.8004	564.8719	809.1140 (98)
Space heating												4185.3822 (98)
Space heating per m2												(98) / (4) = 30.4657 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	782.0853	622.1094	543.3694	351.9570	194.0748	0.0000	0.0000	0.0000	0.0000	317.8004	564.8719	809.1140	(98)
Space heating efficiency (main heating system 1)	91.2000	91.2000	91.2000	91.2000	91.2000	0.0000	0.0000	0.0000	0.0000	91.2000	91.2000	91.2000	(210)
Space heating fuel (main heating system)	857.5497	682.1375	595.7998	385.9178	212.8013	0.0000	0.0000	0.0000	0.0000	348.4654	619.3770	887.1865	(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	203.9356	180.4037	190.9126	172.6041	171.0243	163.5912	157.3548	172.3321	171.9228	179.4683	187.2301	198.7395	(64)
Efficiency of water heater (217)m	88.7599	88.5540	88.1535	87.3784	85.8544	80.5000	80.5000	80.5000	80.5000	87.0253	88.2789	88.8707	(217)
Fuel for water heating, kWh/month	229.7610	203.7217	216.5684	197.5364	199.2027	203.2189	195.4718	214.0771	213.5687	206.2255	212.0892	223.6277	(219)
Water heating fuel used													2515.0691 (219)
Annual totals kWh/year													
Space heating fuel - main system													4589.2348 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 13.1040, total flow = 53.0000, SFP = 0.2472)													107.5347 (230a)
mechanical ventilation fans (SFP = 0.2472)													30.0000 (230c)
central heating pump													45.0000 (230e)
main heating flue fan													182.5347 (231)
Total electricity for the above, kWh/year													504.6859 (232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.34 + 1068 * 1.00) =										-1144.9716			-1144.9716 (233)
Total delivered energy for all uses													6646.5529 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4589.2348	7.6000	348.7818	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2515.0691	7.6000	191.1453	(247)
Mechanical ventilation fans	107.5347	13.1900	14.1838	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	504.6859	13.1900	66.5681	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1144.9716	13.1900	-151.0217	(252)
Total energy cost			549.5497	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2655 (257)
SAP value		82.3456
SAP rating (Section 12)		82 (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	4589.2348	0.2410	1106.0056	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.0691	0.2410	606.1316	(264)
Space and water heating			1712.1372	(265)
Pumps and fans	182.5347	0.5190	94.7355	(267)
Energy for lighting	504.6859	0.5190	261.9320	(268)
Energy saving/generation technologies				
PV Unit	-1144.9716	0.5190	-594.2402	(269)
Total kg/year			1474.5645	(272)
CO2 emissions per m2			10.7300	(273)
EI value			89.1659	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$7.60 \times (1 + 0.29 \times 0.00) / 0.9120 = 8.333$, stars = 2
Main heating environmental impact	$0.241 \times (1 + 0.29 \times 0.00) / 0.9120 = 0.2643$, stars = 4
Water heating energy efficiency	$7.60 / 0.8541 = 8.899$, stars = 3
Water heating environmental impact	$0.241 / 0.8541 = 0.2822$, stars = 5

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	68.6900 (1b)	2.5100 (2b)	172.4119 (1b) - (3b)
First floor	68.6900 (1c)	2.6800 (2c)	184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 356.5011 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes	4.0000							
Measured/design AP50					0.2000 (18)							
Infiltration rate					2 (19)							
Number of sides sheltered												
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 5.7000	Feb 5.8000	Mar 5.7000	Apr 5.0000	May 4.6000	Jun 4.4000	Jul 4.0000	Aug 4.1000	Sep 4.6000	Oct 5.2000	Nov 5.3000	Dec 5.1000 (22)
Wind factor	1.4250	1.4500	1.4250	1.2500	1.1500	1.1000	1.0000	1.0250	1.1500	1.3000	1.3250	1.2750 (22a)
Adj infilt rate	0.2423	0.2465	0.2423	0.2125	0.1955	0.1870	0.1700	0.1743	0.1955	0.2210	0.2253	0.2168 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	76.6600	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	237.5693	209.4994	220.2678	197.7986	194.0846	173.7788	167.2356	183.0411	182.5712	205.0889	216.4292	231.9692 (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)
FGHRS	-34.5172	-29.9678	-30.3192	-26.1525	-24.4521	-10.1876	-9.8808	-10.7090	-10.6484	-26.7734	-30.2459	-34.3569 eq. (G6)
Output from w/h	203.0520	179.5316	189.9486	171.6460	169.6325	163.5912	157.3548	172.3321	171.9228	178.3155	186.1833	197.6124 (64)
Heat gains from water heating, kWh/month	107.0840	95.0322	101.3313	92.9541	92.6254	84.9675	83.6981	88.9534	87.8910	96.2843	99.1488	105.2220 (65)
												2141.1228 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4435	63.4555	51.6055	39.0687	29.2043	24.6555	26.6411	34.6291	46.4792	59.0160	68.8803	73.4291 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	457.3327	462.0784	450.1194	424.6602	392.5225	362.3176	342.1389	337.3932	349.3522	374.8114	406.9491	437.1540 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	143.9302	141.4170	136.1980	129.1029	124.4965	118.0104	112.4975	119.5611	122.0708	129.4144	137.7066	141.4275 (72)
Total internal gains	789.3284	783.5728	754.5449	709.4537	662.8452	621.6055	597.8994	608.2054	634.5241	679.8637	730.1580	768.6325 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	9.6800	8.2005	0.6300	0.6300	0.7000	0.7700	24.2599 (74)					
South	10.5600	38.1750	0.6300	0.6300	0.7000	0.7700	123.2011 (78)					
West	1.4400	14.7869	0.6300	0.6300	0.7000	0.7700	6.5075 (80)					
Solar gains	153.9684	297.4240	448.8809	568.5499	675.4112	625.1698	599.8258	537.2164	459.0254	321.7057	190.8999	120.3701 (83)
Total gains	943.2968	1080.9968	1203.4258	1278.0036	1338.2564	1246.7753	1197.7253	1145.4218	1093.5495	1001.5694	921.0579	889.0027 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640 (85)
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043
util living area	0.9594	0.9433	0.9156	0.8758	0.8185	0.7488	0.6785	0.7011	0.8001	0.8997	0.9470	0.9662 (86)
MIT	18.6901	18.9021	19.2893	19.7293	20.1342	20.4947	20.6912	20.6586	20.3771	19.7766	19.1229	18.5495 (87)
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118 (88)
util rest of house	0.9539	0.9358	0.9043	0.8581	0.7913	0.7052	0.6182	0.6427	0.7618	0.8823	0.9388	0.9617 (89)
MIT 2	16.9058	17.2106	17.7669	18.3939	18.9601	19.4530	19.7061	19.6686	19.3051	18.4732	17.5352	16.7021 (90)
Living area fraction									fLA = Living area / (4) =			0.1565 (91)
MIT	17.1851	17.4753	18.0051	18.6029	19.1438	19.6161	19.8603	19.8236	19.4729	18.6772	17.7836	16.9912 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0351	17.3253	17.8551	18.4529	18.9938	19.4661	19.7103	19.6736	19.3229	18.5272	17.6336	16.8412 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	877.1710	981.0270	1048.9492	1052.0890	1014.2682	844.5869	715.6486	710.0612	798.1840	849.2877	839.2210	835.6691 (95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000 (96)
Heat loss rate W	2050.3253	2048.8718	1918.9741	1694.7221	1447.0626	1084.6538	852.4101	861.8573	1093.1331	1452.0452	1781.4130	2081.1003 (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	872.8268	717.5917	647.2985	462.6958	321.9990	0.0000	0.0000	0.0000	0.0000	448.4515	678.3783	926.6008 (98)
Space heating												5075.8423 (98)
Space heating per m2												(98) / (4) = 36.9475 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	872.8268	717.5917	647.2985	462.6958	321.9990	0.0000	0.0000	0.0000	0.0000	448.4515	678.3783	926.6008	(98)
Space heating efficiency (main heating system 1)	91.2000	91.2000	91.2000	91.2000	91.2000	0.0000	0.0000	0.0000	0.0000	91.2000	91.2000	91.2000	(210)
Space heating fuel (main heating system)	957.0469	786.8330	709.7571	507.3419	353.0691	0.0000	0.0000	0.0000	0.0000	491.7232	743.8358	1016.0096	(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	203.0520	179.5316	189.9486	171.6460	169.6325	163.5912	157.3548	172.3321	171.9228	178.3155	186.1833	197.6124	(64)
Efficiency of water heater (217)m	88.9681	88.8370	88.5303	88.0337	87.2008	80.5000	80.5000	80.5000	80.5000	87.8769	88.6621	89.1178	(217)
Fuel for water heating, kWh/month	228.2301	202.0911	214.5577	194.9776	194.5310	203.2189	195.4718	214.0771	213.5687	202.9151	209.9919	221.7428	(219)
Water heating fuel used													2495.3737 (219)
Annual totals kWh/year													
Space heating fuel - main system													5565.6166 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 13.1040, total flow = 53.0000, SFP = 0.2472)													107.5347 (230a)
mechanical ventilation fans (SFP = 0.2472)													30.0000 (230c)
central heating pump													45.0000 (230e)
main heating flue fan													182.5347 (231)
Total electricity for the above, kWh/year													504.6859 (232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.34 * 1017 * 1.00) =										-1090.3028			-1090.3028 (233)
Total delivered energy for all uses													7657.9082 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5565.6166	9.4500	525.9508	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2495.3737	9.4500	235.8128	(247)
Mechanical ventilation fans	107.5347	25.0500	26.9374	(249)
Pumps and fans for heating	75.0000	25.0500	18.7875	(249)
Energy for lighting	504.6859	25.0500	126.4238	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1090.3028	25.0500	-273.1208	(252)
Total energy cost			730.7915	(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	5565.6166	0.2410	1341.3136	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2495.3737	0.2410	601.3851	(264)
Space and water heating			1942.6987	(265)
Pumps and fans	182.5347	0.5190	94.7355	(267)
Energy for lighting	504.6859	0.5190	261.9320	(268)
Energy saving/generation technologies				
PV Unit	-1090.3028	0.5190	-565.8671	(269)
Total kg/year			1733.4990	(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	5565.6166	1.0900	6066.5221	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2495.3737	1.0900	2719.9574	(264)
Space and water heating			8786.4795	(265)
Pumps and fans	182.5347	3.0700	560.3816	(267)
Energy for lighting	504.6859	3.0700	1549.3856	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-1090.3028	3.0700	-3347.2295 (269)
Primary energy kWh/year			7549.0172 (272)
Primary energy kWh/m ² /year			54.9499 (273)

SAP 2012 EPC IMPROVEMENTS

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.8	-£ 100	-262 kg (15.1%)

Current energy efficiency rating:	B 82
Current environmental impact rating:	B 89

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£100 1.91 kg/m ²	B 85	B 91
Total Savings	£100 1.91 kg/m²		

Potential energy efficiency rating:	B 85
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, North East Scotland):

	Current	Potential	Saving
Electricity	£172	£185	-£13
Bulk LPG	£832	£719	£113
Space heating	£642	£646	-£4
Water heating	£236	£131	£105
Lighting	£126	£126	£0
Generated (PV)	-£273	-£273	£0
Total cost of fuels	£731	£631	£100
Total cost of uses	£731	£630	£101
Delivered energy	56 kWh/m ²	47 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.7 tonnes	1.5 tonnes	0.3 tonnes
CO2 emissions per m ²	13 kg/m ²	11 kg/m ²	2 kg/m ²
Primary energy	55 kWh/m ²	47 kWh/m ²	8 kWh/m ²

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	68.6900 (1b)	2.5100 (2b)	172.4119 (1b) - (3b)
First floor	68.6900 (1c)	2.6800 (2c)	184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 356.5011 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					4.0000							
Infiltration rate					0.2000 (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) =	0.1700 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	76.6600	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	25.7796	23.2848	25.7796	24.9480	25.7796	24.9480	25.7796	25.7796	24.9480	25.7796	24.9480	25.7796 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	226.5209	199.5202	207.8237	180.3530	170.2419	150.4801	143.1603	159.8963	166.4763	192.6448	205.7372	220.9208 (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												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												1.0595 (H8)
Utilisation factor												0.6109 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												108.7981 (H14)
Volume ratio Veff/V												1.1719 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-974.1692 (H17)
Solar input	-28.2490	-47.1394	-80.2838	-107.5961	-132.9259	-130.6874	-128.9603	-112.6732	-88.2457	-60.2615	-33.5073	-23.6396 (63)
FGHRS	-29.4963	-22.7039	-18.7393	-8.5885	-2.7501	0.0000	0.0000	-3.1617	-4.8815	-17.9580	-24.5440	-29.6170 eq. (G6)
Output from w/h	168.7756	129.6768	108.8006	64.1684	34.5659	19.7927	14.2000	44.0614	73.3490	114.4253	147.6859	167.6643 (64)
Heat gains from water heating, kWh/month	98.2453	87.0488	91.3760	78.9976	73.5512	66.3285	64.4378	70.4376	75.0151	86.3290	90.5952	96.3833 (65)
Total per year (kWh/year) = Sum(64)m =												1087.1658 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4435	63.4555	51.6055	39.0687	29.2043	24.6555	26.6411	34.6291	46.4792	59.0160	68.8803	73.4291	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	457.3327	462.0784	450.1194	424.6602	392.5225	362.3176	342.1389	337.3932	349.3522	374.8114	406.9491	437.1540	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	(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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	(71)
Water heating gains (Table 5)	132.0502	129.5370	122.8172	109.7189	98.8592	92.1230	86.6100	94.6741	104.1876	116.0336	125.8266	129.5475	(72)
Total internal gains	777.4484	771.6928	741.1641	690.0697	637.2079	595.7180	572.0120	583.3184	616.6409	666.4829	718.2780	756.7525	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
North	9.6800	10.6334	0.6300	0.7000	0.7700	31.4571 (74)							
South	10.5600	46.7521	0.6300	0.7000	0.7700	150.8817 (78)							
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)							
Solar gains	190.9822	324.1297	444.7658	560.4499	641.5245	644.3400	618.0074	555.4590	484.0180	358.1497	228.4299	163.7077	(83)
Total gains	968.4305	1095.8225	1185.9299	1250.5196	1278.7325	1240.0580	1190.0193	1138.7774	1100.6588	1024.6327	946.7079	920.4603	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	
util living area	0.9511	0.9312	0.9004	0.8470	0.7593	0.6294	0.4962	0.5310	0.7054	0.8593	0.9311	0.9569	(86)
MIT	18.9100	19.1612	19.5418	20.0066	20.4451	20.7674	20.9118	20.8910	20.6628	20.1064	19.4131	18.8365	(87)
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	(88)
util rest of house	0.9442	0.9216	0.8861	0.8233	0.7189	0.5619	0.4022	0.4382	0.6453	0.8328	0.9198	0.9507	(89)
MIT 2	17.2249	17.5854	18.1302	18.7865	19.3858	19.7955	19.9521	19.9337	19.6764	18.9374	17.9540	17.1193	(90)
Living area fraction												fLA = Living area / (4) = 0.1565 (91)	
MIT	17.4886	17.8320	18.3511	18.9774	19.5516	19.9476	20.1023	20.0835	19.8307	19.1204	18.1824	17.3880	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3386	17.6820	18.2011	18.8274	19.4016	19.7976	19.9523	19.9335	19.6807	18.9704	18.0324	17.2380	(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	0.9177	0.8910	0.8521	0.7887	0.6901	0.5457	0.3961	0.4303	0.6223	0.7978	0.8889	0.9258	(94)	
Useful gains	888.7488	976.4020	1010.5080	986.2359	882.4978	676.7000	471.3818	489.9741	684.9178	817.4592	841.5557	852.1571	(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	1946.3626	1908.0545	1746.7004	1481.9353	1149.6699	775.8781	500.4134	527.4712	833.0751	1249.5038	1631.9503	1946.2710	(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	786.8647	626.0705	547.7272	356.9036	198.7761	0.0000	0.0000	0.0000	0.0000	321.4412	569.0841	814.0208	(98)	
Space heating												4220.8880	(98)	
Space heating per m2												(98) / (4) =	30.7242	(99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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 %)													91.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	786.8647	626.0705	547.7272	356.9036	198.7761	0.0000	0.0000	0.0000	0.0000	321.4412	569.0841	814.0208	(98)	
Space heating efficiency (main heating system 1)	91.2000	91.2000	91.2000	91.2000	91.2000	0.0000	0.0000	0.0000	0.0000	91.2000	91.2000	91.2000	(210)	
Space heating fuel (main heating system)	862.7902	686.4808	600.5781	391.3416	217.9562	0.0000	0.0000	0.0000	0.0000	352.4574	623.9957	892.5667	(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	168.7756	129.6768	108.8006	64.1684	34.5659	19.7927	14.2000	44.0614	73.3490	114.4253	147.6859	167.6643	(64)	
Efficiency of water heater (217)m	89.1082	89.1664	89.2344	89.3893	89.4390	80.5000	80.5000	80.5000	80.5000	88.1249	88.7689	89.1756	(216)	
Fuel for water heating, kWh/month	189.4052	145.4325	121.9267	71.7853	38.6474	24.5872	17.6398	54.7346	91.1168	129.8445	166.3712	188.0159	(219)	
Water heating fuel used												1239.5071	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4628.1667	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans: (MEVD) decentralised, Database: total watage = 13.1040, total flow = 53.0000, SFP = 0.2472)														
mechanical ventilation fans (SFP = 0.2472)													107.5347	(230a)
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													232.5347	(231)
Electricity for lighting (calculated in Appendix L)													504.6859	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.34 * 1068 * 1.00) =										-1144.9716			-1144.9716	(233)
Total delivered energy for all uses													5459.9229	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4628.1667	7.6000	351.7407	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1239.5071	7.6000	94.2025	(247)
Mechanical ventilation fans	107.5347	13.1900	14.1838	(249)
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	504.6859	13.1900	66.5681	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1144.9716	13.1900	-151.0217	(252)
Total energy cost			462.1609	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		1.0643	(257)
SAP value		85.1530	
SAP rating (Section 12)		85	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

 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	4628.1667	0.2410	1115.3882 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1239.5071	0.2410	298.7212 (264)
Space and water heating			1414.1094 (265)
Pumps and fans	232.5347	0.5190	120.6855 (267)
Energy for lighting	504.6859	0.5190	261.9320 (268)
Energy saving/generation technologies			
PV Unit	-1144.9716	0.5190	-594.2402 (269)
Total kg/year			1202.4866 (272)
CO2 emissions per m2			8.7500 (273)
EI value			91.1650
EI rating			91 (274)
EI band			B

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	68.6900 (1b)	2.5100 (2b)	172.4119 (1b) - (3b)
First floor	68.6900 (1c)	2.6800 (2c)	184.0892 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.3800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 356.5011 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes	4.0000							
Measured/design AP50					0.2000 (18)							
Infiltration rate					2 (19)							
Number of sides sheltered												
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 5.7000	Feb 5.8000	Mar 5.7000	Apr 5.0000	May 4.6000	Jun 4.4000	Jul 4.0000	Aug 4.1000	Sep 4.6000	Oct 5.2000	Nov 5.3000	Dec 5.1000 (22)
Wind factor	1.4250	1.4500	1.4250	1.2500	1.1500	1.1000	1.0000	1.0250	1.1500	1.3000	1.3250	1.2750 (22a)
Adj infilt rate	0.2423	0.2465	0.2423	0.2125	0.1955	0.1870	0.1700	0.1743	0.1955	0.2210	0.2253	0.2168 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			21.6800	1.3258	28.7424		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	168.9900	25.8800	143.1100	0.1600	22.8976		(29a)
Feature granite nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m ²)			337.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 76.6600		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7940 (36)
 Total fabric heat loss (33) + (36) = 90.4540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan 58.8227	Feb 58.8227	Mar 58.8227	Apr 58.8227	May 58.8227	Jun 58.8227	Jul 58.8227	Aug 58.8227	Sep 58.8227	Oct 58.8227	Nov 58.8227	Dec 58.8227 (38)
Heat transfer coeff	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767	149.2767 (39)
Average = Sum(39)m / 12 =												149.2767 (39)
HLP	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866	1.0866 (40)
HLP (average)												1.0866 (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												2.9119 (42)
Average daily hot water use (litres/day)												108.7981 (43)
Daily hot water use	119.6779	115.3260	110.9741	106.6221	102.2702	97.9183	97.9183	102.2702	106.6221	110.9741	115.3260	119.6779 (44)
Energy conte	177.4789	155.2242	160.1774	139.6466	133.9942	115.6268	107.1452	122.9507	124.4192	144.9985	158.2772	171.8788 (45)
Energy content (annual)												Total = Sum(45)m = 1711.8178 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water storage loss:	26.6218	23.2836	24.0266	20.9470	20.0991	17.3440	16.0718	18.4426	18.6629	21.7498	23.7416	25.7818 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss												
	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage												
	25.7796	23.2848	25.7796	24.9480	25.7796	24.9480	25.7796	25.7796	24.9480	25.7796	24.9480	25.7796 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	226.5209	199.5202	207.8237	180.3530	170.2419	150.4801	143.1603	159.8963	166.4763	192.6448	205.7372	220.9208 (62)
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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												1017.1843 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1708.8697 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												0.9983 (H8)
Utilisation factor												0.6328 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												108.7981 (H14)
Volume ratio Veff/V												1.1719 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-950.7758 (H17)
Solar input	-22.6771	-43.0007	-80.8076	-110.0897	-142.8005	-130.0570	-128.0980	-110.4593	-83.7717	-53.8285	-27.8625	-17.3232 (63)
FGHRS	-31.0072	-23.9580	-19.2639	-8.3940	0.0000	0.0000	0.0000					-31.4683 eq.(G6)
Output from w/h												
	172.8365	132.5615	107.7523	61.8693	27.4414	20.4231	15.0623	46.1593	77.5886	119.2240	151.7051	172.1294 (64)
Heat gains from water heating, kWh/month												
	98.2453	87.0488	91.3760	78.9976	73.5512	66.3285	64.4378	70.4376	75.0151	86.3290	90.5952	96.3833 (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	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154	174.7154 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.4435	63.4555	51.6055	39.0687	29.2043	24.6555	26.6411	34.6291	46.4792	59.0160	68.8803	73.4291 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	457.3327	462.0784	450.1194	424.6602	392.5225	362.3176	342.1389	337.3932	349.3522	374.8114	406.9491	437.1540 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835	55.3835 (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)	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770	-116.4770 (71)
Water heating gains (Table 5)	132.0502	129.5370	122.8172	109.7189	98.8592	92.1230	86.6100	94.6741	104.1876	116.0336	125.8266	129.5475 (72)
Total internal gains	777.4484	771.6928	741.1641	690.0697	637.2079	595.7180	572.0120	583.3184	616.6409	666.4829	718.2780	756.7525 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	9.6800	8.2005	0.6300	0.7000	0.7700	24.2599 (74)						
South	10.5600	38.1750	0.6300	0.7000	0.7700	123.2011 (78)						
West	1.4400	14.7869	0.6300	0.7000	0.7700	6.5075 (80)						
Solar gains	153.9684	297.4240	448.8809	568.5499	675.4112	625.1698	599.8258	537.2164	459.0254	321.7057	190.8999	120.3701 (83)
Total gains	931.4168	1069.1168	1190.0450	1258.6196	1312.6191	1220.8879	1171.8378	1120.5349	1075.6663	988.1886	909.1779	877.1227 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640	25.5640 (85)
alpha	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043	2.7043
util living area	0.9606	0.9446	0.9175	0.8793	0.8242	0.7562	0.6870	0.7094	0.8053	0.9023	0.9484	0.9673 (86)
MIT	18.6764	18.8891	19.2760	19.7125	20.1162	20.4809	20.6810	20.6477	20.3654	19.7640	19.1097	18.5355 (87)
Th 2	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118	20.0118 (88)
util rest of house												
	0.9552	0.9372	0.9063	0.8619	0.7975	0.7131	0.6270	0.6514	0.7675	0.8852	0.9405	0.9628 (89)
MIT 2	16.8861	17.1920	17.7481	18.3708	18.9363	19.4362	19.6949	19.6565	19.2904	18.4559	17.5164	16.6818 (90)
Living area fraction									fLA = Living area / (4) =			0.1565 (91)
MIT	17.1662	17.4576	17.9872	18.5808	19.1210	19.5997	19.8493	19.8116	19.4586	18.6606	17.7657	16.9719 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.0162	17.3076	17.8372	18.4308	18.9710	19.4497	19.6993	19.6616	19.3086	18.5106	17.6157	16.8219 (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	0.9315	0.9093	0.8739	0.8271	0.7638	0.6847	0.6055	0.6279	0.7352	0.8510	0.9132	0.9415	(94)
Useful gains	867.6390	972.1323	1039.9928	1040.9804	1002.5347	835.9121	709.5866	703.5770	790.8187	840.9773	830.2217	825.8359	(95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000	(96)
Heat loss rate W	2047.5149	2046.2293	1916.3015	1691.4246	1443.6501	1082.2157	850.7669	860.0790	1091.0088	1449.5644	1778.7407	2078.2156	(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	877.8277	721.7932	651.9737	468.3198	328.1899	0.0000	0.0000	0.0000	0.0000	452.7888	682.9337	931.7705	(98)
Space heating												5115.5973	(98)
Space heating per m2												(98) / (4) =	37.2368 (99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	877.8277	721.7932	651.9737	468.3198	328.1899	0.0000	0.0000	0.0000	0.0000	452.7888	682.9337	931.7705	(98)
Space heating efficiency (main heating system 1)	91.2000	91.2000	91.2000	91.2000	91.2000	0.0000	0.0000	0.0000	0.0000	91.2000	91.2000	91.2000	(210)
Space heating fuel (main heating system)	962.5304	791.4399	714.8835	513.5086	359.8573	0.0000	0.0000	0.0000	0.0000	496.4789	748.8308	1021.6782	(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	172.8365	132.5615	107.7523	61.8693	27.4414	20.4231	15.0623	46.1593	77.5886	119.2240	151.7051	172.1294	(64)
Efficiency of water heater (217)m	89.2485	89.3571	89.5125	89.8070	90.2741	80.5000	80.5000	80.5000	80.5000	88.7415	89.0486	89.3482	(216)
Fuel for water heating, kWh/month	193.6575	148.3503	120.3768	68.8914	30.3978	25.3703	18.7109	57.3407	96.3834	134.3497	170.3621	192.6502	(219)
Water heating fuel used												1256.8409	(219)
Annual totals kWh/year													
Space heating fuel - main system												5609.2076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 13.1040, total flow = 53.0000, SFP = 0.2472)													
mechanical ventilation fans (SFP = 0.2472)													107.5347 (230a)
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													232.5347 (231)
Electricity for lighting (calculated in Appendix L)													504.6859 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.34 * 1017 * 1.00) =													-1090.3028 (233)
Total delivered energy for all uses													6512.9664 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5609.2076	9.4500	530.0701	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1256.8409	9.4500	118.7715	(247)
Mechanical ventilation fans	107.5347	25.0500	26.9374	(249)
Pumps and fans for heating	75.0000	25.0500	18.7875	(249)
Pump for solar water heating	50.0000	25.0500	12.5250	(249)
Energy for lighting	504.6859	25.0500	126.4238	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1090.3028	25.0500	-273.1208	(252)
Total energy cost			630.3945	(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	5609.2076	0.2410	1351.8190	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1256.8409	0.2410	302.8987	(264)
Space and water heating			1654.7177	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Pumps and fans	232.5347	0.5190	120.6855 (267)
Energy for lighting	504.6859	0.5190	261.9320 (268)
Energy saving/generation technologies			
PV Unit	-1090.3028	0.5190	-565.8671 (269)
Total kg/year			1471.4680 (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	5609.2076	1.0900	6114.0363 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1256.8409	1.0900	1369.9566 (264)
Space and water heating			7483.9929 (265)
Pumps and fans	232.5347	3.0700	713.8816 (267)
Energy for lighting	504.6859	3.0700	1549.3856 (268)
Energy saving/generation technologies			
PV Unit	-1090.3028	3.0700	-3347.2295 (269)
Primary energy kWh/year			6400.0306 (272)
Primary energy kWh/m2/year			46.5863 (273)

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 80 cublean		Issued on Date	31/01/2023
Assessment Reference	1-07-22 ajc	Prop Type Ref		
Project	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com	Assessor ID	1910-0001
Client			

Building Elements

Roof Horizontal ceiling

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Earthwool Loft Roll 40 over ceiling				
	Main construction	200	0.0400	5.0000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Earthwool Loft Roll 40 in ceiling				
	Main construction	200	0.0400	5.0000	92.17
	Main construction	200	0.1300	1.5385	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 9.805 m² K/W Lower limit = 9.450 m² K/W Average = 9.628 m² K/W
 Total correction = 0.0019 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 413 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 80 cublean		Issued on Date	31/01/2023
Assessment Reference	1-07-22 ajc	Prop Type Ref		
Project	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com	Assessor ID	1910-0001
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Client	
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Building Elements

Wall Masonry clad T/Frame

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Render - Cement and Sand				
	Main construction	20	1.0000	0.0200	100.00
Layer 2	Blockwork, dense				
	Main construction	100	1.5900	0.0629	100.00
Layer 3	Low E perp vented cavity				
	Main construction	50	0.0648	0.7717	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Reflective breather membrane				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 5	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 6	Earthwool Frametherm Roll 35 in T/Frame				
	Main construction	140	0.0350	4.0000	85.00
	Main construction	140	0.1300	1.0769	15.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Reflective VCL				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 8	PIR over T/Frame				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 9	Low E battened cavity				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard				
	Main construction	15	0.2500	0.0600	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.462 m ² K/W	Lower limit = 5.936 m ² K/W	Average = 6.199 m ² K/W
	Total correction = 0.0021 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 403 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 80 cublean		Issued on Date	31/01/2023
Assessment Reference	1-07-22 ajc	Prop Type Ref		
Project	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com	Assessor ID	1910-0001
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Client	
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Building Elements

Wall Granite wall cladding

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Granite				
	Main construction	100	2.8000	0.0357	100.00
Layer 2	Low E cavity				
	Main construction	50	0.0649	0.7700	100.00
Layer 3	Reflective breather membrane				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Earthwool Frametherm Roll 35 in T/F				
	Main construction	140	0.0350	4.0000	85.00
	Main construction	140	0.1300	1.0769	15.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Reflective VCL				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 7	PIR over T/Frame				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 8	Low E battened cavity				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 9	Plasterboard				
	Main construction	15	0.2500	0.0600	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.410 m ² K/W	Lower limit = 5.887 m ² K/W	Average = 6.149 m ² K/W
	Total correction = 0.0021 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 383 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 80 cublean		Issued on Date	31/01/2023
Assessment Reference	1-07-22 ajc	Prop Type Ref		
Project	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com	Assessor ID	1910-0001
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Client	
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Building Elements

Floor Ground floor

Floor Type: Slab On Ground Floor

Area = 79.00 m², Perimeter = 34.68 m, Wall thickness = 382.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: Width D = 150.0 mm, Thickness dn = 25.0 mm, Lambda = 0.022

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Sand blinded hardcore				
	Main construction	200	2.3000	0.0870	100.00
Layer 2	Polythene,1000 gauge				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 3	PIR floor insulation				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Concrete, reinforced (1% steel)				
	Main construction	150	2.3000	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 6.970 m² K/W Lower limit = 6.970 m² K/W Average = 6.970 m² K/W
 Total correction = 0.0096 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 500 mm

U-value: 0.12 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 80 cublean		Issued on Date	31/01/2023	
Assessment Reference	1-07-22 ajc	Prop Type Ref			
Property	Cublean, Plot 80, Phase 4A , Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.88	TER	12.72
Environmental	89 B	% DER<TER	6.60		
CO ₂ Emissions (t/year)	1.73	FEE	44.84	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		
Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			Assessor ID	1910-0001
Client					

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

Orientation	South
Property Tenure	Owner-occupied
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
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:	34.68 m	68.69 m ²	2.51 m
1st Storey:	34.68 m	68.69 m ²	2.68 m

7.0 Living Area	21.50	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m ² K

9.0 External Walls		U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type			
Main T/Frame ACDS	Timber Frame	0.16	168.99	143.11
Feature granite nominal area	Timber Frame	0.16	5.00	5.00
Render /lathe nominal area	Timber Frame	0.16	6.00	6.00

10.0 External Roofs		U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type			
Horizontal ceiling	External Plane Roof	0.10	79.00	79.00

11.0 Heat Loss Floors		U-Value (W/m ² K)	Area (m ²)
Description	Type Construction		
Insulated slab	Ground Floor - Solid	0.12	79.00

12.0 Opening Types

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Part glazed door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows / Patios	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front door	Half Glazed Door	[1] Main T/Frame ACDS	South							2.10	
Front glass	Window	[1] Main T/Frame ACDS	South	None	0.00					10.56	
Rear glass	Window	[1] Main T/Frame ACDS	North	None	0.00					9.68	
Rear door	Half Glazed Door	[1] Main T/Frame ACDS	North							2.10	
Gable glass	Window	[1] Main T/Frame ACDS	West	None	0.00					1.44	

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
Scotland ACD 2015	E2 Other lintels (including other steel lintels)	18.05	0.037	No
Scotland ACD 2015	E3 Sill	14.25	0.033	No
Scotland ACD 2015	E4 Jamb	51.30	0.031	No
Scotland ACD 2015	E5 Ground floor (normal)	34.68	0.173	No
Scotland ACD 2015	E6 Intermediate floor within a dwelling	34.68	0.065	No
Scotland ACD 2015	E10 Eaves (insulation at ceiling level)	13.55	0.043	No
Scotland ACD 2015	E12 Gable (insulation at ceiling level)	21.13	0.051	No
Scotland ACD 2015	E16 Corner (normal)	29.52	0.038	No
Scotland ACD 2015	E17 Corner (inverted – internal area greater than external area)	9.90	0.003	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Duct Type

Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	In Room Fan Kitchen	1
0.20	In Room Fan Other Wet Room	5

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				0
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	36	
Total number of L.E.L. fittings	36	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Description	LPG condensing system	
Percentage of Heat	100	%
Database Ref. No.	18746	
Fuel Type	Bulk LPG	
Main Heating	BLB	
SAP Code	102	
In Winter	91.2	
In Summer	80.5	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	

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	Yes
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
SAP Code	901

28.1 Flue Gas Heat Recovery System	
Database ID	60048
Brand Model	Baxi, Assure
Details	Year: 2021 + current Applicable Fuel: 2 Boiler Types: RCSK Heat Store Volume: 0 PV module: 0

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	2.20	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store	None
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32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.34	South	45°	None Or Little	Yes

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	£100	B 85	