

PREDICTED ENERGY ASSESSMENT

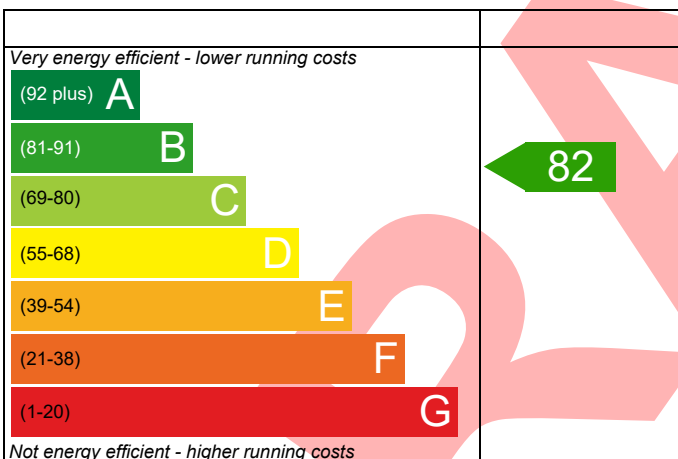
Cairn, Plot 98, Phase 4 A,
Tarland Road,
Aboyne

Dwelling type: House, Detached
Date of assessment: 31/01/2023
Produced by: Northern Energy
Total floor area: 171.5 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.

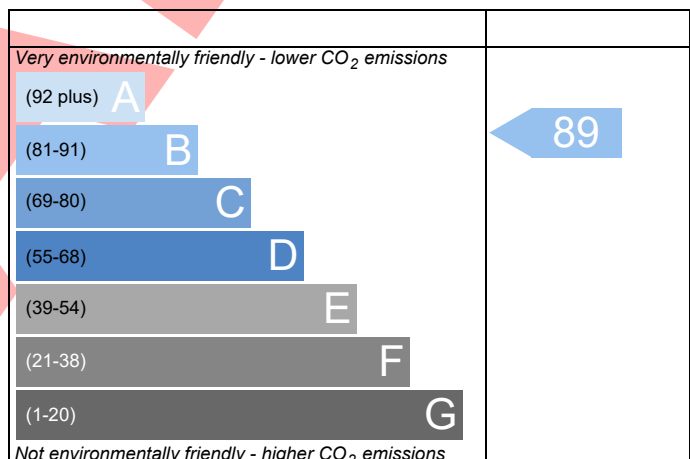
Energy Efficiency Rating



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 98 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 98	Prop Type Ref			
Property	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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)	12.47	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.63	kgCO ₂ /m ²	Pass
	-0.84 (-6.7%)	kgCO ₂ /m ²	

6.2 Building insulation envelope

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.22)	0.20 (max. 0.70)	Pass
Floor	0.13 (max. 0.18)	0.16 (max. 0.70)	Pass
Roof	0.12 (max. 0.15)	0.15 (max. 0.35)	Pass
Openings	1.39 (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: 2.22 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

Based on:

Overshading

Average

Windows facing North

4.77 m², No overhang

Windows facing East

12.15 m², No overhang

Windows facing South

5.25 m², No overhang

Windows facing West

7.74 m², No overhang

Air change rate

2.50 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	£71	B 84	B 90	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£71	B 84	B 90	

DRAFT

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 98	Prop Type Ref			
Property	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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	24.10	0.89	
External wall	E3 Sill	Scotland ACD 2015	0.033	19.60	0.65	
External wall	E4 Jamb	Scotland ACD 2015	0.031	45.40	1.41	
External wall	E5 Ground floor (normal)	Scotland ACD 2015	0.173	46.22	8.00	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	18.74	6.00	
External wall	E6 Intermediate floor within a dwelling	Scotland ACD 2015	0.065	27.97	1.82	
External wall	E10 Eaves (insulation at ceiling level)	Scotland ACD 2015	0.043	34.51	1.48	
External wall	E11 Eaves (insulation at rafter level)	Scotland ACD 2015	0.018	22.46	0.40	
External wall	E12 Gable (insulation at ceiling level)	Scotland ACD 2015	0.051	29.59	1.51	
External wall	E13 Gable (insulation at rafter level)	Scotland ACD 2015	0.036	6.60	0.24	
External wall	E16 Corner (normal)	Scotland ACD 2015	0.038	38.30	1.46	
External wall	E17 Corner (inverted – internal area greater than external area)	Scotland ACD 2015	-0.029	22.50	-0.65	
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.55	0.04	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	0.55	0.03	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	0.78	0.06	

Total: **23.33** W/mK:
 Y-Value: **0.050** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 98	Prop Type Ref			
Property	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO₂ Emissions (t/year)	2.22	FEE	50.73	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 172 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) 12.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.63 kgCO₂/m² OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.22)	0.20 (max. 0.70)	OK
Floor	0.13 (max. 0.18)	0.16 (max. 0.70)	OK
Roof	0.12 (max. 0.15)	0.15 (max. 0.35)	OK
Openings	1.39 (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: 2.22 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: 4.77 m², No overhang
Windows facing East: 12.15 m², No overhang
Windows facing South: 5.25 m², No overhang
Windows facing West: 7.74 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Photovoltaic array 2.35 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Half hour door			1.8900	1.4000	2.6460		(26)					
Part glazed doors			4.2000	1.4000	5.8800		(26a)					
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)					
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)					
Insulated slab			94.5000	0.1200	11.3400		(28a)					
Floor above garage			19.3400	0.1600	3.0944		(28b)					
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)					
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)					
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)					
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)					
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)					
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)					
Total net area of external elements Aum(A, m2)			468.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 113.3436		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)					
Total fabric heat loss							(33) + (36) = 136.6776 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.4897	Feb 70.4897	Mar 70.4897	Apr 70.4897	May 70.4897	Jun 70.4897	Jul 70.4897	Aug 70.4897	Sep 70.4897	Oct 70.4897	Nov 70.4897	Dec 70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	Jan 1.2080	Feb 1.2080	Mar 1.2080	Apr 1.2080	May 1.2080	Jun 1.2080	Jul 1.2080	Aug 1.2080	Sep 1.2080	Oct 1.2080	Nov 1.2080	Dec 1.2080 (40)
HLP (average)												1.2080 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)	Total = Sum(45)m = 1732.5288 (45)											
Distribution loss (46)m = 0.15 x (45)m	26.9439	23.5653	24.3173	21.2004	20.3423	17.5539	16.2662	18.6657	18.8887	22.0129	24.0288	26.0938 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1988 (55)
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (57)
Total heat required for water heating calculated for each month	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	240.0514	211.6798	222.5406	199.8121	196.0406	175.5018	168.8668	184.8635	184.4005	207.1780	218.6682	234.3836 (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	-38.3476	-33.5151	-33.3435	-27.6130	-24.8694	-10.6717	-10.3318	-11.2231	-11.1675	-28.5363	-33.7284	-37.7936 eq. (G6)
Output from w/h	201.7037	178.1647	189.1971	172.1992	171.1712	164.8301	158.5349	173.6404	173.2330	178.6417	184.9398	196.5900 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 2142.8459 (64)											
	108.0659	95.8986	102.2435	93.7751	93.4323	85.6919	84.3970	89.7159	88.6507	97.1355	100.0447	106.1813 (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	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.7615	27.3221	22.2198	16.8219	12.5745	10.6160	11.4709	14.9103	20.0126	25.4106	29.6579	31.6165 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.0764	346.6365	337.6652	318.5665	294.4578	271.7991	256.6617	253.1016	262.0728	281.1715	305.2802	327.9390 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229 (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)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)	145.2498	142.7062	137.4241	130.2431	125.5810	119.0165	113.4368	120.5859	123.1260	130.5584	138.9510	142.7168 (72)
Total internal gains	589.5564	587.1334	567.7778	536.1002	503.0821	471.9002	452.0380	459.0665	475.6801	507.6092	544.3578	572.7409 (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							
North	4.7700	10.6334	0.6300	0.7000	0.7700	15.5011 (74)						
East	12.1500	19.6403	0.6300	0.7000	0.7700	72.9282 (76)						
South	5.2500	46.7521	0.6300	0.7000	0.7700	75.0122 (78)						
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580 (80)						
East	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)						
West	3.4700	25.9287	0.6300	0.7000	1.0000	35.7102 (82)						
Solar gains	251.1668	468.5834	732.1076	1031.3753	1248.2156	1274.6371	1214.5364	1050.9528	837.3598	544.0816	308.6803	209.6465 (83)
Total gains	840.7232	1055.7168	1299.8854	1567.4755	1751.2977	1746.5373	1666.5744	1510.0193	1313.0399	1051.6908	853.0381	782.3874 (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	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954
alpha	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330
util living area	0.9788	0.9623	0.9283	0.8591	0.7503	0.6129	0.4860	0.5408	0.7467	0.9096	0.9673	0.9822 (86)
MIT	18.3073	18.6313	19.1646	19.8153	20.3743	20.7392	20.8962	20.8607	20.5415	19.7767	18.9019	18.2305 (87)
Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136 (88)
util rest of house	0.9754	0.9563	0.9166	0.8354	0.7066	0.5403	0.3851	0.4395	0.6854	0.8892	0.9610	0.9793 (89)
MIT 2	16.3021	16.7714	17.5394	18.4594	19.2193	19.6785	19.8469	19.8175	19.4582	18.4264	17.1693	16.1906 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.8241	17.2556	17.9625	18.8124	19.5200	19.9547	20.1201	20.0891	19.7402	18.7780	17.6204	16.7217 (92)
Temperature adjustment	-0.1500											
adjusted MIT	16.6741	17.1056	17.8125	18.6624	19.3700	19.8047	19.9701	19.9391	19.5902	18.6280	17.4704	16.5717 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9593	0.9332	0.8857	0.8013	0.6813	0.5322	0.3908	0.4421	0.6638	0.8564	0.9396	0.9651 (94)
Useful gains	806.5140	985.2013	1151.2860	1255.9582	1193.1482	929.5916	651.2198	667.5752	871.6280	900.6814	801.5069	755.0650 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W	2563.5137	2528.6050	2343.5840	2022.4536	1588.9758	1078.2381	698.1671	733.1892	1137.3958	1663.1301	2148.4051	2563.0066 (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	1307.2077	1037.1673	887.0698	551.8767	294.4957	0.0000	0.0000	0.0000	0.0000	567.2618	969.7667	1345.1086 (98)
Space heating												6959.9542 (98)
Space heating per m2												(98) / (4) = 40.5828 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												91.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1307.2077	1037.1673	887.0698	551.8767	294.4957	0.0000	0.0000	0.0000	0.0000	567.2618	969.7667	1345.1086 (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)	1433.3418	1137.2448	972.6642	605.1279	322.9119	0.0000	0.0000	0.0000	0.0000	621.9976	1063.3407	1474.8997 (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	201.7037	178.1647	189.1971	172.1992	171.1712	164.8301	158.5349	173.6404	173.2330	178.6417	184.9398	196.5900 (64)
Efficiency of water heater	89.6078	89.4569	89.1177	88.4054	86.9516	80.5000	80.5000	80.5000	80.5000	88.3863	89.2990	89.6800 (216)
Fuel for water heating, kWh/month	225.0961	199.1627	212.3003	194.7835	196.8579	204.7579	196.9378	215.7024	215.1963	202.1147	207.1018	219.2127 (219)
Water heating fuel used												2489.2240 (219)
Annual totals kWh/year												
Space heating fuel - main system												7631.5287 (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)												128.8633 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												203.8633 (231)
Electricity for lighting (calculated in Appendix L)												543.2584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.35 * 853 * 1.00) =										-1603.6963		-1603.6963 (233)
Total delivered energy for all uses												9264.1783 (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	7631.5287	0.2410	1839.1984 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.2240	0.2410	599.9030 (264)
Space and water heating			2439.1014 (265)
Pumps and fans	203.8633	0.5190	105.8051 (267)
Energy for lighting	543.2584	0.5190	281.9511 (268)
Energy saving/generation technologies			
PV Unit	-1603.6963	0.5190	-832.3184 (269)
Total CO2, kg/year			1994.5393 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.6300 (273)

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

DER			11.6300 ZC1
Total Floor Area		TFA	171.5000
Assumed number of occupants		N	2.9646
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			11.8542 ZC2
CO2 emissions from cooking, equation (L16)			1.1087 ZC3
Total CO2 emissions			24.5930 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			24.5930 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	1	0	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) =	0.1404 (8)							
Pressure test				Yes								
Measured/design AP50					7.0000							
Infiltration rate					0.4904 (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) =	0.4169 (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	0.5315	0.5211	0.5107	0.4586	0.4481	0.3960	0.3960	0.3856	0.4169	0.4481	0.4690	0.4898 (22b)
	0.6413	0.6358	0.6304	0.6051	0.6004	0.5784	0.5784	0.5743	0.5869	0.6004	0.6100	0.6200 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8500	1.4000	2.5900		(26)					
TER Opening Type (Uw = 1.40)			41.0300	1.3258	54.3958		(27)					
Insulated slab			94.5000	0.1500	14.1750		(28a)					
Floor above garage			19.3400	0.1500	2.9010		(28b)					
ACDS 2015 T/F	218.1800	42.8800	175.3000	0.1700	29.8010		(29a)					
M/Wool over / in ceiling	136.2600		136.2600	0.1100	14.9886		(30)					
Total net area of external elements Aum, m2)			468.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		118.8514 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (User defined value 0.080 * total exposed area)							37.4624 (36)					
Total fabric heat loss							(33) + (36) = 156.3138 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 90.4040	Feb 89.6307	Mar 88.8727	Apr 85.3125	May 84.6464	Jun 81.5455	Jul 81.5455	Aug 80.9713	Sep 82.7399	Oct 84.6464	Nov 85.9939	Dec 87.4027 (38)
Heat transfer coeff	246.7178	245.9445	245.1866	241.6263	240.9602	237.8594	237.8594	237.2851	239.0538	240.9602	242.3077	243.7165 (39)
Average = Sum(39)m / 12 =												241.6231 (39)
HLP	Jan 1.4386	Feb 1.4341	Mar 1.4297	Apr 1.4089	May 1.4050	Jun 1.3869	Jul 1.3869	Aug 1.3836	Sep 1.3939	Oct 1.4050	Nov 1.4129	Dec 1.4211 (40)
HLP (average)												1.4089 (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												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)
Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)												Total = Sum(45)m = 1732.5288 (45)
Distribution loss (46)m = 0.15 x (45)m	26.9439	23.5653	24.3173	21.2004	20.3423	17.5539	16.2662	18.6657	18.8887	22.0129	24.0288	26.0938 (46)
Water storage loss:												150.0000 (47)
Store volume												1.8900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
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												
	234.5272	206.6902	217.0164	194.4661	190.5164	170.1558	163.3426	179.3393	179.0545	201.6538	213.3222	228.8594 (62)
WWHRS	-44.1631	-38.8570	-39.6591	-32.6360	-30.3061	-25.0031	-21.1647	-25.6243	-26.3702	-32.5947	-37.7509	-42.6843 eq. (G10)
Total of WWHRS savings												-396.8135
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	190.3641	167.8332	177.3573	161.8302	160.2103	145.1526	142.1778	153.7150	152.6843	169.0592	175.5713	186.1750 (64)
Total per year (kWh/year) = Sum(64)m =												1982.1304 (64)
Heat gains from water heating, kWh/month												
	103.6465	91.9069	97.8242	89.4983	89.0129	81.4151	79.9776	85.2965	84.3739	92.7161	95.7679	101.7620 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	30.5855	27.1658	22.0927	16.7256	12.5026	10.5552	11.4053	14.8250	19.8981	25.2652	29.4882	31.4356 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	343.0764	346.6365	337.6652	318.5665	294.4578	271.7991	256.6617	253.1016	262.0728	281.1715	305.2802	327.9390 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229 (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)												
	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)												
	139.3098	136.7662	131.4841	124.3031	119.6410	113.0765	107.4968	114.6459	117.1860	124.6184	133.0110	136.7768 (72)
Total internal gains	583.4404	581.0371	561.7107	530.0639	497.0701	465.8994	446.0324	453.0411	469.6255	501.5238	538.2480	566.6200 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
East		41.0300	19.6403	0.6300		0.7000	0.7700	246.2752 (76)				
Solar gains	246.2752	481.7665	793.4008	1157.1278	1418.1035	1451.6813	1382.0598	1187.1689	922.7580	571.6566	307.0762	202.5247 (83)
Total gains	829.7156	1062.8036	1355.1115	1687.1917	1915.1737	1917.5808	1828.0922	1640.2101	1392.3835	1073.1804	845.3243	769.1447 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	19.3091	19.3698	19.4296	19.7159	19.7704	20.0282	20.0282	20.0766	19.9281	19.7704	19.6605	19.5468
alpha	2.2873	2.2913	2.2953	2.3144	2.3180	2.3352	2.3352	2.3384	2.3285	2.3180	2.3107	2.3031
util living area	0.9795	0.9636	0.9294	0.8587	0.7513	0.6161	0.4937	0.5499	0.7563	0.9148	0.9690	0.9827 (86)
MIT	17.8677	18.2159	18.8197	19.5900	20.2324	20.6718	20.8613	20.8173	20.4271	19.5411	18.5663	17.8207 (87)
Th 2	19.7339	19.7373	19.7407	19.7565	19.7595	19.7734	19.7734	19.7759	19.7680	19.7595	19.7535	19.7472 (88)
util rest of house	0.9759	0.9573	0.9169	0.8328	0.7035	0.5361	0.3805	0.4369	0.6900	0.8937	0.9626	0.9796 (89)
MIT 2	15.5761	16.0823	16.9536	18.0510	18.9257	19.4877	19.6898	19.6568	19.2134	18.0100	16.6040	15.5136 (90)
Living area fraction									fLA = Living area / (4) =			0.2603 (91)
MIT	16.1727	16.6378	17.4395	18.4517	19.2659	19.7960	19.9948	19.9589	19.5294	18.4086	17.1149	16.1142 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0227	16.4878	17.2895	18.3017	19.1159	19.6460	19.8448	19.8089	19.3794	18.2586	16.9649	15.9642 (93)

8. Space heating requirement

Utilisation	0.9583	0.9319	0.8819	0.7938	0.6741	0.5267	0.3877	0.4403	0.6645	0.8573	0.9395	0.9642 (94)
Useful gains	795.1273	990.4525	1195.1177	1339.3190	1290.9456	1010.0418	708.7145	722.2111	925.2532	920.0017	794.2149	741.6070 (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	2892.2031	2849.9561	2645.4332	2271.6863	1786.9378	1200.2321	771.8066	808.8880	1262.0522	1845.4232	2390.3298	2867.1409 (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	1560.2244	1249.5864	1079.0347	671.3045	369.0182	0.0000	0.0000	0.0000	0.0000	688.5136	1149.2027	1581.3972 (98)
Space heating												8348.2816 (98)
Space heating per m ²										(98) / (4) =		48.6780 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)													0.1000 (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)
Space heating requirement	1560.2244	1249.5864	1079.0347	671.3045	369.0182	0.0000	0.0000	0.0000	0.0000	688.5136	1149.2027	1581.3972	(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)	1526.3064	1222.4215	1055.5774	656.7109	360.9960	0.0000	0.0000	0.0000	0.0000	673.5459	1124.2200	1547.0190	(211)
Water heating requirement	260.0374	208.2644	179.8391	111.8841	61.5030	0.0000	0.0000	0.0000	0.0000	114.7523	191.5338	263.5662	(215)
Water heating requirement	190.3641	167.8332	177.3573	161.8302	160.2103	145.1526	142.1778	153.7150	152.6843	169.0592	175.5713	186.1750	(64)
Efficiency of water heater (217)m	88.9994	88.8701	88.5683	87.8779	86.5234	79.3000	79.3000	79.3000	79.3000	87.8408	88.6824	79.3000	(216)
Fuel for water heating, kWh/month	213.8938	188.8523	200.2493	184.1535	185.1642	183.0424	179.2911	193.8398	192.5401	192.4610	197.9776	209.0793	(219)
Water heating fuel used													2320.5443 (219)
Annual totals kWh/year													
Space heating fuel - main system													8166.7972 (211)
Space heating fuel - secondary													1391.3803 (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)													540.1497 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.72 * 1029 * 1.00) =										-1416.1609			-1416.1609 (233)
Total delivered energy for all uses													11077.7106 (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	8166.7972	0.2410	1968.1981 (261)
Space heating - secondary	1391.3803	0.0190	26.4362 (263)
Water heating (other fuel)	2320.5443	0.2410	559.2512 (264)
Space and water heating			2553.8855 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	540.1497	0.5190	280.3377 (268)
Energy saving/generation technologies			
PV Unit	-1416.1609	0.5190	-734.9875 (269)
Total CO2, kg/m2/year			2138.1607 (272)
Target Carbon Dioxide Emission Rate (TER) = 2138.1607 / 171.50, rounded to 2 d.p.			12.4700 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) =	0.0936 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2936 (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) =		0.2496 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3182	0.3120	0.3057	0.2745	0.2683	0.2371	0.2371	0.2309	0.2496	0.2683	0.2808	0.2933 (22b)
	0.5506	0.5487	0.5467	0.5377	0.5360	0.5281	0.5281	0.5266	0.5311	0.5360	0.5394	0.5430 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Half hour door			1.8900	1.4000	2.6460		(26)
Part glazed doors			4.2000	1.4000	5.8800		(26a)
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)
Insulated slab			94.5000	0.1200	11.3400		(28a)
Floor above garage			19.3400	0.1600	3.0944		(28b)
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)
Total net area of external elements Aum(A, m2)			468.2800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	113.3436	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)
Total fabric heat loss							(33) + (36) = 136.6776 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	77.6278	77.3506	77.0789	75.8028	75.5640	74.4526	74.4526	74.2467	74.8807	75.5640	76.0470	76.5520 (38)
Average = Sum(39)m / 12 =	214.3055	214.0283	213.7566	212.4804	212.2417	211.1302	211.1302	210.9244	211.5583	212.2417	212.7247	213.2297 (39)
												212.4793 (39)
HLP	1.2496	1.2480	1.2464	1.2390	1.2376	1.2311	1.2311	1.2299	1.2336	1.2376	1.2404	1.2433 (40)
HLP (average)												1.2389 (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												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)
Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1732.5288 (45)									
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:																							
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	38.1706	33.3842	34.4495	30.0339	28.8183	24.8680	23.0438	26.4431	26.7590	31.1850	34.0408	36.9662	65)										

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289	148.2289
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	30.7615	27.3221	22.2198	16.8219	12.5745	10.6160	11.4709	14.9103	20.0126	25.4106	29.6579	31.6165	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	343.0764	346.6365	337.6652	318.5665	294.4578	271.7991	256.6617	253.1016	262.0728	281.1715	305.2802	327.9390	(68)
Pumps, fans	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	37.8229	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	(71)
Total internal gains	51.3045	49.6789	46.3031	41.7138	38.7342	34.5389	30.9729	35.5419	37.1652	41.9153	47.2789	49.6857	(72)
	492.6111	491.1061	473.6569	444.5708	413.2353	384.4226	366.5741	371.0224	386.7193	415.9661	449.6857	476.7098	(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	4.7700	10.6334	0.6300	0.7000	0.7700	15.5011 (74)							
East	12.1500	19.6403	0.6300	0.7000	0.7700	72.9282 (76)							
South	5.2500	46.7521	0.6300	0.7000	0.7700	75.0122 (78)							
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580 (80)							
East	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)							
West	3.4700	25.9287	0.6300	0.7000	1.0000	35.7102 (82)							
Solar gains	251.1668	468.5834	732.1076	1031.3753	1248.2156	1274.6371	1214.5364	1050.9528	837.3598	544.0816	308.6803	209.6465	(83)
Total gains	743.7779	959.6895	1205.7644	1475.9461	1661.4509	1659.0597	1581.1105	1421.9752	1224.0791	960.0476	758.3660	686.3563	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.2294	22.2582	22.2865	22.4204	22.4456	22.5637	22.5637	22.5858	22.5181	22.4456	22.3946	22.3416	
alpha	2.4820	2.4839	2.4858	2.4947	2.4964	2.5042	2.5042	2.5057	2.5012	2.4964	2.4930	2.4894	
util living area	0.9839	0.9695	0.9393	0.8754	0.7725	0.6382	0.5118	0.5696	0.7741	0.9252	0.9748	0.9867	(86)
MIT	18.1330	18.4656	19.0172	19.7075	20.3020	20.7037	20.8787	20.8376	20.4815	19.6664	18.7600	18.0685	(87)
Th 2	19.8805	19.8818	19.8831	19.8890	19.8901	19.8952	19.8952	19.8962	19.8932	19.8901	19.8878	19.8855	(88)
util rest of house	0.9812	0.9645	0.9290	0.8533	0.7299	0.5647	0.4066	0.4651	0.7148	0.9074	0.9698	0.9845	(89)
MIT 2	17.2531	17.5837	18.1284	18.8021	19.3587	19.7117	19.8417	19.8190	19.5383	18.7773	17.8829	17.1923	(90)
Living area fraction	17.4822	17.8133	18.3598	19.0378	19.6043	19.9700	20.1117	20.0842	19.7838	19.0088	18.1113	17.4204	(92)
Temperature adjustment	17.4822	17.8133	18.3598	19.0378	19.6043	19.9700	20.1117	20.0842	19.7838	19.0088	18.1113	0.0000	
adjusted MIT	17.4822	17.8133	18.3598	19.0378	19.6043	19.9700	20.1117	20.0842	19.7838	19.0088	18.1113	17.4204	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9729	0.9516	0.9106	0.8328	0.7174	0.5702	0.4287	0.4845	0.7080	0.8890	0.9585	0.9774	(94)
Ext temp.	723.6202	913.2501	1097.9901	1229.1728	1191.9902	945.9286	677.8451	688.9545	866.6390	853.4932	726.9237	670.8273	(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	2825.0147	2763.8100	2535.1128	2154.0885	1677.6249	1133.7656	741.4177	777.0874	1202.4646	1784.6943	2342.3706	2818.9907	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1563.4375	1243.5762	1069.2193	665.9393	361.3122	0.0000	0.0000	0.0000	0.0000	692.8136	1163.1218	1598.2336	(98)
												8357.6535 (98)	
												(98) / (4) =	48.7327 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1984.6238	1562.3635	1603.0252	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7218	0.7860	0.7467	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1432.4409	1228.0100	1196.9273	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	2024.8724	1933.0583	1756.7359	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	426.5507	524.5559	416.4976	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction													1367.6042 (104)
Intermittency factor (Table 10b)													FC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	106.6377	131.1390	104.1244	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													341.9011 (107)
Space cooling per m2													1.9936 (108)
Energy for space heating													48.7327 (99)
Energy for space cooling													1.9936 (108)
Total													50.7263 (109)
Dwelling Fabric Energy Efficiency (DFEE)													50.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.8000	5.7000	5.0000	4.6000	4.4000	4.0000	4.1000	4.6000	5.2000	5.3000	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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Half hour door			1.8900	1.4000	2.6460		(26)
Part glazed doors			4.2000	1.4000	5.8800		(26a)
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)
Insulated slab			94.5000	0.1200	11.3400		(28a)
Floor above garage			19.3400	0.1600	3.0944		(28b)
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)
Total net area of external elements Aum(A, m2)			468.2800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	113.3436	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)
Total fabric heat loss						(33) + (36) =	136.6776 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080 (40)
HLP (average)												1.2080 (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												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)												Total = Sum(45)m = 1732.5288 (45)
Distribution loss (46)m = 0.15 x (45)m	26.9439	23.5653	24.3173	21.2004	20.3423	17.5539	16.2662	18.6657	18.8887	22.0129	24.0288	26.0938 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1988 (55)
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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												
Solar input	240.0514	211.6798	222.5406	199.8121	196.0406	175.5018	168.8668	184.8635	184.4005	207.1780	218.6682	234.3836 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	240.0514	211.6798	222.5406	199.8121	196.0406	175.5018	168.8668	184.8635	184.4005	207.1780	218.6682	234.3836 (64)
Total per year (kWh/year) = Sum(64)m =												2443.9868 (64)
RHI water heating demand												2444 (64)
Heat gains from water heating, kWh/month	108.0659	95.8986	102.2435	93.7751	93.4323	85.6919	84.3970	89.7159	88.6507	97.1355	100.0447	106.1813 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9039	68.3053	55.5496	42.0546	31.4363	26.5399	28.6773	37.2758	50.0315	63.5265	74.1448	79.0413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	512.0543	517.3678	503.9779	475.4724	439.4893	405.6703	383.0771	377.7636	391.1535	419.6590	455.6421	489.4611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520 (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)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)	145.2498	142.7062	137.4241	130.2431	125.5810	119.0165	113.4368	120.5859	123.1260	130.5584	138.9510	142.7168 (72)
Total internal gains	852.2516	846.4230	814.9953	765.8138	714.5503	669.2702	643.2348	653.6688	682.3545	731.7875	786.7815	829.2628 (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	4.7700	8.2005	0.6300	0.7000	0.7700	11.9545 (74)						
East	12.1500	14.7869	0.6300	0.7000	0.7700	54.9068 (76)						
South	5.2500	38.1750	0.6300	0.7000	0.7700	61.2505 (78)						
West	7.7400	14.7869	0.6300	0.7000	0.7700	34.9777 (80)						
East	0.5400	19.3273	0.6300	0.7000	1.0000	4.1423 (82)						
West	3.4700	19.3273	0.6300	0.7000	1.0000	26.6184 (82)						
Solar gains	193.8503	410.6617	707.4768	1013.1751	1288.2001	1219.1264	1159.2346	989.3906	763.1080	466.7751	246.7243	147.7376 (83)
Total gains	1046.1018	1257.0846	1522.4720	1778.9889	2002.7504	1888.3967	1802.4694	1643.0595	1445.4626	1198.5626	1033.5058	977.0004 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954
alpha	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330
util living area	0.9698	0.9537	0.9195	0.8620	0.7816	0.7042	0.6355	0.6763	0.8012	0.9144	0.9598	0.9753 (86)
MIT	18.2914	18.5431	19.0446	19.6253	20.1232	20.4963	20.6888	20.6326	20.2786	19.5382	18.7761	18.1438 (87)
Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136 (88)
util rest of house	0.9654	0.9471	0.9080	0.8419	0.7496	0.6549	0.5697	0.6125	0.7605	0.8981	0.9531	0.9717 (89)
MIT 2	16.2762	16.6394	17.3601	18.1832	18.8702	19.3733	19.6171	19.5554	19.1057	18.0800	16.9826	16.0616 (90)
Living area fraction												fLA = Living area / (4) = 0.2603 (91)
MIT	16.8008	17.1350	17.7986	18.5587	19.1964	19.6657	19.8961	19.8359	19.4110	18.4596	17.4496	16.6037 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6508	16.9850	17.6486	18.4087	19.0464	19.5157	19.7461	19.6859	19.2610	18.3096	17.2996	16.4537 (93)

8. Space heating requirement

Utilisation	0.9453	0.9215	0.8759	0.8073	0.7199	0.6345	0.5585	0.5974	0.7311	0.8656	0.9292	0.9539 (94)
Useful gains	988.8419	1158.4152	1333.5004	1436.2308	1441.7249	1198.2763	1006.6446	981.5520	1056.7738	1037.4178	960.3054	931.9837 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	2765.8578	2772.9394	2620.3850	2342.7875	2019.1430	1515.5663	1190.4137	1198.6399	1504.2519	1970.0786	2403.0483	2807.8833 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
Space heating	1322.0998	1084.9603	957.4421	652.7208	429.5991	0.0000	0.0000	0.0000	0.0000	693.8996	1038.7749	1395.6693 (98)
RHI space heating demand												7575.1658 (98)
												7575 (98)

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Half hour door			1.8900	1.4000	2.6460		(26)
Part glazed doors			4.2000	1.4000	5.8800		(26a)
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)
Insulated slab			94.5000	0.1200	11.3400		(28a)
Floor above garage			19.3400	0.1600	3.0944		(28b)
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)
Total net area of external elements Aum(A, m2)			468.2800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	113.3436	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)
Total fabric heat loss						(33) + (36) =	136.6776 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080 (40)
HLP (average)												1.2080 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)	Total = Sum(45)m = 1732.5288 (45)											
Distribution loss (46)m = 0.15 x (45)m	26.9439	23.5653	24.3173	21.2004	20.3423	17.5539	16.2662	18.6657	18.8887	22.0129	24.0288	26.0938 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1988 (55)
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (57)
Total heat required for water heating calculated for each month	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	240.0514	211.6798	222.5406	199.8121	196.0406	175.5018	168.8668	184.8635	184.4005	207.1780	218.6682	234.3836 (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	-37.7038	-32.8040	-32.5480	-27.1043	-24.5615	-10.6717	-10.3318	-11.2231	-11.1675	-27.9200	-32.8374	-37.1660 eq. (G6)
Output from w/h	202.3476	178.8758	189.9926	172.7078	171.4791	164.8301	158.5349	173.6404	173.2330	179.2581	185.8308	197.2176 (64)
Heat gains from water heating, kWh/month	108.0659	95.8986	102.2435	93.7751	93.4323	85.6919	84.3970	89.7159	88.6507	97.1355	100.0447	106.1813 (65)
Total per year (kWh/year) = Sum(64)m = 2147.9479 (64)												

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	76.9039	68.3053	55.5496	42.0546	31.4363	26.5399	28.6773	37.2758	50.0315	63.5265	74.1448	79.0413 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	512.0543	517.3678	503.9779	475.4724	439.4893	405.6703	383.0771	377.7636	391.1535	419.6590	455.6421	489.4611 (68)
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)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)	145.2498	142.7062	137.4241	130.2431	125.5810	119.0165	113.4368	120.5859	123.1260	130.5584	138.9510	142.7168 (72)
Total internal gains	852.2516	846.4230	814.9953	765.8138	714.5503	669.2702	643.2348	653.6688	682.3545	731.7875	786.7815	829.2628 (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							
North	4.7700	10.6334	0.6300	0.7000	0.7700	15.5011 (74)						
East	12.1500	19.6403	0.6300	0.7000	0.7700	72.9282 (76)						
South	5.2500	46.7521	0.6300	0.7000	0.7700	75.0122 (78)						
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580 (80)						
East	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)						
West	3.4700	25.9287	0.6300	0.7000	1.0000	35.7102 (82)						
Solar gains	251.1668	468.5834	732.1076	1031.3753	1248.2156	1274.6371	1214.5364	1050.9528	837.3598	544.0816	308.6803	209.6465 (83)
Total gains	1103.4184	1315.0063	1547.1028	1797.1891	1962.7659	1943.9074	1857.7712	1704.6216	1519.7144	1275.8691	1095.4618	1038.9092 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	
util living area	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	
util rest of house	0.9616	0.9404	0.9001	0.8238	0.7103	0.5711	0.4459	0.4942	0.6947	0.8717	0.9446	0.9667 (86)	
MIT	18.5505	18.8568	19.3544	19.9520	20.4561	20.7797	20.9150	20.8872	20.6183	19.9355	19.1160	18.4714 (87)	
Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136 (88)	
util rest of house	0.9558	0.9315	0.8849	0.7964	0.6641	0.4991	0.3502	0.3972	0.6297	0.8453	0.9347	0.9616 (89)	
MIT 2	16.6530	17.0936	17.8049	18.6417	19.3182	19.7183	19.8600	19.8376	19.5435	18.6408	17.4747	16.5388 (90)	
Living area fraction	fLA = Living area / (4) = 0.2603 (91)												
MIT	17.1470	17.5527	18.2083	18.9828	19.6145	19.9946	20.1347	20.1108	19.8233	18.9779	17.9020	17.0419 (92)	
Temperature adjustment	-0.1500												
adjusted MIT	16.9970	17.4027	18.0583	18.8328	19.4645	19.8446	19.9847	19.9608	19.6733	18.8279	17.7520	16.8919 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9326	0.9027	0.8511	0.7636	0.6426	0.4942	0.3569	0.4017	0.6133	0.8115	0.9067	0.9402 (94)
Ext temp.	1029.0225	1187.0768	1316.8023	1372.3962	1261.3138	960.5914	662.9809	684.8012	931.9671	1035.4020	993.2632	976.7654 (95)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Heat loss rate W	2630.3988	2590.1412	2394.5106	2057.7486	1608.5492	1086.5166	701.2012	737.6912	1154.6063	1704.5468	2206.7491	2629.3501 (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	1191.4240	942.8592	801.8150	493.4537	258.3432	0.0000	0.0000	0.0000	0.0000	497.8438	873.7099	1229.5230 (98)
Space heating												6288.9718 (98)
Space heating per m2												(98) / (4) = 36.6704 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												91.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1191.4240	942.8592	801.8150	493.4537	258.3432	0.0000	0.0000	0.0000	0.0000	497.8438	873.7099	1229.5230 (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)	1306.3859	1033.8369	879.1831	541.0677	283.2710	0.0000	0.0000	0.0000	0.0000	545.8813	958.0153	1348.1612 (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	202.3476	178.8758	189.9926	172.7078	171.4791	164.8301	158.5349	173.6404	173.2330	179.2581	185.8308	197.2176 (64)
Efficiency of water heater (217)m	89.4734	89.3071	88.9355	88.1619	86.6073	80.5000	80.5000	80.5000	80.5000	88.0998	89.1223	89.5546 (217)
Fuel for water heating, kWh/month	226.1539	200.2930	213.6296	195.8985	197.9961	204.7579	196.9378	215.7024	215.1963	203.4716	208.5121	220.2205 (219)
Water heating fuel used												2498.7696 (219)
Annual totals kWh/year												
Space heating fuel - main system												6895.8024 (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)												128.8633 (230a)
mechanical ventilation fans (SFP = 0.2472)												30.0000 (230c)
central heating pump												45.0000 (230e)
main heating flue fan												203.8633 (231)
Total electricity for the above, kWh/year												543.2584 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.35 * 853 * 1.00) =										-1603.6963		-1603.6963 (233)
Total delivered energy for all uses												8537.9974 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6895.8024	7.6000	524.0810 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2498.7696	7.6000	189.9065 (247)
Mechanical ventilation fans	128.8633	13.1900	16.9971 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	543.2584	13.1900	71.6558 (250)
Additional standing charges			70.0000 (251)
Energy saving/generation technologies			
PV Unit	-1603.6963	13.1900	-211.5275 (252)
Total energy cost			671.0053 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.3017 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	81.8410
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	6895.8024	0.2410	1661.8884 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2498.7696	0.2410	602.2035 (264)
Space and water heating			2264.0918 (265)
Pumps and fans	203.8633	0.5190	105.8051 (267)
Energy for lighting	543.2584	0.5190	281.9511 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-1603.6963	0.5190	-832.3184 (269)
Total kg/year			1819.5297 (272)
CO2 emissions per m2			10.6100 (273)
EI value			88.7382
EI rating			89 (274)
EI band			B

 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	$7.60 / 0.8594 = 8.844$, stars = 3
Water heating environmental impact	$0.241 / 0.8594 = 0.2804$, 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	x 2.5000 (2b)	= 236.2500 (1b) - (3b)
First floor	77.0000 (1c)	x 2.4800 (2c)	= 190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 427.2100 (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					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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.7000	5.8000	5.7000	5.0000	4.6000	4.4000	4.0000	4.1000	4.6000	5.2000	5.3000	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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Half hour door			1.8900	1.4000	2.6460		(26)
Part glazed doors			4.2000	1.4000	5.8800		(26a)
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)
Insulated slab			94.5000	0.1200	11.3400		(28a)
Floor above garage			19.3400	0.1600	3.0944		(28b)
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)
Total net area of external elements Aum(A, m2)			468.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.3436		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)
Total fabric heat loss						(33) + (36) =	136.6776 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080 (40)
HLP (average)												1.2080 (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												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)												Total = Sum(45)m = 1732.5288 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.9439	23.5653	24.3173	21.2004	20.3423	17.5539	16.2662	18.6657	18.8887	22.0129	24.0288	26.0938 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1988 (55)
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												
	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (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												
	240.0514	211.6798	222.5406	199.8121	196.0406	175.5018	168.8668	184.8635	184.4005	207.1780	218.6682	234.3836 (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	-38.4305	-33.7543	-34.0001	-28.4910	-26.0201	-10.6717	-10.3318	-11.2231	-11.1675	-29.6607	-34.2062	-38.0681 eq. (G6)
Output from w/h	201.6209	177.9255	188.5405	171.3211	170.0205	164.8301	158.5349	173.6404	173.2330	177.5174	184.4620	196.3154 (64)
Heat gains from water heating, kWh/month	108.0659	95.8986	102.2435	93.7751	93.4323	85.6919	84.3970	89.7159	88.6507	97.1355	100.0447	106.1813 (65)
												Total per year (kWh/year) = Sum(64)m = 2137.9619 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	76.9039	68.3053	55.5496	42.0546	31.4363	26.5399	28.6773	37.2758	50.0315	63.5265	74.1448	79.0413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	512.0543	517.3678	503.9779	475.4724	439.4893	405.6703	383.0771	377.7636	391.1535	419.6590	455.6421	489.4611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520 (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)												
	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)												
	145.2498	142.7062	137.4241	130.2431	125.5810	119.0165	113.4368	120.5859	123.1260	130.5584	138.9510	142.7168 (72)
Total internal gains	852.2516	846.4230	814.9953	765.8138	714.5503	669.2702	643.2348	653.6688	682.3545	731.7875	786.7815	829.2628 (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							
North	4.7700	8.2005	0.6300	0.7000	0.7700	11.9545 (74)						
East	12.1500	14.7869	0.6300	0.7000	0.7700	54.9068 (76)						
South	5.2500	38.1750	0.6300	0.7000	0.7700	61.2505 (78)						
West	7.7400	14.7869	0.6300	0.7000	0.7700	34.9777 (80)						
East	0.5400	19.3273	0.6300	0.7000	1.0000	4.1423 (82)						
West	3.4700	19.3273	0.6300	0.7000	1.0000	26.6184 (82)						
Solar gains	193.8503	410.6617	707.4768	1013.1751	1288.2001	1219.1264	1159.2346	989.3906	763.1080	466.7751	246.7243	147.7376 (83)
Total gains	1046.1018	1257.0846	1522.4720	1778.9889	2002.7504	1888.3967	1802.4694	1643.0595	1445.4626	1198.5626	1033.5058	977.0004 (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	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954
alpha	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330
util living area	0.9698	0.9537	0.9195	0.8620	0.7816	0.7042	0.6355	0.6763	0.8012	0.9144	0.9598	0.9753 (86)
MIT	18.2914	18.5431	19.0446	19.6253	20.1232	20.4963	20.6888	20.6326	20.2786	19.5382	18.7761	18.1438 (87)
Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136 (88)
util rest of house	0.9654	0.9471	0.9080	0.8419	0.7496	0.6549	0.5697	0.6125	0.7605	0.8981	0.9531	0.9717 (89)
MIT 2	16.2762	16.6394	17.3601	18.1832	18.8702	19.3733	19.6171	19.5554	19.1057	18.0800	16.9826	16.0616 (90)
Living area fraction												fLA = Living area / (4) = 0.2603 (91)
MIT	16.8008	17.1350	17.7986	18.5587	19.1964	19.6657	19.8961	19.8359	19.4110	18.4596	17.4496	16.6037 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6508	16.9850	17.6486	18.4087	19.0464	19.5157	19.7461	19.6859	19.2610	18.3096	17.2996	16.4537 (93)

8. Space heating requirement

Utilisation	0.9453	0.9215	0.8759	0.8073	0.7199	0.6345	0.5585	0.5974	0.7311	0.8656	0.9292	0.9539 (94)
Useful gains	988.8419	1158.4152	1333.5004	1436.2308	1441.7249	1198.2763	1006.6446	981.5520	1056.7738	1037.4178	960.3054	931.9837 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Heat loss rate W	2765.8578	2772.9394	2620.3850	2342.7875	2019.1430	1515.5663	1190.4137	1198.6399	1504.2519	1970.0786	2403.0483	2807.8833 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1322.0998	1084.9603	957.4421	652.7208	429.5991	0.0000	0.0000	0.0000	0.0000	693.8996	1038.7749	1395.6693 (98)
Space heating												7575.1658 (98)
Space heating per m2												(98) / (4) = 44.1701 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												91.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1322.0998	1084.9603	957.4421	652.7208	429.5991	0.0000	0.0000	0.0000	0.0000	693.8996	1038.7749	1395.6693	(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)	1449.6709	1189.6494	1049.8269	715.7026	471.0516	0.0000	0.0000	0.0000	0.0000	760.8548	1139.0075	1530.3391	(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	201.6209	177.9255	188.5405	171.3211	170.0205	164.8301	158.5349	173.6404	173.2330	177.5174	184.4620	196.3154	(64)
Efficiency of water heater (217)m	89.6237	89.5235	89.2483	88.7475	87.8876	80.5000	80.5000	80.5000	80.5000	88.7957	89.4079	89.7293	(217)
Fuel for water heating, kWh/month	224.9639	198.7472	211.2539	193.0433	193.4522	204.7579	196.9378	215.7024	215.1963	199.9167	206.3151	218.7864	(219)
Water heating fuel used												2479.0731	(219)
Annual totals kWh/year													
Space heating fuel - main system													8306.1029 (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)													128.8633 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													203.8633 (231)
Electricity for lighting (calculated in Appendix L)													543.2584 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 2.35 * 789 * 1.00) =													-1483.4411 (233)
Total delivered energy for all uses													10048.8565 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8306.1029	6.9800	579.7660	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2479.0731	6.9800	173.0393	(247)
Mechanical ventilation fans	128.8633	22.5500	29.0587	(249)
Pumps and fans for heating	75.0000	22.5500	16.9125	(249)
Energy for lighting	543.2584	22.5500	122.5048	(250)
Additional standing charges			63.0000	(251)
Energy saving/generation technologies				
PV Unit	-1483.4411	22.5500	-334.5160	(252)
Total energy cost			649.7653	(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	8306.1029	0.2410	2001.7708	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2479.0731	0.2410	597.4566	(264)
Space and water heating			2599.2274	(265)
Pumps and fans	203.8633	0.5190	105.8051	(267)
Energy for lighting	543.2584	0.5190	281.9511	(268)
Energy saving/generation technologies				
PV Unit	-1483.4411	0.5190	-769.9060	(269)
Total kg/year			2217.0776	(272)

13a. Primary energy - Individual heating systems including micro-CHP

Energy Primary energy factor Primary energy

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	8306.1029	1.0900	9053.6521 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.0731	1.0900	2702.1897 (264)
Space and water heating			11755.8418 (265)
Pumps and fans	203.8633	3.0700	625.8603 (267)
Energy for lighting	543.2584	3.0700	1667.8034 (268)
Energy saving/generation technologies			
PV Unit	-1483.4411	3.0700	-4554.1643 (269)
Primary energy kWh/year			9495.3412 (272)
Primary energy kWh/m2/year			55.3664 (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	+ 2.3	-£ 71	-259 kg (11.7%)

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

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£71	1.51 kg/m ²	B 84	B 90
Total Savings	£71	1.51 kg/m²		

Potential energy efficiency rating: B 84
 Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
 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	£168	£180	-£11
Bulk LPG	£816	£733	£83
Space heating	£689	£692	-£3
Water heating	£173	£99	£74
Lighting	£123	£123	£0
Generated (PV)	-£335	-£335	£0
Total cost of fuels	£649	£578	£72
Total cost of uses	£650	£579	£71
Delivered energy	59 kWh/m ²	52 kWh/m ²	7 kWh/m ²
Carbon dioxide emissions	2.2 tonnes	2.0 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	49 kWh/m ²	7 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Half hour door			1.8900	1.4000	2.6460		(26)
Part glazed doors			4.2000	1.4000	5.8800		(26a)
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)
Insulated slab			94.5000	0.1200	11.3400		(28a)
Floor above garage			19.3400	0.1600	3.0944		(28b)
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)
Total net area of external elements Aum(A, m2)			468.2800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	113.3436	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)
Total fabric heat loss						(33) + (36) =	136.6776 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897	70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080	1.2080 (40)
HLP (average)												1.2080 (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												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)												Total = Sum(45)m = 1732.5288 (45)
Distribution loss (46)m = 0.15 x (45)m												26.9439
Water storage loss:												250.0000 (47)
Store volume												2.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1988 (55)
Enter (49) or (54) in (55)												
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												26.0140
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	228.9025	201.6099	209.9960	182.2693	172.0974	152.1058	144.6910	161.6182	168.2084	194.6335	207.8790	223.2347 (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												1.0468 (H8)
Utilisation factor												0.6153 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												110.1144 (H14)
Volume ratio Veff/V												1.1579 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-981.2151 (H17)
Solar input	-28.4533	-47.4803	-80.8645	-108.3743	-133.8873	-131.6326	-129.8930	-113.4882	-88.8840	-60.6973	-33.7497	-23.8105 (63)
FGHRS	-32.6240	-25.3308	-20.5251	-9.1184	-2.8851	0.0000	0.0000	-3.2136	-4.9431	-19.2835	-27.2945	-32.6701 eq. (G6)
Output from w/h	167.8253	128.7987	108.6065	64.7766	35.3250	20.4733	14.7980	44.9165	74.3813	114.6526	146.8348	166.7540 (64)
Heat gains from water heating, kWh/month	99.1468	87.8426	92.2079	79.7408	74.2777	66.9751	65.0564	71.1197	75.6970	87.0998	91.4133	97.2622 (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	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9039	68.3053	55.5496	42.0546	31.4363	26.5399	28.6773	37.2758	50.0315	63.5265	74.1448	79.0413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	512.0543	517.3678	503.9779	475.4724	439.4893	405.6703	383.0771	377.7636	391.1535	419.6590	455.6421	489.4611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520 (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)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)	133.2618	130.7182	123.9353	110.7511	99.8357	93.0210	87.4413	95.5909	105.1348	117.0696	126.9630	130.7288 (72)
Total internal gains	840.2636	834.4350	801.5065	746.3218	688.8049	643.2748	617.2393	628.6739	664.3633	718.2987	774.7935	817.2748 (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	4.7700	10.6334	0.6300	0.7000	0.7700	15.5011 (74)						
East	12.1500	19.6403	0.6300	0.7000	0.7700	72.9282 (76)						
South	5.2500	46.7521	0.6300	0.7000	0.7700	75.0122 (78)						
West	7.7400	19.6403	0.6300	0.7000	0.7700	46.4580 (80)						
East	0.5400	25.9287	0.6300	0.7000	1.0000	5.5572 (82)						
West	3.4700	25.9287	0.6300	0.7000	1.0000	35.7102 (82)						
Solar gains	251.1668	468.5834	732.1076	1031.3753	1248.2156	1274.6371	1214.5364	1050.9528	837.3598	544.0816	308.6803	209.6465 (83)
Total gains	1091.4304	1303.0183	1533.6140	1777.6971	1937.0206	1917.9119	1831.7757	1679.6267	1501.7232	1262.3803	1083.4738	1026.9212 (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)	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954 (85)
alpha	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330
util living area	0.9625	0.9415	0.9017	0.8268	0.7150	0.5763	0.4510	0.4998	0.6991	0.8740	0.9458	0.9675 (86)
MIT	18.5397	18.8467	19.3445	19.9410	20.4469	20.7748	20.9128	20.8842	20.6123	19.9265	19.1058	18.4604 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	(88)
util rest of house													
MIT 2	0.9568	0.9328	0.8867	0.7997	0.6691	0.5042	0.3546	0.4022	0.6343	0.8480	0.9362	0.9625	(89)
Living area fraction	16.6374	17.0793	17.7912	18.6272	19.3072	19.7136	19.8585	19.8353	19.5369	18.6288	17.4602	16.5230	(90)
MIT	17.1327	17.5395	18.1956	18.9693	19.6039	19.9899	20.1330	20.1084	fLA = Living area / (4) =			0.2603	(91)
Temperature adjustment									19.8169	18.9667	17.8887	17.0274	(92)
adjusted MIT	16.9827	17.3895	18.0456	18.8193	19.4539	19.8399	19.9830	19.9584	19.6669	18.8167	17.7387	-0.1500	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9339	0.9042	0.8530	0.7668	0.6472	0.4989	0.3612	0.4066	0.6174	0.8142	0.9084	0.9414	(94)
Useful gains	1019.2606	1178.1501	1308.2222	1363.0872	1253.5892	956.8789	661.5648	682.8531	927.2247	1027.8331	984.2251	966.7793	(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													
Month fracti	2627.4414	2587.4068	2391.8711	2054.9450	1606.3525	1085.5339	700.8376	737.1857	1153.2711	1702.2288	2203.9826	2626.3371	(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	1196.4865	947.0205	806.2348	498.1376	262.4559	0.0000	0.0000	0.0000	0.0000	501.7504	878.2254	1234.7110	(98)
Space heating per m2												(98) / (4) =	36.8806 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1196.4865	947.0205	806.2348	498.1376	262.4559	0.0000	0.0000	0.0000	0.0000	501.7504	878.2254	1234.7110	(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)	1311.9369	1038.3997	884.0294	546.2035	287.7806	0.0000	0.0000	0.0000	0.0000	550.1649	962.9665	1353.8498	(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	167.8253	128.7987	108.6065	64.7766	35.3250	20.4733	14.7980	44.9165	74.3813	114.6526	146.8348	166.7540	(64)
Efficiency of water heater (217)m	89.7328	89.7714	89.7833	89.8261	89.7843	80.5000	80.5000	80.5000	80.5000	88.9996	89.4960	89.7801	(216)
Fuel for water heating, kWh/month	187.0278	143.4740	120.9652	72.1134	39.3443	25.4326	18.3826	55.7969	92.3992	128.8237	164.0686	185.7361	(219)
Water heating fuel used													1233.5642 (219)
Annual totals kWh/year													
Space heating fuel - main system													6935.3313 (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)													128.8633 (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													253.8633 (231)
Electricity for lighting (calculated in Appendix L)													543.2584 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.35 * 853 * 1.00) =										-1603.6963			-1603.6963 (233)
Total delivered energy for all uses													7362.3210 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6935.3313	7.6000	527.0852 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1233.5642	7.6000	93.7509 (247)	
Mechanical ventilation fans	128.8633	13.1900	16.9971 (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	543.2584	13.1900	71.6558 (250)	
Additional standing charges			70.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1603.6963	13.1900	-211.5275 (252)	
Total energy cost			584.4489 (255)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1338 (257)
SAP value		84.1834
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6935.3313	0.2410	1671.4148 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1233.5642	0.2410	297.2890 (264)
Space and water heating			1968.7038 (265)
Pumps and fans	253.8633	0.5190	131.7551 (267)
Energy for lighting	543.2584	0.5190	281.9511 (268)
Energy saving/generation technologies			
PV Unit	-1603.6963	0.5190	-832.3184 (269)
Total kg/year			1550.0916 (272)
CO2 emissions per m2			9.0400 (273)
EI value			90.4059
EI rating			90 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	94.5000 (1b)	2.5000 (2b)	236.2500 (1b) - (3b)
First floor	77.0000 (1c)	2.4800 (2c)	190.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 427.2100 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				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 5.7000	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												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Half hour door			1.8900	1.4000	2.6460		(26)					
Part glazed doors			4.2000	1.4000	5.8800		(26a)					
Windows and patios (Uw = 1.40)			29.9100	1.3258	39.6534		(27)					
Velux roof lights (Uw = 1.30)			4.0100	1.2357	4.9553		(27a)					
Insulated slab			94.5000	0.1200	11.3400		(28a)					
Floor above garage			19.3400	0.1600	3.0944		(28b)					
ACDS 2015 T/F	129.6500	30.5100	99.1400	0.1600	15.8624		(29a)					
Hanging posts	62.8500		62.8500	0.1700	10.6845		(29a)					
House to Garage	15.8800	1.8900	13.9900	0.1900	2.6581		(29a)					
Dormer walls	9.8000	3.6000	6.2000	0.2000	1.2400		(29a)					
M/Wool over / in ceiling	90.1600		90.1600	0.1000	9.0160		(30)					
Sloping ceiling	46.1000	4.0100	42.0900	0.1500	6.3135		(30)					
Total net area of external elements Aum(A, m2)			468.2800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	113.3436	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.3340 (36)					
Total fabric heat loss							(33) + (36) = 136.6776 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.4897	Feb 70.4897	Mar 70.4897	Apr 70.4897	May 70.4897	Jun 70.4897	Jul 70.4897	Aug 70.4897	Sep 70.4897	Oct 70.4897	Nov 70.4897	Dec 70.4897 (38)
Heat transfer coeff	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673	207.1673 (39)
Average = Sum(39)m / 12 =												207.1673 (39)
HLP	Jan 1.2080	Feb 1.2080	Mar 1.2080	Apr 1.2080	May 1.2080	Jun 1.2080	Jul 1.2080	Aug 1.2080	Sep 1.2080	Oct 1.2080	Nov 1.2080	Dec 1.2080 (40)
HLP (average)												1.2080 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9646 (42)
Average daily hot water use (litres/day)												110.1144 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	121.1259	116.7213	112.3167	107.9121	103.5076	99.1030	99.1030	103.5076	107.9121	112.3167	116.7213	121.1259 (44)
Energy conte	179.6262	157.1022	162.1154	141.3361	135.6154	117.0258	108.4416	124.4383	125.9245	146.7528	160.1922	173.9584 (45)
Energy content (annual)												Total = Sum(45)m = 1732.5288 (45)
Distribution loss (46)m = 0.15 x (45)m												26.0938 (46)
Water storage loss:												250.0000 (47)
Store volume												2.2200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1988 (55)
Enter (49) or (54) in (55)												
Total storage loss	37.1628	33.5664	37.1628	35.9640	37.1628	35.9640	37.1628	37.1628	35.9640	37.1628	35.9640	37.1628 (56)
If cylinder contains dedicated solar storage												26.0140 (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	228.9025	201.6099	209.9960	182.2693	172.0974	152.1058	144.6910	161.6182	168.2084	194.6335	207.8790	223.2347 (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												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												0.9863 (H8)
Utilisation factor												0.6372 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												110.1144 (H14)
Volume ratio Veff/V												1.1579 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-957.4234 (H17)
Solar input	-22.8357	-43.3013	-81.3725	-110.8594	-143.7989	-130.9663	-128.9937	-111.2316	-84.3574	-54.2049	-28.0573	-17.4443 (63)
FGHRS	-34.0285	-26.6429	-21.3994	-9.0184	0.0000	0.0000	0.0000	-3.3318	-5.1803	-21.4347	-29.2461	-34.3587 eq. (G6)
Output from w/h	172.0384	131.6657	107.2240	62.3915	28.2985	21.1395	15.6973	47.0548	78.6707	118.9939	150.5756	171.4318 (64)
Heat gains from water heating, kWh/month	99.1468	87.8426	92.2079	79.7408	74.2777	66.9751	65.0564	71.1197	75.6970	87.0998	91.4133	97.2622 (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	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746	177.8746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.9039	68.3053	55.5496	42.0546	31.4363	26.5399	28.6773	37.2758	50.0315	63.5265	74.1448	79.0413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	512.0543	517.3678	503.9779	475.4724	439.4893	405.6703	383.0771	377.7636	391.1535	419.6590	455.6421	489.4611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520	55.7520 (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)	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831	-118.5831 (71)
Water heating gains (Table 5)	133.2618	130.7182	123.9353	110.7511	99.8357	93.0210	87.4413	95.5909	105.1348	117.0696	126.9630	130.7288 (72)
Total internal gains	840.2636	834.4350	801.5065	746.3218	688.8049	643.2748	617.2393	628.6739	664.3633	718.2987	774.7935	817.2748 (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	4.7700	8.2005	0.6300	0.7000	0.7700	11.9545 (74)						
East	12.1500	14.7869	0.6300	0.7000	0.7700	54.9068 (76)						
South	5.2500	38.1750	0.6300	0.7000	0.7700	61.2505 (78)						
West	7.7400	14.7869	0.6300	0.7000	0.7700	34.9777 (80)						
East	0.5400	19.3273	0.6300	0.7000	1.0000	4.1423 (82)						
West	3.4700	19.3273	0.6300	0.7000	1.0000	26.6184 (82)						
Solar gains	193.8503	410.6617	707.4768	1013.1751	1288.2001	1219.1264	1159.2346	989.3906	763.1080	466.7751	246.7243	147.7376 (83)
Total gains	1034.1138	1245.0966	1508.9832	1759.4969	1977.0050	1862.4012	1776.4739	1618.0646	1427.4714	1185.0738	1021.5178	965.0124 (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)	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954	22.9954 (85)
alpha	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330	2.5330
util living area	0.9706	0.9546	0.9209	0.8646	0.7856	0.7093	0.6411	0.6820	0.8049	0.9163	0.9608	0.9759 (86)
MIT	18.2803	18.5326	19.0341	19.6127	20.1108	20.4872	20.6821	20.6248	20.2693	19.5278	18.7654	18.1325 (87)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Th 2	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	19.9136	(88)
util rest of house														
MIT 2	0.9662	0.9481	0.9095	0.8447	0.7540	0.6602	0.5754	0.6184	0.7646	0.9002	0.9542	0.9724	0.9724	(89)
Living area fraction	16.2602	16.6243	17.3452	18.1662	18.8543	19.3625	19.6101	19.5470	19.0941	18.0656	16.9673	16.0453	16.0453	(90)
MIT	16.7861	17.1211	17.7849	18.5428	19.1814	19.6554	19.8892	19.8276	19.4000	18.4463	17.4354	16.5887	16.5887	(92)
Temperature adjustment														-0.1500
adjusted MIT	16.6361	16.9711	17.6349	18.3928	19.0314	19.5054	19.7392	19.6776	19.2500	18.2963	17.2854	16.4387	16.4387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9464	0.9228	0.8776	0.8101	0.7239	0.6394	0.5637	0.6028	0.7349	0.8678	0.9306	0.9550	(94)
Useful gains	978.7039	1148.9720	1324.2397	1425.4421	1431.2118	1190.7392	1001.3654	975.4116	1049.1151	1028.4385	950.6405	921.5798	(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	2762.8084	2770.0645	2617.5367	2339.4931	2016.0368	1513.4303	1188.9721	1196.9270	1501.9701	1967.3130	2400.1151	2804.7722	(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	1327.3738	1089.3742	962.2129	658.1168	435.1098	0.0000	0.0000	0.0000	0.0000	698.5226	1043.6217	1401.0951	(98)
Space heating per m2										(98) / (4) =		44.4048	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)	
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														91.2000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement	1327.3738	1089.3742	962.2129	658.1168	435.1098	0.0000	0.0000	0.0000	0.0000	698.5226	1043.6217	1401.0951	1401.0951	(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	91.2000	(210)	
Space heating fuel (main heating system)	1455.4537	1194.4893	1055.0580	721.6193	477.0941	0.0000	0.0000	0.0000	0.0000	765.9239	1144.3221	1536.2885	1536.2885	(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	0.0000	(215)	
Water heating requirement	172.0384	131.6657	107.2240	62.3915	28.2985	21.1395	15.6973	47.0548	78.6707	118.9939	150.5756	171.4318	171.4318	(64)	
Efficiency of water heater (217)m	89.8300	89.9113	90.0006	90.1622	90.4657	80.5000	80.5000	80.5000	80.5000	89.4690	89.6967	89.8973	89.8973	(216)	
Fuel for water heating, kWh/month	191.5155	146.4395	119.1370	69.1991	31.2809	26.2603	19.4998	58.4531	97.7276	133.0001	167.8719	190.6973	190.6973	(219)	
Water heating fuel used														1251.0820	(219)
Annual totals kWh/year															
Space heating fuel - main system														8350.2488	(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)															
mechanical ventilation fans (SFP = 0.2472)														128.8633	(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														253.8633	(231)
Electricity for lighting (calculated in Appendix L)														543.2584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 + 2.35 + 789 + 1.00) =										-1483.4411				-1483.4411	(233)
Total delivered energy for all uses														8915.0114	(238)

10a. Fuel costs - using BEDF prices (510)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8350.2488	6.9800	582.8474	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1251.0820	6.9800	87.3255	(247)
Mechanical ventilation fans	128.8633	22.5500	29.0587	(249)
Pumps and fans for heating	75.0000	22.5500	16.9125	(249)
Pump for solar water heating	50.0000	22.5500	11.2750	(249)
Energy for lighting	543.2584	22.5500	122.5048	(250)
Additional standing charges			63.0000	(251)
Energy saving/generation technologies				
PV Unit	-1483.4411	22.5500	-334.5160	(252)
Total energy cost			578.4079	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	8350.2488	0.2410	2012.4100 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1251.0820	0.2410	301.5108 (264)
Space and water heating			2313.9207 (265)
Pumps and fans	253.8633	0.5190	131.7551 (267)
Energy for lighting	543.2584	0.5190	281.9511 (268)
Energy saving/generation technologies			
PV Unit	-1483.4411	0.5190	-769.9060 (269)
Total kg/year			1957.7210 (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	8350.2488	1.0900	9101.7712 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1251.0820	1.0900	1363.6794 (264)
Space and water heating			10465.4506 (265)
Pumps and fans	253.8633	3.0700	779.3603 (267)
Energy for lighting	543.2584	3.0700	1667.8034 (268)
Energy saving/generation technologies			
PV Unit	-1483.4411	3.0700	-4554.1643 (269)
Primary energy kWh/year			8358.4500 (272)
Primary energy kWh/m2/year			48.7373 (273)

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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

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 ties				
	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 ties				
	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 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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

Roof Vented lie ins

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1000	
Layer 1	Tiling, concrete				
	Main construction	12	1.5000	0.0000	100.00
Layer 2	Battens and counter battens cavity				
	Main construction	38	0.0000	0.0000	79.43
	Main construction	38	0.1300	0.0000	20.57
	Corrections - Cavity Ventilated, Emissivity: Normal				
Layer 3	Sarking felt				
	Main construction	2	0.2300	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0000	100.00
Layer 5	Vented rafters cavity				
	Main construction	25	0.0000	0.0000	92.17
	Main construction	25	0.1300	0.0000	7.83
	Corrections - Cavity Ventilated, Emissivity: Normal				
Layer 6	PIR in rafters				
	Main construction	75	0.0220	3.4091	92.17
	Main construction	75	0.1300	0.5769	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	PIR in rafters				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 8	VCL				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 9	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 7.303 m ² K/W	Lower limit = 6.005 m ² K/W	Average = 6.654 m ² K/W
	Total correction = 0.0038 m ² K/W	U-value (unrounded) = 0.15 W/m ² K	

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 274 mm

U-value: 0.15 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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	0.0649	0.7700	100.00
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	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 battens cavity				
	Main construction	38	0.0571	0.6651	90.70
	Main construction	38	0.1300	0.2923	9.30
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard,				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.471 m ² K/W	Lower limit = 5.952 m ² K/W	Average = 6.212 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: 400 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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 Hanging Posts

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	Earthwool Frametherm Roll 35 in posts				
	Main construction	140	0.0350	4.0000	88.56
	Main construction	140	0.1300	1.0769	11.44
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	VCL				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 3	Thermawall TW55 over T/Frame				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 4	Low E batten cavity				
	Main construction	38	0.0571	0.6651	90.70
	Main construction	38	0.1300	0.2923	9.30
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	Plasterboard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.648 m ² K/W	Lower limit = 5.240 m ² K/W	Average = 5.444 m ² K/W
	Total correction = 0.0031 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space:	RoomInRoof	
Total thickness: 221 mm	U-value: 0.17 W/m² K	Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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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Building Elements

Wall House to Garage wall

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	Plasterboard, Main construction	12.5	0.2500	0.0500	100.00
Layer 2	Orientated Strand Board Main construction	9	0.1300	0.0692	100.00
Layer 3	Earthwool Frametherm Slab 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 4	Plasterboard Main construction	12.5	0.2500	0.0500	100.00
Layer 5	VCL Main construction	0.4	0.0000	0.0000	100.00
Layer 6	Thermawall TW55 over T/Frame Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 7	Low E batten 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 8	Plasterboard Main construction	12.5	0.2500	0.0500	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.650 m ² K/W	Lower limit = 5.171 m ² K/W	Average = 5.411 m ² K/W
	Total correction = 0.0028 m ² K/W	U-value (unrounded) = 0.19 W/m ² K	

Unheated space: None

Total thickness: 255 mm

U-value: 0.19 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn	Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref	
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne		
Calculation Type	New Build (As Designed)		

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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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Building Elements

Wall Dormers

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	Tiling, concrete				
	Main construction	20	1.5000	0.0133	100.00
Layer 2	Batten cavity				
	Main construction	25	0.0324	0.7717	81.80
	Main construction	25	0.1300	0.1923	18.20
	Corrections - Cavity Unventilated, Emissivity: Normal				
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	Phenolic in T/Frame				
	Main construction	140	0.0200	7.0000	85.00
	Main construction	140	0.1300	1.0769	15.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	VCL				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 7	Plasterboard				
	Main construction	12.5	0.2500	0.0500	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.520 m ² K/W	Lower limit = 4.637 m ² K/W	Average = 5.078 m ² K/W
	Total correction = 0.0057 m ² K/W	U-value (unrounded) = 0.2 W/m ² K	

Unheated space:	None	
Total thickness: 207 mm	U-value: 0.20 W/m² K	Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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 Insulated conc slab

Floor Type: Slab On Ground Floor

Area = 94.50 m², Perimeter = 46.22 m, Wall thickness = 382.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: Width D = 125.0 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,1200 gauge				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 3	Thermafloor TF70 zero ODP				
	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	125	2.3000	0.0543	100.00
Int surface				0.1700	

Total resistance: Upper limit = 6.959 m² K/W Lower limit = 6.959 m² K/W Average = 6.959 m² K/W
 Total correction = 0.0096 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 475 mm

U-value: 0.12 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 98	Prop Type Ref		
Project	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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 Garage ceiling

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, high density				
	Main construction	12.5	0.2500	0.0500	100.00
Layer 2	Frametherm Roll 35 in I joists flanges				
	Main construction	90	0.0350	2.5714	92.17
	Main construction	90	0.1300	0.6923	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Frametherm 35 in I joist webs				
	Main construction	130	0.0350	3.7143	98.50
	Main construction	130	0.1300	1.0000	1.50
Layer 4	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance: Upper limit = 6.445 m² K/W Lower limit = 6.119 m² K/W Average = 6.282 m² K/W
 Total correction = 0.0011 m² K/W U-value (unrounded) = 0.16 W/m² K

Unheated space: None

Total thickness: 255 mm

U-value: 0.16 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 98 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 98	Prop Type Ref			
Property	Cairn, Plot 98, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.63	TER	12.47
Environmental	89 B	% DER<TER	6.74		
CO ₂ Emissions (t/year)	2.22	FEE	50.73	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	East
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	2020
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:	46.22 m	94.50 m ²	2.50 m
1st Storey:	46.71 m	77.00 m ²	2.48 m

7.0 Living Area m²

8.0 Thermal Mass Parameter
 Thermal Mass kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
ACDS 2015 T/F	Timber Frame	0.16	129.65	99.14
Hanging posts	Timber Frame	0.17	62.85	62.85
House to Garage	Timber Frame	0.19	15.88	13.99
Dormer walls	Timber Frame	0.20	9.80	6.20

10.0 External Roofs

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
M/Wool over / in ceiling	External Plane Roof	0.10	90.16	90.16
Sloping ceiling	External Slope Roof	0.15	46.10	42.09

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Insulated slab	Ground Floor - Solid		0.12	94.50
Floor above garage	Exposed Floor - Timber		0.16	19.34

12.0 Opening Types

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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)
Half hour door	Manufacture	Solid Door							1.40
Part glazed doors	Manufacture	Half Glazed Door	Double Low-E Soft	0.05		0.63		0.70	1.40
Windows and patios	Manufacture	Window	Double Low-E Soft	0.05		0.63		0.70	1.40
Velux roof lights	Manufacture	Roof Window	Double Low-E Soft	0.05		0.63		0.70	1.30

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 glass	Window	[1] ACDS 2015 T/F	East	None	0.00					8.55	
To house/garage	Solid Door	[3] House to Garage	North							1.89	
Front dormer	Window	[4] Dormer walls	East	None	0.00					3.60	
Rear glass	Window	[1] ACDS 2015 T/F	West	None	0.00					7.74	
LHS glass	Window	[1] ACDS 2015 T/F	South	None	0.00					5.25	
RHS glass	Window	[1] ACDS 2015 T/F	North	None	0.00					4.77	
Rear door	Half Glazed Door	[1] ACDS 2015 T/F	West							2.10	
Rear velux	Roof Window	[2] Sloping ceiling	West	None						3.47	
Front velux	Roof Window	[2] Sloping ceiling	East	None						0.54	
RHS door	Half Glazed Door	[1] ACDS 2015 T/F	North							2.10	

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)	24.10	0.037	No
Scotland ACD 2015	E3 Sill	19.60	0.033	No
Scotland ACD 2015	E4 Jamb	45.40	0.031	No
Scotland ACD 2015	E5 Ground floor (normal)	46.22	0.173	No
Table K1 - Default	E20 Exposed floor (normal)	18.74	0.320	No
Scotland ACD 2015	E6 Intermediate floor within a dwelling	27.97	0.065	No
Scotland ACD 2015	E10 Eaves (insulation at ceiling level)	34.51	0.043	No
Scotland ACD 2015	E11 Eaves (insulation at rafter level)	22.46	0.018	No
Scotland ACD 2015	E12 Gable (insulation at ceiling level)	29.59	0.051	No
Scotland ACD 2015	E13 Gable (insulation at rafter level)	6.60	0.036	No
Scotland ACD 2015	E16 Corner (normal)	38.30	0.038	No
Scotland ACD 2015	E17 Corner (inverted – internal area greater than external area)	22.50	-0.029	No
Table K1 - Default	R1 Head of roof window	0.55	0.080	No
Table K1 - Default	R2 Sill of roof window	0.55	0.060	No
Table K1 - Default	R3 Jamb of roof window	0.78	0.080	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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Night Ventilation
 Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present
 Approved Installation
 Mechanical Ventilation data Type
 Type
 MV Reference Number
 Duct Type

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

22.0 Lighting

Internal

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

External

External lights fitted
 Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Description
 Percentage of Heat %
 Database Ref. No.
 Fuel Type
 Main Heating
 SAP Code
 In Winter
 In Summer
 Controls
 PCDF Controls
 Delayed Start Stat
 Sap Code

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

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	2.22	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
2.35	West	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	£71	B 84	