

PREDICTED ENERGY ASSESSMENT

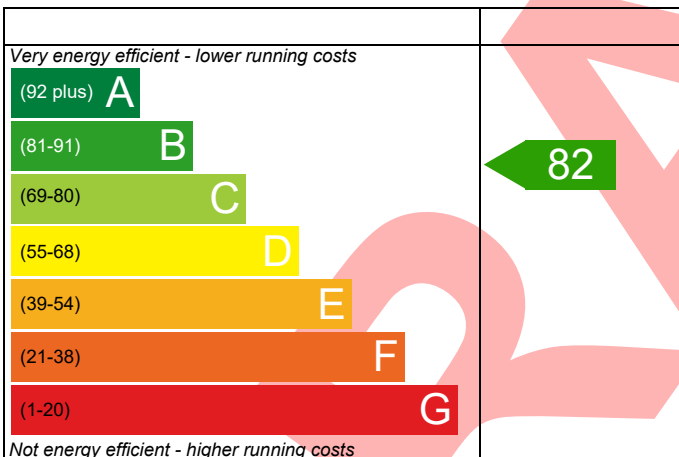
Cairn, Plot 96, Phase 4 A,
Tarland Road,
Aboyne

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.

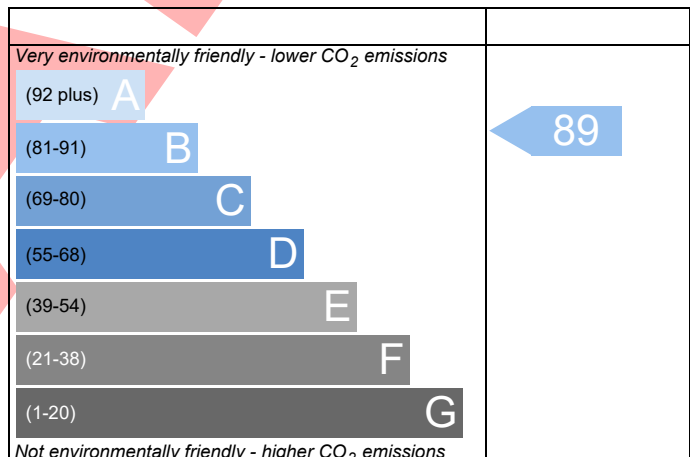
Energy Efficiency Rating



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 96 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 96	Prop Type Ref			
Property	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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)	11.21	kgCO ₂ /m ²	Pass
	-1.26 (-10.1%)	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	%	Pass
Minimum	75	%	

6.6 Mechanical ventilation and air conditioning

8 Mechanical ventilation

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

9 Summertime temperature

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

Overshading	Average
Windows facing North	7.74 m ² , No overhang
Windows facing East	4.77 m ² , No overhang
Windows facing South	12.15 m ² , No overhang
Windows facing West	5.25 m ² , 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 85	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£71	B 85	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 96 cairn	Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref	
Property	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne		

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn			Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref			
Property	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO₂ Emissions (t/year)	2.12	FEE	50.24	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) 11.21 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: 7.74 m², No overhang
Windows facing East: 4.77 m², No overhang
Windows facing South: 12.15 m², No overhang
Windows facing West: 5.25 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 2.01 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												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
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	-38.2488	-33.4418	-33.3401	-27.7346	-24.9980	-10.6717	-10.3318	-11.2231	-11.1675	-28.4584	-33.5711	-37.6996 eq. (G6)
Output from w/h	201.8026	178.2380	189.2005	172.0776	171.0426	164.8301	158.5349	173.6404	173.2330	178.7197	185.0971	196.6840 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 2143.1005 (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						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	7.7400	10.6334	0.6300	0.7000	0.7700	25.1527 (74)						
East	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311 (76)						
South	12.1500	46.7521	0.6300	0.7000	0.7700	173.5997 (78)						
West	5.2500	19.6403	0.6300	0.7000	0.7700	31.5122 (80)						
North	3.4700	15.2954	0.6300	0.7000	1.0000	21.0655 (82)						
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)						
Solar gains	290.0371	507.2363	733.0923	980.3880	1168.6328	1192.4686	1136.1372	989.9228	817.3804	570.7502	349.7033	246.7721 (83)
Total gains	879.5935	1094.3698	1300.8701	1516.4882	1671.7149	1664.3688	1588.1753	1448.9892	1293.0604	1078.3594	894.0610	819.5130 (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	0.9766	0.9593	0.9282	0.8668	0.7658	0.6317	0.5042	0.5568	0.7519	0.9053	0.9638	0.9803 (86)
MIT	18.3441	18.6659	19.1654	19.7825	20.3398	20.7196	20.8869	20.8508	20.5331	19.7967	18.9392	18.2661 (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	0.9728	0.9528	0.9165	0.8440	0.7233	0.5590	0.4013	0.4544	0.6911	0.8841	0.9570	0.9771 (89)
MIT 2	16.3554	16.8211	17.5405	18.4153	19.1770	19.6588	19.8402	19.8098	19.4487	18.4537	17.2228	16.2422 (90)
Living area fraction	fLA = Living area / (4) = 0.2603 (91)											
MIT	16.8732	17.3014	17.9636	18.7713	19.4797	19.9350	20.1127	20.0808	19.7311	18.8033	17.6697	16.7691 (92)
Temperature adjustment	-0.1500											
adjusted MIT	16.7232	17.1514	17.8136	18.6213	19.3297	19.7850	19.9627	19.9308	19.5811	18.6533	17.5197	16.6191 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9556	0.9288	0.8855	0.8098	0.6966	0.5495	0.4064	0.4562	0.6690	0.8510	0.9343	0.9618 (94)
Useful gains	840.5562	1016.4691	1151.9806	1228.0325	1164.5150	914.5611	645.3556	661.0562	865.0597	917.7340	835.2857	788.1692 (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	2573.6711	2538.0884	2343.7976	2013.9265	1580.6336	1074.1656	696.6415	731.4668	1135.4944	1668.3848	2158.6216	2572.8370 (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	1289.4375	1022.5282	886.7118	565.8437	309.5922	0.0000	0.0000	0.0000	0.0000	558.4842	952.8019	1327.7928 (98)
Space heating												6913.1923 (98)
Space heating per m2												(98) / (4) = 40.3102 (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	1289.4375	1022.5282	886.7118	565.8437	309.5922	0.0000	0.0000	0.0000	0.0000	558.4842	952.8019	1327.7928 (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)	1413.8569	1121.1932	972.2717	620.4427	339.4651	0.0000	0.0000	0.0000	0.0000	612.3730	1044.7389	1455.9132 (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	201.8026	178.2380	189.2005	172.0776	171.0426	164.8301	158.5349	173.6404	173.2330	178.7197	185.0971	196.6840 (64)
Efficiency of water heater	89.5885	89.4354	89.1170	88.4582	87.0809	80.5000	80.5000	80.5000	80.5000	88.3530	89.2699	89.6624 (216)
Fuel for water heating, kWh/month	225.2549	199.2924	212.3057	194.5299	196.4180	204.7579	196.9378	215.7024	215.1963	202.2792	207.3456	219.3606 (219)
Water heating fuel used												2489.3807 (219)
Annual totals kWh/year												
Space heating fuel - main system												7580.2547 (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 * 2.01 * 1068 * 1.00) =										-1717.4573		-1717.4573 (233)
Total delivered energy for all uses												9099.2998 (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	7580.2547	0.2410	1826.8414 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2489.3807	0.2410	599.9408 (264)
Space and water heating			2426.7821 (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	-1717.4573	0.5190	-891.3604 (269)
Total CO2, kg/year			1923.1780 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.2100 (273)

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

DER			11.2100 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			24.1730 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			24.1730 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)	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	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(A, 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	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	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	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	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	-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	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	186.1750 (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	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	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	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	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	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	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	-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	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	566.6200 (73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains				
		m ²	Table 6a	or Table 6b	W/m ²	or Table 6c		factor	W				
								Table 6d					
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	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	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)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	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	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	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	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	15.5136 (90)
Living area fraction													
	16.1727	16.6378	17.4395	18.4517	19.2659	19.7960	19.9948	19.9589	19.5294	18.4086	17.1149	16.1142	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	15.9642 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9583	0.9319	0.8819	0.7938	0.6741	0.5267	0.3877	0.4403	0.6645	0.8573	0.9395	0.9642	0.9642 (94)	
Ext temp.	795.1273	990.4525	1195.1177	1339.3190	1290.9456	1010.0418	708.7145	722.2111	925.2532	920.0017	794.2149	741.6070	741.6070 (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	4.2000 (96)	
Month fracti	2892.2031	2849.9561	2645.4332	2271.6863	1786.9378	1200.2321	771.8066	808.8880	1262.0522	1845.4232	2390.3298	2867.1409	2867.1409 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating per m ²	1560.2244	1249.5864	1079.0347	671.3045	369.0182	0.0000	0.0000	0.0000	0.0000	688.5136	1149.2027	1581.3972	1581.3972 (98)	
(98) / (4) =												8348.2816	8348.2816 (98)	
													48.6780	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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	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)
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)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
	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
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
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
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
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	(66)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(69)
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)	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)
Total internal gains	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	7.7400	10.6334	0.6300	0.7000	0.7700	25.1527 (74)							
East	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311 (76)							
South	12.1500	46.7521	0.6300	0.7000	0.7700	173.5997 (78)							
West	5.2500	19.6403	0.6300	0.7000	0.7700	31.5122 (80)							
North	3.4700	15.2954	0.6300	0.7000	1.0000	21.0655 (82)							
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)							
Solar gains	290.0371	507.2363	733.0923	980.3880	1168.6328	1192.4686	1136.1372	989.9228	817.3804	570.7502	349.7033	246.7721	(83)
Total gains	782.6482	998.3425	1206.7491	1424.9588	1581.8681	1576.8912	1502.7113	1360.9452	1204.0997	986.7162	799.3890	723.4819	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	22.2294	22.2582	22.2865	22.4204	22.4456	22.5637	22.5637	22.5858	22.5181	22.4456	22.3946	22.3416	
util living area	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	0.9820	0.9668	0.9392	0.8828	0.7879	0.6576	0.5313	0.5867	0.7794	0.9212	0.9717	0.9851	(86)
MIT	18.1700	18.5007	19.0180	19.6731	20.2645	20.6816	20.8677	20.8259	20.4722	19.6873	18.7979	18.1043	(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	0.9790	0.9614	0.9288	0.8617	0.7468	0.5845	0.4242	0.4813	0.7207	0.9026	0.9662	0.9826	(89)
MIT 2	17.2897	17.6181	18.1292	18.7702	19.3270	19.6963	19.8362	19.8127	19.5310	18.7970	17.9202	17.2278	(90)
Living area fraction	17.5189	17.8479	18.3606	19.0053	19.5711	19.9528	20.1048	20.0765	19.7760	19.0288	18.1487	17.4560	(92)
Temperature adjustment	17.5189	17.8479	18.3606	19.0053	19.5711	19.9528	20.1048	20.0765	19.7760	19.0288	18.1487	17.4560	(93)
adjusted MIT	17.5189	17.8479	18.3606	19.0053	19.5711	19.9528	20.1048	20.0765	19.7760	19.0288	18.1487	17.4560	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9699	0.9479	0.9105	0.8412	0.7332	0.5887	0.4462	0.5002	0.7134	0.8840	0.9541	0.9748	(94)
Ext temp.	759.1239	946.2799	1098.7362	1198.6046	1159.8081	928.2952	670.4386	680.7837	859.0109	872.2288	762.6824	705.2240	(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	2832.8866	2771.2200	2535.2822	2147.1687	1670.5668	1130.1384	739.9609	775.4560	1200.8063	1788.9393	2350.3367	2826.5692	(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	1542.8794	1226.3597	1068.7902	682.9661	380.0045	0.0000	0.0000	0.0000	0.0000	682.0327	1143.1111	1578.2808	(98)
												8304.4246 (98)	
												(98) / (4) = 48.4223 (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	0.7056	0.7718	0.7342	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1400.3415	1205.9088	1176.9024	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1935.3606	1848.4271	1693.9146	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	385.2138	478.0336	384.6571	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction													1247.9044 (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	96.3034	119.5084	96.1643	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													311.9761 (107)
Space cooling per m2													1.8191 (108)
Energy for space heating													48.4223 (99)
Energy for space cooling													1.8191 (108)
Total													50.2414 (109)
Dwelling Fabric Energy Efficiency (DFEE)													50.2 (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)
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)
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)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 2443.9868 (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	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)	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	7.7400	8.2005	0.6300	0.7000	0.7700	19.3979 (74)						
East	4.7700	14.7869	0.6300	0.7000	0.7700	21.5560 (76)						
South	12.1500	38.1750	0.6300	0.7000	0.7700	141.7512 (78)						
West	5.2500	14.7869	0.6300	0.7000	0.7700	23.7252 (80)						
North	3.4700	12.1077	0.6300	0.7000	1.0000	16.6752 (82)						
South	0.5400	37.0090	0.6300	0.7000	1.0000	7.9320 (82)						
Solar gains	231.0375	458.3828	725.9642	975.6557	1210.7944	1141.0870	1086.4672	940.2098	760.0855	504.0840	288.4889	179.4476 (83)
Total gains	1083.2891	1304.8057	1540.9594	1741.4695	1925.3447	1810.3573	1729.7020	1593.8786	1442.4400	1235.8715	1075.2704	1008.7104 (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	0.9675	0.9500	0.9176	0.8669	0.7938	0.7195	0.6514	0.6876	0.8018	0.9093	0.9563	0.9735 (86)
MIT	18.3256	18.5846	19.0590	19.6010	20.0855	20.4684	20.6696	20.6171	20.2770	19.5666	18.8132	18.1735 (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	0.9627	0.9429	0.9059	0.8473	0.7628	0.6710	0.5858	0.6243	0.7612	0.8922	0.9491	0.9696 (89)
MIT 2	16.3255	16.6988	17.3803	18.1502	18.8215	19.3403	19.5968	19.5385	19.1037	18.1192	17.0357	16.1046 (90)
Living area fraction												fLA = Living area / (4) = 0.2603 (91)
MIT	16.8462	17.1898	17.8174	18.5279	19.1506	19.6340	19.8761	19.8194	19.4092	18.4960	17.4985	16.6432 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6962	17.0398	17.6674	18.3779	19.0006	19.4840	19.7261	19.6694	19.2592	18.3460	17.3485	16.4932 (93)

8. Space heating requirement

Utilisation	0.9416	0.9163	0.8736	0.8127	0.7321	0.6491	0.5732	0.6082	0.7317	0.8593	0.9241	0.9511 (94)
Useful gains	1020.0662	1195.6449	1346.1149	1415.3748	1409.6286	1175.1657	991.5074	969.3190	1055.4947	1061.9265	993.6502	959.3416 (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	2775.2634	2784.2874	2624.2652	2336.4169	2009.6408	1508.9987	1186.2691	1195.2224	1503.8710	1977.6270	2413.1829	2816.0756 (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	1305.8667	1067.5678	950.9439	663.1503	446.4090	0.0000	0.0000	0.0000	0.0000	681.2812	1022.0635	1381.4100 (98)
RHI space heating demand												7518.6924 (98)
												7519 (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)

	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 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 content (annual)	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)
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)
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)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	-37.6133	-32.6819	-32.5450	-27.2119	-24.6719	-10.6717	-10.3318	-11.2231	-11.1675	-27.8523	-32.6957	-37.0795 eq. (G6)
Heat gains from water heating, kWh/month	202.4381	178.9979	189.9956	172.6003	171.3687	164.8301	158.5349	173.6404	173.2330	179.3258	185.9725	197.3041 (64)
Total per year (kWh/year) = Sum(64)m =	108.0659	95.8986	102.2435	93.7751	93.4323	85.6919	84.3970	89.7159	88.6507	97.1355	100.0447	2148.2413 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	7.7400	10.6334	0.6300	0.7000	0.7700	25.1527 (74)						
East	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311 (76)						
South	12.1500	46.7521	0.6300	0.7000	0.7700	173.5997 (78)						
West	5.2500	19.6403	0.6300	0.7000	0.7700	31.5122 (80)						
North	3.4700	15.2954	0.6300	0.7000	1.0000	21.0655 (82)						
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)						
Solar gains	290.0371	507.2363	733.0923	980.3880	1168.6328	1192.4686	1136.1372	989.9228	817.3804	570.7502	349.7033	246.7721 (83)
Total gains	1142.2887	1353.6593	1548.0875	1746.2018	1883.1831	1861.7389	1779.3720	1643.5916	1499.7349	1302.5377	1136.4847	1076.0349 (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)
util living area	0.9587	0.9369	0.9000	0.8316	0.7251	0.5880	0.4616	0.5081	0.6995	0.8670	0.9403	0.9641 (86)
MIT	18.5853	18.8889	19.3551	19.9231	20.4269	20.7639	20.9079	20.8796	20.6116	19.9530	19.1506	18.5052 (87)
util rest of house	0.9525	0.9275	0.8848	0.8050	0.6797	0.5156	0.3638	0.4097	0.6348	0.8400	0.9298	0.9586 (89)
MIT 2	16.7029	17.1393	17.8059	18.6035	19.2832	19.7029	19.8551	19.8320	19.5361	18.6641	17.5237	16.5874 (90)
Living area fraction	17.1929	17.5948	18.2093	18.9470	19.5809	19.9791	20.1292	20.1047	19.8161	18.9997	17.9472	17.0867 (92)
Temperature adjustment	17.0429	17.4448	18.0593	18.7970	19.4309	19.8291	19.9792	19.9547	19.6661	18.8497	17.7972	16.9367 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1060.4132	1215.5931	1317.4266	1347.8284	1236.9390	948.4911	658.5466	679.9181	926.6950	1050.1724	1023.8441	1007.4535 (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 ENERGY RATINGS 09 Jan 2014

Heat loss rate W	2639.9214	2598.8824	2394.7026	2050.3418	1601.5985	1083.3048	700.0612	736.4223	1153.1218	1709.0658	2216.1191	2638.6226 (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	1175.1541	929.5705	801.4933	505.8096	271.3067	0.0000	0.0000	0.0000	0.0000	490.2167	858.4380	1213.5898 (98)
Space heating												6245.5788 (98)
Space heating per m2												(98) / (4) = 36.4174 (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	1175.1541	929.5705	801.4933	505.8096	271.3067	0.0000	0.0000	0.0000	0.0000	490.2167	858.4380	1213.5898 (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)	1288.5462	1019.2659	878.8304	554.6158	297.4854	0.0000	0.0000	0.0000	0.0000	537.5183	941.2698	1330.6906 (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	202.4381	178.9979	189.9956	172.6003	171.3687	164.8301	158.5349	173.6404	173.2330	179.3258	185.9725	197.3041 (64)
Efficiency of water heater (217)m	89.4528	89.2838	88.9348	88.2168	86.7369	80.5000	80.5000	80.5000	80.5000	88.0649	89.0914	89.5357 (217)
Fuel for water heating, kWh/month	226.3072	200.4820	213.6348	195.6547	197.5730	204.7579	196.9378	215.7024	215.1963	203.6292	208.7436	220.3635 (219)
Water heating fuel used												2498.9825 (219)
Annual totals kWh/year												
Space heating fuel - main system												6848.2223 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 13.1040, total filow = 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 * 2.01 * 1068 * 1.00) =										-1717.4573		-1717.4573 (233)
Total delivered energy for all uses												8376.8692 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6848.2223	7.6000	520.4649 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2498.9825	7.6000	189.9227 (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	-1717.4573	13.1900	-226.5326 (252)
Total energy cost			652.4003 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.2656 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	82.3445
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	6848.2223	0.2410	1650.4216 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2498.9825	0.2410	602.2548 (264)
Space and water heating			2252.6764 (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	-1717.4573	0.5190	-891.3604 (269)
Total kg/year			1749.0722 (272)
CO2 emissions per m2			10.2000 (273)
EI value			89.1743
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	$7.60 / 0.8594 = 8.843$, 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	-38.3402	-33.6673	-33.9394	-28.5818	-26.1633	-10.6717	-10.3318	-11.2231	-11.1675	-29.5486	-34.1211	-37.9907 eq. (G6)
Output from w/h	201.7112	178.0126	188.6012	171.2303	169.8773	164.8301	158.5349	173.6404	173.2330	177.6294	184.5471	196.3928 (64)
												Total per year (kWh/year) = Sum(64)m = 2138.2403 (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	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)	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	7.7400	8.2005	0.6300	0.7000	0.7700	19.3979 (74)						
East	4.7700	14.7869	0.6300	0.7000	0.7700	21.5560 (76)						
South	12.1500	38.1750	0.6300	0.7000	0.7700	141.7512 (78)						
West	5.2500	14.7869	0.6300	0.7000	0.7700	23.7252 (80)						
North	3.4700	12.1077	0.6300	0.7000	1.0000	16.6752 (82)						
South	0.5400	37.0090	0.6300	0.7000	1.0000	7.9320 (82)						
Solar gains	231.0375	458.3828	725.9642	975.6557	1210.7944	1141.0870	1086.4672	940.2098	760.0855	504.0840	288.4889	179.4476 (83)
Total gains	1083.2891	1304.8057	1540.9594	1741.4695	1925.3447	1810.3573	1729.7020	1593.8786	1442.4400	1235.8715	1075.2704	1008.7104 (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	0.9675	0.9500	0.9176	0.8669	0.7938	0.7195	0.6514	0.6876	0.8018	0.9093	0.9563	0.9735 (86)
MIT	18.3256	18.5846	19.0590	19.6010	20.0855	20.4684	20.6696	20.6171	20.2770	19.5666	18.8132	18.1735 (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	0.9627	0.9429	0.9059	0.8473	0.7628	0.6710	0.5858	0.6243	0.7612	0.8922	0.9491	0.9696 (89)
MIT 2	16.3255	16.6988	17.3803	18.1502	18.8215	19.3403	19.5968	19.5385	19.1037	18.1192	17.0357	16.1046 (90)
Living area fraction												fLA = Living area / (4) = 0.2603 (91)
MIT	16.8462	17.1898	17.8174	18.5279	19.1506	19.6340	19.8761	19.8194	19.4092	18.4960	17.4985	16.6432 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6962	17.0398	17.6674	18.3779	19.0006	19.4840	19.7261	19.6694	19.2592	18.3460	17.3485	16.4932 (93)

8. Space heating requirement

Utilisation	0.9416	0.9163	0.8736	0.8127	0.7321	0.6491	0.5732	0.6082	0.7317	0.8593	0.9241	0.9511 (94)
Useful gains	1020.0662	1195.6449	1346.1149	1415.3748	1409.6286	1175.1657	991.5074	969.3190	1055.4947	1061.9265	993.6502	959.3416 (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)

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Calculation Type: New Build (As Designed)

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Heat loss rate W	2775.2634	2784.2874	2624.2652	2336.4169	2009.6408	1508.9987	1186.2691	1195.2224	1503.8710	1977.6270	2413.1829	2816.0756 (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	1305.8667	1067.5678	950.9439	663.1503	446.4090	0.0000	0.0000	0.0000	0.0000	681.2812	1022.0635	1381.4100 (98)
Space heating												7518.6924 (98)
Space heating per m2											(98) / (4) =	43.8408 (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	1305.8667	1067.5678	950.9439	663.1503	446.4090	0.0000	0.0000	0.0000	0.0000	681.2812	1022.0635	1381.4100 (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)	1431.8713	1170.5787	1042.7016	727.1385	489.4836	0.0000	0.0000	0.0000	0.0000	747.0189	1120.6837	1514.7040 (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	201.7112	178.0126	188.6012	171.2303	169.8773	164.8301	158.5349	173.6404	173.2330	177.6294	184.5471	196.3928 (64)
Efficiency of water heater (217)m	89.6064	89.4998	89.2369	88.7783	87.9766	80.5000	80.5000	80.5000	80.5000	88.7601	89.3829	89.7157 (217)
Fuel for water heating, kWh/month	225.1080	198.8971	211.3489	192.8740	193.0936	204.7579	196.9378	215.7024	215.1963	200.1231	206.4680	218.9058 (219)
Water heating fuel used												2479.4128 (219)
Annual totals kWh/year												
Space heating fuel - main system												8244.1803 (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 * 2.01 * 1017 * 1.00) =										-1635.4542		-1635.4542 (233)
Total delivered energy for all uses												9835.2607 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8244.1803	6.9800	575.4438 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2479.4128	6.9800	173.0630 (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	-1635.4542	22.5500	-368.7949 (252)
Total energy cost			611.1878 (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	8244.1803	0.2410	1986.8474 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.4128	0.2410	597.5385 (264)
Space and water heating			2584.3859 (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	-1635.4542	0.5190	-848.8007 (269)
Total kg/year			2123.3414 (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	8244.1803	1.0900	8986.1565 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2479.4128	1.0900	2702.5600 (264)
Space and water heating			11688.7164 (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	-1635.4542	3.0700	-5020.8443 (269)
Primary energy kWh/year			8961.5359 (272)
Primary energy kWh/m2/year			52.2539 (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 (12.2%)

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 85	B 91
Total Savings	£71	1.51 kg/m²		

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

Fuel prices for cost data on this page from database revision number 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	£812	£729	£83
Space heating	£684	£687	-£3
Water heating	£173	£99	£74
Lighting	£123	£123	£0
Generated (PV)	-£369	-£369	£0
Total cost of fuels	£611	£540	£72
Total cost of uses	£611	£540	£71
Delivered energy	57 kWh/m ²	51 kWh/m ²	7 kWh/m ²
Carbon dioxide emissions	2.1 tonnes	1.9 tonnes	0.3 tonnes
CO2 emissions per m ²	12 kg/m ²	11 kg/m ²	2 kg/m ²
Primary energy	52 kWh/m ²	46 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	-32.5448	-25.2303	-20.5231	-9.1495	-2.8868	0.0000	0.0000	-3.2136	-4.9431	-19.2344	-27.1687	-32.5931 eq. (G6)
Output from w/h	167.9044	128.8992	108.6085	64.7455	35.3232	20.4733	14.7980	44.9165	74.3813	114.7018	146.9606	166.8311 (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	7.7400	10.6334	0.6300	0.7000	0.7700	25.1527 (74)						
East	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311 (76)						
South	12.1500	46.7521	0.6300	0.7000	0.7700	173.5997 (78)						
West	5.2500	19.6403	0.6300	0.7000	0.7700	31.5122 (80)						
North	3.4700	15.2954	0.6300	0.7000	1.0000	21.0655 (82)						
South	0.5400	47.0123	0.6300	0.7000	1.0000	10.0760 (82)						
Solar gains	290.0371	507.2363	733.0923	980.3880	1168.6328	1192.4686	1136.1372	989.9228	817.3804	570.7502	349.7033	246.7721 (83)
Total gains	1130.3007	1341.6713	1534.5987	1726.7098	1857.4378	1835.7434	1753.3765	1618.5967	1481.7437	1289.0489	1124.4967	1064.0469 (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	0.9596	0.9380	0.9016	0.8347	0.7299	0.5935	0.4670	0.5140	0.7040	0.8694	0.9416	0.9650 (86)
MIT	18.5746	18.8790	19.3453	19.9119	20.4171	20.7586	20.9054	20.8764	20.6054	19.9442	19.1405	18.4943 (87)

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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	0.9535	0.9288	0.8866	0.8083	0.6849	0.5210	0.3685	0.4150	0.6395	0.8427	0.9313	0.9596	0.9596	(89)
Living area fraction	16.6875	17.1252	17.7922	18.5885	19.2713	19.6977	19.8533	19.8295	19.5294	18.6524	17.5094	16.5717	16.5717	(90)
MIT	17.1788	17.5818	18.1965	18.9331	19.5696	19.9739	20.1272	20.1020	fLA = Living area / (4) =			0.2603	0.2603	(91)
Temperature adjustment									19.8095	18.9887	17.9341	17.0723	17.0723	(92)
adjusted MIT	17.0288	17.4318	18.0465	18.7831	19.4196	19.8239	19.9772	19.9520	19.6595	18.8387	17.7841	-0.1500	-0.1500	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9296	0.8995	0.8529	0.7750	0.6615	0.5145	0.3747	0.4188	0.6221	0.8089	0.9026	0.9375	0.9375 (94)
Useful gains	1050.7746	1206.7923	1308.8503	1338.2489	1228.7325	944.4327	656.9632	677.7899	921.8512	1042.7337	1014.9630	997.5836	997.5836 (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	4.2000 (96)
Heat loss rate W													
Month fracti	2636.9955	2596.1837	2392.0644	2047.4474	1599.2460	1082.2219	699.6530	735.8674	1151.7545	1706.7907	2213.3966	2635.6382	2635.6382 (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	1.0000 (97a)
Space heating	1180.1483	933.6710	805.9113	510.6229	275.6620	0.0000	0.0000	0.0000	0.0000	494.0584	862.8721	1218.7126	1218.7126 (98)
Space heating per m2													(98) / (4) = 36.6277 (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	1180.1483	933.6710	805.9113	510.6229	275.6620	0.0000	0.0000	0.0000	0.0000	494.0584	862.8721	1218.7126	1218.7126 (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)	1294.0223	1023.7621	883.6746	559.8935	302.2610	0.0000	0.0000	0.0000	0.0000	541.7307	946.1317	1336.3077	1336.3077 (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	167.9044	128.8992	108.6085	64.7455	35.3232	20.4733	14.7980	44.9165	74.3813	114.7018	146.9606	166.8311	166.8311 (64)
Efficiency of water heater (217)m	89.7147	89.7528	89.7827	89.8560	89.8436	80.5000	80.5000	80.5000	80.5000	88.9718	89.4693	89.7634	89.7634 (217)
Fuel for water heating, kWh/month	187.1537	143.6158	120.9681	72.0548	39.3164	25.4326	18.3826	55.7969	92.3992	128.9193	164.2581	185.8565	185.8565 (219)
Water heating fuel used													1234.1539 (219)
Annual totals kWh/year													
Space heating fuel - main system													6887.7836 (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 + 2.01 + 1068 + 1.00) =										-1717.4573			-1717.4573 (233)
Total delivered energy for all uses													7201.6019 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6887.7836	7.6000	523.4716	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1234.1539	7.6000	93.7957	(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	-1717.4573	13.1900	-226.5326	(252)
Total energy cost			565.8750	(255)

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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)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0978 (257)
SAP value		84.6861
SAP rating (Section 12)		85 (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	6887.7836	0.2410	1659.9559 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1234.1539	0.2410	297.4311 (264)
Space and water heating			1957.3869 (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	-1717.4573	0.5190	-891.3604 (269)
Total kg/year			1479.7328 (272)
CO2 emissions per m2			8.6300 (273)
EI value			90.8414
EI rating			91 (274)
EI band			B

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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												
	26.9439	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												
	26.0140	23.4965	26.0140	25.1748	26.0140	25.1748	26.0140	26.0140	25.1748	26.0140	25.1748	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	-33.9470	-26.5800	-21.3597	-9.0427	0.0000	0.0000	0.0000	-3.3318	-5.1803	-21.3491	-29.1746	-34.2873 eq. (G6)
Output from w/h	172.1198	131.7286	107.2638	62.3672	28.2985	21.1395	15.6973	47.0548	78.6707	119.0795	150.6471	171.5032 (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)
												Total per year (kWh/year) = Sum(64)m = 1105.5701 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		7.7400	8.2005	0.6300	0.7000	0.7700	19.3979 (74)					
East		4.7700	14.7869	0.6300	0.7000	0.7700	21.5560 (76)					
South		12.1500	38.1750	0.6300	0.7000	0.7700	141.7512 (78)					
West		5.2500	14.7869	0.6300	0.7000	0.7700	23.7252 (80)					
North		3.4700	12.1077	0.6300	0.7000	1.0000	16.6752 (82)					
South		0.5400	37.0090	0.6300	0.7000	1.0000	7.9320 (82)					
Solar gains	231.0375	458.3828	725.9642	975.6557	1210.7944	1141.0870	1086.4672	940.2098	760.0855	504.0840	288.4889	179.4476 (83)
Total gains	1071.3011	1292.8177	1527.4706	1721.9775	1899.5994	1784.3618	1703.7065	1568.8837	1424.4488	1222.3827	1063.2824	996.7224 (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	0.9682	0.9509	0.9190	0.8695	0.7979	0.7246	0.6572	0.6935	0.8055	0.9112	0.9573	0.9742 (86)
MIT	18.3146	18.5743	19.0485	19.5883	20.0726	20.4586	20.6624	20.6090	20.2677	19.5564	18.8026	18.1623 (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	0.9636	0.9440	0.9074	0.8501	0.7672	0.6764	0.5918	0.6304	0.7653	0.8944	0.9502	0.9704	0.9704	(89)
Living area fraction	16.3097	16.6840	17.3656	18.1328	18.8047	19.3287	19.5892	19.5296	19.0921	18.1051	17.0205	16.0884	16.0884	(90)
MIT	16.8317	17.1761	17.8037	18.5117	19.1348	19.6229	19.8686	19.8106	fLA = Living area / (4) =			0.2603	0.2603	(91)
Temperature adjustment									19.3982	18.4829	17.4845	16.6283	16.6283	(92)
adjusted MIT	16.6817	17.0261	17.6537	18.3617	18.9848	19.4729	19.7186	19.6606	19.2482	18.3329	17.3345	-0.1500	-0.1500	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9428	0.9176	0.8753	0.8156	0.7363	0.6541	0.5786	0.6137	0.7356	0.8615	0.9256	0.9521	0.9521 (94)
Useful gains	1010.0376	1186.3468	1336.9199	1404.3924	1398.6247	1167.1381	985.8211	962.8625	1047.8177	1053.1208	984.1309	949.0267	949.0267 (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	2.9000 (96)
Heat loss rate W	2772.2402	2781.4512	2621.4368	2333.0587	2006.3702	1506.7050	1184.7035	1193.4105	1501.5832	1974.9150	2410.2874	2812.9848	2812.9848 (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	1.0000 (97a)
Space heating kWh	1311.0788	1071.9102	955.6805	668.6398	452.1626	0.0000	0.0000	0.0000	0.0000	685.8149	1026.8326	1386.7849	1386.7849 (98)
Space heating per m2													7558.9043 (98)
										(98) / (4) =			44.0752 (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	1311.0788	1071.9102	955.6805	668.6398	452.1626	0.0000	0.0000	0.0000	0.0000	685.8149	1026.8326	1386.7849	1386.7849 (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)	1437.5864	1175.3401	1047.8953	733.1576	495.7924	0.0000	0.0000	0.0000	0.0000	751.9901	1125.9130	1520.5974	1520.5974 (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	172.1198	131.7286	107.2638	62.3672	28.2985	21.1395	15.6973	47.0548	78.6707	119.0795	150.6471	171.5032	171.5032 (64)
Efficiency of water heater (217)m	89.8146	89.8923	89.9929	90.1774	90.4916	80.5000	80.5000	80.5000	80.5000	89.4412	89.6750	89.8851	89.8851 (217)
Fuel for water heating, kWh/month	191.6390	146.5404	119.1914	69.1606	31.2720	26.2603	19.4998	58.4531	97.7276	133.1372	167.9923	190.8027	190.8027 (219)
Water heating fuel used													1251.6764 (219)
Annual totals kWh/year													
Space heating fuel - main system													8288.2722 (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 + 2.01 + 1017 + 1.00) =										-1635.4542			-1635.4542 (233)
Total delivered energy for all uses													8701.6162 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8288.2722	6.9800	578.5214	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1251.6764	6.9800	87.3670	(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	-1635.4542	22.5500	-368.7949	(252)
Total energy cost			539.8445	(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	8288.2722	0.2410	1997.4736 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1251.6764	0.2410	301.6540 (264)
Space and water heating			2299.1276 (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	-1635.4542	0.5190	-848.8007 (269)
Total kg/year			1864.0331 (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	8288.2722	1.0900	9034.2168 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1251.6764	1.0900	1364.3273 (264)
Space and water heating			10398.5440 (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	-1635.4542	3.0700	-5020.8443 (269)
Primary energy kWh/year			7824.8635 (272)
Primary energy kWh/m2/year			45.6260 (273)

U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023
Assessment Reference	Cairn 96	Prop Type Ref		
Project	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	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 96 cairn		Issued on Date	31/01/2023	
Assessment Reference	Cairn 96	Prop Type Ref			
Property	Cairn, Plot 96, Phase 4 A, Tarland Road, Aboyne				
SAP Rating	82 B	DER	11.21	TER	12.47
Environmental	89 B	% DER<TER	10.10		
CO ₂ Emissions (t/year)	2.12	FEE	50.24	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		
Assessor Details	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			Assessor ID	1910-0001
Client					

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

Orientation	South
Property Tenure	Owner-occupied
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	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	South	None	0.00					8.55	
To house/garage	Solid Door	[3] House to Garage	East							1.89	
Front dormer	Window	[4] Dormer walls	South	None	0.00					3.60	
Rear glass	Window	[1] ACDS 2015 T/F	North	None	0.00					7.74	
LHS glass	Window	[1] ACDS 2015 T/F	West	None	0.00					5.25	
RHS glass	Window	[1] ACDS 2015 T/F	East	None	0.00					4.77	
Rear door	Half Glazed Door	[1] ACDS 2015 T/F	North							2.10	
Rear velux	Roof Window	[2] Sloping ceiling	North	None						3.47	
Front velux	Roof Window	[2] Sloping ceiling	South	None						0.54	
RHS door	Half Glazed Door	[1] ACDS 2015 T/F	East							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
Loss	2.22
Pipes insulation	Fully insulated primary pipework

L kWh/day

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

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£71	B 85	