

# PREDICTED ENERGY ASSESSMENT

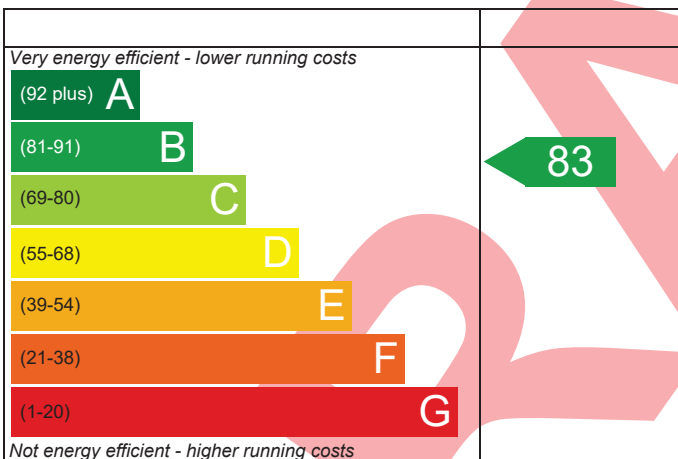
Cairnwell, Plot 94, Phase 4A ,  
Tarland Road,  
Aboyne

Dwelling type: House, Detached  
Date of assessment: 31/01/2023  
Produced by: Northern Energy  
Total floor area: 150.3 m<sup>2</sup>

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 (CO<sub>2</sub>) emissions.

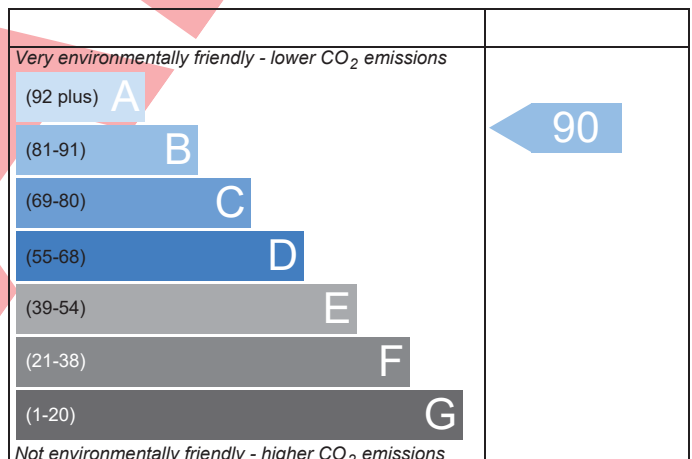
## Energy Efficiency Rating



**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 (CO<sub>2</sub>) 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 (CO<sub>2</sub>) 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 94 cairnwell	Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref	
Property	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne		

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	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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### 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)	11.80	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	10.76	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.04 (-8.8%)	kgCO <sub>2</sub> /m <sup>2</sup>	

#### 6.2 Building insulation envelope

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.22)	0.19 (max. 0.70)	Pass
Floor	0.12 (max. 0.18)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.15)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 1.60)	1.40 (max. 3.30)	Pass

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

Air permeability at 50 pascals	4.00 (design value)
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#### 6.3 Heating System

##### 4 Heating efficiency

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

##### 6 Controls

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

#### 6.4 Insulation of pipes, ducts and vessels

# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

### 5 Cylinder insulation

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

### 6.5 Artificial and display lighting

#### 7 Low energy lights

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

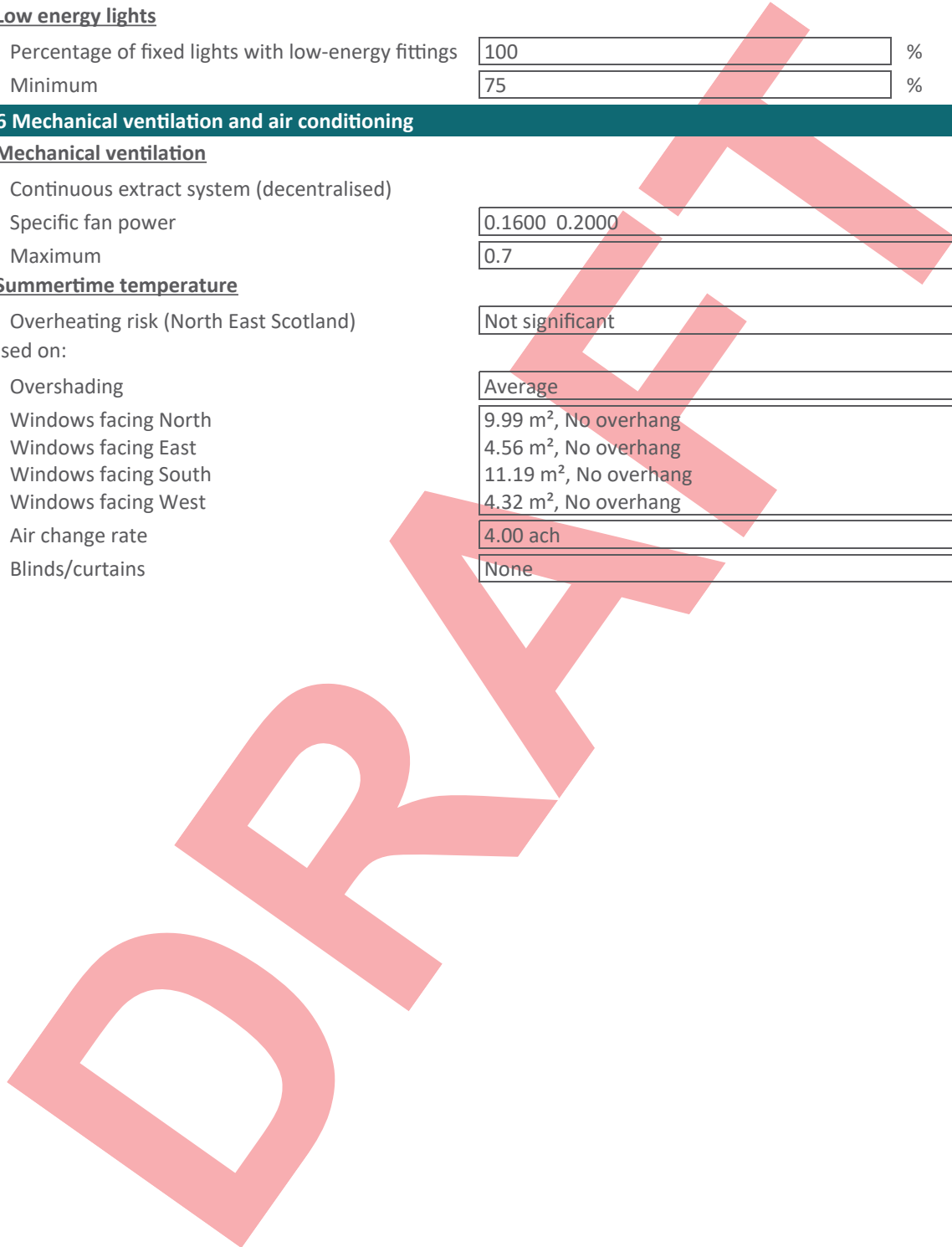
### 6.6 Mechanical ventilation and air conditioning

#### 8 Mechanical ventilation

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

#### 9 Summertime temperature

Overheating risk (North East Scotland)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing North	9.99 m <sup>2</sup> , No overhang	
Windows facing East	4.56 m <sup>2</sup> , No overhang	
Windows facing South	11.19 m <sup>2</sup> , No overhang	
Windows facing West	4.32 m <sup>2</sup> , No overhang	
Air change rate	4.00 ach	
Blinds/curtains	None	



# RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£101	B 86	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
<b>Totals</b>	<b>£4,000 - £6,000</b>	<b>£101</b>	<b>B 86</b>	<b>A 92</b>	

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

# THERMAL BRIDGING

## Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023	
Assessment Reference	Cairnwell	Prop Type Ref			
Property	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne				
SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	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					

	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	25.10	0.93	
External wall	E3 Sill	Scotland ACD 2015	0.033	16.70	0.55	
External wall	E4 Jamb	Scotland ACD 2015	0.031	57.50	1.78	
External wall	E5 Ground floor (normal)	Scotland ACD 2015	0.173	40.50	7.01	
External wall	E6 Intermediate floor within a dwelling	Scotland ACD 2015	0.065	34.50	2.24	
External wall	E10 Eaves (insulation at ceiling level)	Scotland ACD 2015	0.043	19.84	0.85	
External wall	E12 Gable (insulation at ceiling level)	Scotland ACD 2015	0.051	20.66	1.05	
External wall	E16 Corner (normal)	Scotland ACD 2015	0.038	29.50	1.12	
External wall	E17 Corner (inverted – internal area greater than external area)	Scotland ACD 2015	0.003	9.93	0.03	

Total: **15.57** W/mK:  
 Y-Value: **0.048** W/m<sup>2</sup>K:

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	ajc 4A 94 cairnwell			<b>Issued on Date</b>	31/01/2023
<b>Assessment Reference</b>	Cairnwell	<b>Prop Type Ref</b>			
<b>Property</b>	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne				
<b>SAP Rating</b>	83 B	<b>DER</b>	10.76	<b>TER</b>	11.80
<b>Environmental</b>	90 B	<b>% DER&lt;TER</b>	8.81		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.75	<b>FEE</b>	45.03	<b>TFEE</b>	N/A
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	N/A		
<b>Assessor Details</b>	Mr. William MacDougall, Northern Energy, Tel: 019755 81400, n.energy@btinternet.com			<b>Assessor ID</b>	1910-0001
<b>Client</b>					

# 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 150 m<sup>2</sup>

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) 11.80 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 10.76 kgCO<sub>2</sub>/m<sup>2</sup> OK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.22)	0.19 (max. 0.70)	OK
Floor	0.12 (max. 0.18)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.15)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 1.60)	1.40 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)

#### 4 Heating efficiency

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

Efficiency: 90.2% SEDBUK2009  
Minimum: 88.0% OK

Secondary heating system: None

#### 5 Cylinder insulation

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

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK  
Independent timer for DHW OK

Boiler interlock: Yes OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

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

#### 9 Summertime temperature

Overheating risk (North East Scotland): Not significant OK

Based on:

Overshading: Average  
Windows facing North: 9.99 m<sup>2</sup>, No overhang  
Windows facing East: 4.56 m<sup>2</sup>, No overhang  
Windows facing South: 11.19 m<sup>2</sup>, No overhang  
Windows facing West: 4.32 m<sup>2</sup>, No overhang  
Air change rate: 4.00 ach  
Blinds/curtains: None

#### 10 Key features

Roof U-value 0.10 W/m<sup>2</sup>K  
Floor U-value 0.12 W/m<sup>2</sup>K  
Photovoltaic array 1.68 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	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 387.1930 (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	4.0000
Measured/design AP50					0.2000 (18)
Infiltration rate					2 (19)
Number of sides sheltered					
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

	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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross 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 to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m2)			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 87.0088		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m													
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	238.4963	210.3102	221.1045	198.5280	194.7845	174.3828	167.7953	183.6833	183.2210	205.8463	217.2560	232.8670	(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	-35.8495	-30.6791	-30.6604	-25.9082	-23.7372	-10.2193	-9.9102	-10.7427	-10.6824	-26.5588	-30.8177	-35.3378	eq. (G6)
Output from w/h	202.6468	179.6310	190.4441	172.6198	171.0473	164.1635	157.8851	172.9407	172.5386	179.2875	186.4382	197.5292	(64)
Heat gains from water heating, kWh/month	107.3923	95.3018	101.6095	93.1966	92.8581	85.1683	83.8842	89.1670	88.1071	96.5362	99.4237	105.5205	(65)
												Total per year (kWh/year) = Sum(64)m =	2147.1719 (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	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8054	25.5847	20.8069	15.7521	11.7749	9.9409	10.7415	13.9622	18.7400	23.7947	27.7719	29.6060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8488	324.1782	315.7882	297.9269	275.3802	254.1895	240.0328	236.7034	245.0934	262.9547	285.5014	306.6921	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	(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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	144.3445	141.8181	136.5719	129.4397	124.8093	118.2894	112.7476	119.8481	122.3709	129.7529	138.0884	141.8287	(72)
Total internal gains	564.0185	561.6008	543.1868	513.1386	481.9842	452.4395	433.5416	440.5334	456.2241	486.5221	521.3816	548.1466	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
North	9.9900	10.6334	0.6300	0.7000	0.7700	32.4645 (74)							
East	4.5600	19.6403	0.6300	0.7000	0.7700	27.3706 (76)							
South	11.1900	46.7521	0.6300	0.7000	0.7700	159.8832 (78)							
West	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300 (80)							
Solar gains	245.6483	428.1561	610.6840	796.7515	927.8657	936.4367	896.4884	796.5382	674.8923	480.0011	296.0248	209.0496	(83)
Total gains	809.6668	989.7569	1153.8708	1309.8901	1409.8499	1388.8762	1330.0300	1237.0716	1131.1164	966.5232	817.4064	757.1962	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	
util living area	0.9735	0.9548	0.9222	0.8605	0.7608	0.6257	0.4941	0.5399	0.7332	0.8945	0.9590	0.9776	(86)
MIT	18.5971	18.9068	19.3718	19.9299	20.4263	20.7631	20.9092	20.8820	20.6149	19.9545	19.1542	18.5192	(87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	(88)
util rest of house	0.9694	0.9480	0.9102	0.8380	0.7200	0.5573	0.3989	0.4452	0.6742	0.8727	0.9517	0.9742	(89)
MIT 2	16.7652	17.2127	17.8812	18.6709	19.3486	19.7756	19.9337	19.9104	19.6082	18.7217	17.5764	16.6522	(90)
Living area fraction	17.1327	17.5525	18.1802	18.9235	19.5648	19.9737	20.1294	20.1053	19.8102	18.9690	17.8929	17.0267	(91)
MIT	16.9827	17.4025	18.0302	18.7735	19.4148	19.8237	19.9794	19.9553	19.6602	18.8190	17.7429	16.8767	(93)
Temperature adjustment													-0.1500
adjusted MIT													16.8767 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9509	0.9230	0.8789	0.8042	0.6929	0.5445	0.3974	0.4411	0.6513	0.8391	0.9276	0.9576	(94)
Ext temp.	769.9361	913.5444	1014.1612	1053.3865	976.8927	756.2119	528.5366	545.7096	736.7283	811.0090	758.2223	725.0590	(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	2111.2128	2081.2303	1919.3661	1643.5826	1284.2426	869.5603	562.5511	591.8355	925.5692	1368.1691	1771.6652	2110.2239	(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)
	997.9099	784.6849	673.4724	424.9412	228.6683	0.0000	0.0000	0.0000	0.0000	414.5271	729.6789	1030.5627	(98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 5284.4453 (98)  
 Space heating per m2 (98) / (4) = 35.1593 (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	997.9099	784.6849	673.4724	424.9412	228.6683	0.0000	0.0000	0.0000	0.0000	414.5271	729.6789	1030.5627	(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)	1094.1994	860.4001	738.4566	465.9443	250.7328	0.0000	0.0000	0.0000	0.0000	454.5253	800.0865	1130.0030	(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	202.6468	179.6310	190.4441	172.6198	171.0473	164.1635	157.8851	172.9407	172.5386	179.2875	186.4382	197.5292	(64)
Efficiency of water heater (217)m	89.1987	88.9965	88.6038	87.8277	86.2918	80.5000	80.5000	80.5000	80.5000	87.6812	88.7980	80.5000	(216)
Fuel for water heating, kWh/month	227.1857	201.8407	214.9390	196.5437	198.2197	203.9298	196.1306	214.8331	214.3337	204.4765	209.9577	221.2195	(219)
Water heating fuel used												2503.6097	(219)
Annual totals kWh/year													
Space heating fuel - main system												5794.3479	(211)
Space heating fuel - secondary												0.0000	(215)

#### Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 11.0240, total flow = 45.0000, SFP = 0.2450)  
 mechanical ventilation fans (SFP = 0.2450) 115.7215 (230a)  
 central heating pump 30.0000 (230c)  
 main heating flue fan 45.0000 (230e)  
 Total electricity for the above, kWh/year 190.7215 (231)  
 Electricity for lighting (calculated in Appendix L) 508.7122 (232)

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

PV Unit 0 (0.80 \* 1.68 \* 1068 \* 1.00) = -1435.4867 -1435.4867 (233)  
 Total delivered energy for all uses 7561.9045 (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	5794.3479	0.2410	1396.4378	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2503.6097	0.2410	603.3699	(264)
Space and water heating			1999.8078	(265)
Pumps and fans	190.7215	0.5190	98.9845	(267)
Energy for lighting	508.7122	0.5190	264.0216	(268)
Energy saving/generation technologies				
PV Unit	-1435.4867	0.5190	-745.0176	(269)
Total CO2, kg/year			1617.7962	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.7600	(273)

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

	DER	TFA	N	EF	
Total Floor Area		150.3000			ZC1
Assumed number of occupants		2.9347			
CO2 emission factor in Table 12 for electricity displaced from grid			0.5190		
CO2 emissions from appliances, equation (L14)				12.6499	ZC2
CO2 emissions from cooking, equation (L16)				1.2604	ZC3
Total CO2 emissions				24.6703	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				24.6703	ZC8

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 387.1930 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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) =	0.1550 (8)							
Pressure test					Yes							
Measured/design AP50					7.0000							
Infiltration rate					0.5050 (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) =	0.4292 (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	0.5473	0.5365	0.5258	0.4721	0.4614	0.4078	0.4078	0.3970	0.4292	0.4614	0.4829	0.5043 (22b)
Effective ac	0.6497	0.6439	0.6382	0.6115	0.6064	0.5831	0.5831	0.5788	0.5921	0.6064	0.6166	0.6272 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Opaque door			1.8500	1.4000	2.5900		(26)					
TER Opening Type (Uw = 1.40)			35.7300	1.3258	47.3693		(27)					
Insulated slab			79.0000	0.1500	11.8500		(28a)					
Main T/Frame ACDS	166.5900	37.5800	129.0100	0.1700	21.9317		(29a)					
Horizontal ceiling	79.0000		79.0000	0.1100	8.6900		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			324.5900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 92.4310		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.0000 (35)					
Thermal bridges (User defined value 0.080 * total exposed area)							25.9672 (36)					
Total fabric heat loss							(33) + (36) = 118.3982 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 83.0200	Feb 82.2770	Mar 81.5488	Apr 78.1282	May 77.4882	Jun 74.5090	Jul 74.5090	Aug 73.9573	Sep 75.6566	Oct 77.4882	Nov 78.7829	Dec 80.1364 (38)
Heat transfer coeff	201.4182	200.6752	199.9470	196.5264	195.8864	192.9072	192.9072	192.3555	194.0548	195.8864	197.1811	198.5346 (39)
Average = Sum(39)m / 12 =												196.5233 (39)
HLP	Jan 1.3401	Feb 1.3352	Mar 1.3303	Apr 1.3076	May 1.3033	Jun 1.2835	Jul 1.2835	Aug 1.2798	Sep 1.2911	Oct 1.3033	Nov 1.3119	Dec 1.3209 (40)
HLP (average)												1.3075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)
Energy content (annual)												Total = Sum(45)m = 1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165 (46)
Water storage loss:												150.0000 (47)
Store volume												1.8900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												1.0206 (55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386 (56)
If cylinder contains dedicated solar storage	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	233.3069	205.6230	215.9151	193.5060	189.5951	169.3608	162.6059	178.4939	178.1990	200.6569	212.2340	227.6776 (62)
WWHRS	-43.7756	-38.5160	-39.3111	-32.3508	-30.0419	-24.7855	-20.9813	-25.4020	-26.1410	-32.3106	-37.4208	-42.3096 eq. (G10)
Total of WWHRS savings												-393.3462
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	189.5313	167.1070	176.6040	161.1552	159.5532	144.5752	141.6246	153.0920	152.0580	168.3463	174.8132	185.3680 (64)
Heat gains from water heating, kWh/month	103.2408	91.5520	97.4580	89.1790	88.7066	81.1507	79.7327	85.0155	84.0895	92.3846	95.4061	101.3690 (65)
											Total per year (kWh/year) = Sum(64)m =	1973.8280 (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	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6039	25.4057	20.6613	15.6420	11.6925	9.8713	10.6663	13.8645	18.6089	23.6283	27.5777	29.3989 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8488	324.1782	315.7882	297.9269	275.3802	254.1895	240.0328	236.7034	245.0934	262.9547	285.5014	306.6921 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733 (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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862 (71)
Water heating gains (Table 5)	138.7645	136.2381	130.9919	123.8597	119.2293	112.7094	107.1676	114.2681	116.7909	124.1729	132.5084	136.2487 (72)
Total internal gains	558.2370	555.8419	537.4613	507.4484	476.3218	446.7900	427.8865	434.8558	450.5130	480.7757	515.6073	542.3595 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
East	35.7300	19.6403	0.6300	0.7000	0.7700	214.4629 (76)						
Solar gains	214.4629	419.5349	690.9142	1007.6572	1234.9218	1264.1622	1203.5339	1033.8179	803.5619	497.8135	267.4100	176.3638 (83)
Total gains	772.6999	975.3768	1228.3755	1515.1056	1711.2436	1710.9522	1631.4204	1468.6736	1254.0749	978.5892	783.0173	718.7233 (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	20.7280	20.8048	20.8805	21.2440	21.3134	21.6425	21.6425	21.7046	21.5145	21.3134	21.1734	21.0291
alpha	2.3819	2.3870	2.3920	2.4163	2.4209	2.4428	2.4428	2.4470	2.4343	2.4209	2.4116	2.4019
util living area	0.9767	0.9593	0.9219	0.8446	0.7295	0.5874	0.4637	0.5185	0.7317	0.9041	0.9647	0.9802 (86)
MIT	18.0904	18.4362	19.0233	19.7620	20.3528	20.7392	20.8952	20.8597	20.5224	19.6992	18.7653	18.0476 (87)
Th 2	19.8095	19.8134	19.8172	19.8349	19.8382	19.8538	19.8538	19.8567	19.8478	19.8382	19.8315	19.8245 (88)
util rest of house	0.9727	0.9525	0.9087	0.8181	0.6822	0.5119	0.3609	0.4146	0.6662	0.8819	0.9578	0.9769 (89)
MIT 2	15.9347	16.4372	17.2831	18.3335	19.1328	19.6247	19.7891	19.7634	19.3833	18.2733	16.9294	15.8800 (90)
Living area fraction												fLA = Living area / (4) = 0.2006 (91)
MIT	16.3671	16.8382	17.6322	18.6201	19.3775	19.8483	20.0110	19.9833	19.6118	18.5594	17.2977	16.3148 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.2171	16.6882	17.4822	18.4701	19.2275	19.6983	19.8610	19.8333	19.4618	18.4094	17.1477	16.1648 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9534	0.9254	0.8724	0.7792	0.6534	0.5006	0.3616	0.4123	0.6402	0.8440	0.9327	0.9598 (94)
Useful gains	736.7002	902.5919	1071.6554	1180.5459	1118.1079	856.4967	589.9078	605.5136	802.8431	825.9217	730.3164	689.8477 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2400.3283	2365.5984	2195.8593	1880.7751	1474.5332	983.4990	629.0611	660.4211	1040.4777	1529.7461	1981.2103	2375.4257 (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	1237.7393	983.1403	836.4078	504.1650	265.1804	0.0000	0.0000	0.0000	0.0000	523.6454	900.6436	1254.0700 (98)
Space heating												6504.9918 (98)
Space heating per m <sup>2</sup>												(98) / (4) = 43.2801 (99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

-----  
 9a. Energy requirements - Individual heating systems, including micro-CHP  
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Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													92.0000 (206)
Efficiency of secondary/supplementary heating system, %													60.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1237.7393	983.1403	836.4078	504.1650	265.1804	0.0000	0.0000	0.0000	0.0000	523.6454	900.6436	1254.0700	(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)	1210.8320	961.7677	818.2250	493.2049	259.4156	0.0000	0.0000	0.0000	0.0000	512.2618	881.0644	1226.8076	(211)
Water heating requirement	206.2899	163.8567	139.4013	84.0275	44.1967	0.0000	0.0000	0.0000	0.0000	87.2742	150.1073	209.0117	(215)
Water heating requirement	189.5313	167.1070	176.6040	161.1552	159.5532	144.5752	141.6246	153.0920	152.0580	168.3463	174.8132	185.3680	(64)
Efficiency of water heater (217)m	88.6789	88.5141	88.1346	87.2697	85.6530	79.3000	79.3000	79.3000	79.3000	87.2565	88.2879	88.7321	(217)
Fuel for water heating, kWh/month	213.7276	188.7914	200.3799	184.6635	186.2787	182.3143	178.5934	193.0542	191.7504	192.9328	198.0036	208.9074	(219)
Water heating fuel used													2319.3972 (219)
Annual totals kWh/year													
Space heating fuel - main system													6363.5790 (211)
Space heating fuel - secondary													1084.1653 (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)													505.1538 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.50 * 1029 * 1.00) =										-1235.0241			-1235.0241 (233)
Total delivered energy for all uses													9112.2712 (238)

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6363.5790	0.2410	1533.6225 (261)
Space heating - secondary	1084.1653	0.0190	20.5991 (263)
Water heating (other fuel)	2319.3972	0.2410	558.9747 (264)
Space and water heating			2113.1964 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	505.1538	0.5190	262.1748 (268)
Energy saving/generation technologies			
PV Unit	-1235.0241	0.5190	-640.9775 (269)
Total CO2, kg/m2/year			1773.3187 (272)
Target Carbon Dioxide Emission Rate (TER) = 1773.3187 / 150.30, rounded to 2 d.p.			11.8000 (273)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 387.1930 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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) =	0.1033 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3033 (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) =	0.2578 (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	0.3287	0.3223	0.3158	0.2836	0.2771	0.2449	0.2449	0.2385	0.2578	0.2771	0.2900	0.3029 (22b)
	0.5540	0.5519	0.5499	0.5402	0.5384	0.5300	0.5300	0.5284	0.5332	0.5384	0.5421	0.5459 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Half hour door to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.0088		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss						(33) + (36) =	102.5776 (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	70.7898	70.5218	70.2590	69.0249	68.7940	67.7192	67.7192	67.5201	68.1332	68.7940	69.2611	69.7495 (38)
Heat transfer coeff	173.3675	173.0994	172.8367	171.6026	171.3717	170.2968	170.2968	170.0978	170.7108	171.3717	171.8388	172.3271 (39)
Average = Sum(39)m / 12 =												171.6015 (39)
HLP	1.1535	1.1517	1.1499	1.1417	1.1402	1.1330	1.1330	1.1317	1.1358	1.1402	1.1433	1.1466 (40)
HLP (average)												1.1417 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)
Energy content (annual)												Total = Sum(45)m = 1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	37.9113	33.1574	34.2155	29.8299	28.6225	24.6990	22.8873	26.2635	26.5772	30.9731	33.8096	36.7150	(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	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	146.7328	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8054	25.5847	20.8069	15.7521	11.7749	9.9409	10.7415	13.9622	18.7400	23.7947	27.7719	29.6060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8488	324.1782	315.7882	297.9269	275.3802	254.1895	240.0328	236.7034	245.0934	262.9547	285.5014	306.6921	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	37.6733	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	50.9560	49.3414	45.9886	41.4304	38.4711	34.3042	30.7625	35.3004	36.9127	41.6306	46.9578	49.3482	(72)
Total internal gains	467.6300	466.1241	449.6035	422.1293	392.6460	365.4544	348.5566	352.9858	367.7659	395.3998	427.2509	452.6660	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North		9.9900	10.6334	0.6300		0.7000	0.7700	32.4645	(74)
East		4.5600	19.6403	0.6300		0.7000	0.7700	27.3706	(76)
South		11.1900	46.7521	0.6300		0.7000	0.7700	159.8832	(78)
West		4.3200	19.6403	0.6300		0.7000	0.7700	25.9300	(80)

Solar gains	245.6483	428.1561	610.6840	796.7515	927.8657	936.4367	896.4884	796.5382	674.8923	480.0011	296.0248	209.0496	(83)
Total gains	713.2783	894.2802	1060.2874	1218.8808	1320.5117	1301.8911	1245.0449	1149.5239	1042.6582	875.4008	723.2757	661.7157	(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	24.0818	24.1191	24.1558	24.3295	24.3623	24.5160	24.5160	24.5447	24.4566	24.3623	24.2960	24.2272		
alpha	2.6055	2.6079	2.6104	2.6220	2.6242	2.6344	2.6344	2.6363	2.6304	2.6242	2.6197	2.6151		
util living area	0.9803	0.9644	0.9361	0.8805	0.7882	0.6578	0.5271	0.5760	0.7671	0.9148	0.9691	0.9837		(86)
MIT	18.3928	18.7138	19.2007	19.8041	20.3405	20.7208	20.8888	20.8560	20.5484	19.8294	18.9893	18.3292		(87)
Th 2	19.9574	19.9588	19.9603	19.9669	19.9681	19.9739	19.9739	19.9750	19.9717	19.9681	19.9656	19.9630		(88)
util rest of house	0.9772	0.9588	0.9257	0.8599	0.7491	0.5887	0.4270	0.4774	0.7101	0.8958	0.9633	0.9811		(89)
MIT 2	17.5621	17.8808	18.3615	18.9525	19.4579	19.7961	19.9226	19.9041	19.6588	18.9887	18.1617	17.5028		(90)
Living area fraction									fLA = Living area / (4) =			0.2006		(91)
MIT	17.7288	18.0479	18.5299	19.1233	19.6350	19.9816	20.1164	20.0950	19.8373	19.1573	18.3277	17.6686		(92)
Temperature adjustment												0.0000		
adjusted MIT	17.7288	18.0479	18.5299	19.1233	19.6350	19.9816	20.1164	20.0950	19.8373	19.1573	18.3277	17.6686		(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9677	0.9450	0.9074	0.8396	0.7346	0.5893	0.4419	0.4900	0.7015	0.8769	0.9508	0.9729	(94)	
Useful gains	690.2643	845.0852	962.0759	1023.4283	970.0605	767.1789	550.2438	563.2565	731.4407	767.6820	687.6623	643.7548	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	2328.1110	2275.8878	2079.2012	1754.3429	1359.8313	916.4686	598.8362	628.5170	979.4109	1466.4791	1929.3588	2321.0039	(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	1218.5579	961.4994	831.1412	526.2585	289.9895	0.0000	0.0000	0.0000	0.0000	519.9051	894.0215	1247.8733	(98)	
Space heating												6489.2463	(98)	
Space heating per m2												(98) / (4) =	43.1753	(99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1600.7901	1260.1965	1292.7431	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7352	0.8006	0.7695	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1176.8242	1008.8524	994.7668	0.0000	0.0000	0.0000	0.0000	(102)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1647.3158	1577.9532	1468.7488	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	338.7540	423.4110	352.6426	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1114.8076 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	84.6885	105.8528	88.1606	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												278.7019 (107)
Space cooling per m2												1.8543 (108)
Energy for space heating												43.1753 (99)
Energy for space cooling												1.8543 (108)
Total												45.0296 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.0 (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	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 387.1930 (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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross 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 to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m2)			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	87.0088	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)
HLP	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (40)
HLP (average)												1.1075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m													
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	238.4963	210.3102	221.1045	198.5280	194.7845	174.3828	167.7953	183.6833	183.2210	205.8463	217.2560	232.8670	(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	238.4963	210.3102	221.1045	198.5280	194.7845	174.3828	167.7953	183.6833	183.2210	205.8463	217.2560	232.8670	(64)
Total per year (kWh/year) = Sum(64)m =												2428.2752 (64)	
												2428 (64)	
RHI water heating demand													
Heat gains from water heating, kWh/month	107.3923	95.3018	101.6095	93.1966	92.8581	85.1683	83.8842	89.1670	88.1071	96.5362	99.4237	105.5205	(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	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.0135	63.9617	52.0172	39.3803	29.4373	24.8522	26.8537	34.9054	46.8500	59.4868	69.4299	74.0150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	478.8788	483.8480	471.3256	444.6670	411.0152	379.3873	358.2579	353.2886	365.8110	392.4696	426.1214	457.7494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	(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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	144.3445	141.8181	136.5719	129.4397	124.8093	118.2894	112.7476	119.8481	122.3709	129.7529	138.0884	141.8287	(72)
Total internal gains	812.4724	806.8636	777.1504	730.7228	682.4975	639.7645	615.0948	625.2778	652.2676	698.9450	750.8754	790.8287	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
North	9.9900	8.2005	0.6300	0.7000	0.7700	25.0368 (74)							
East	4.5600	14.7869	0.6300	0.7000	0.7700	20.6070 (76)							
South	11.1900	38.1750	0.6300	0.7000	0.7700	130.5511 (78)							
West	4.3200	14.7869	0.6300	0.7000	0.7700	19.5224 (80)							
Solar gains	195.7173	387.7651	608.2486	800.1444	970.9614	904.8164	865.7930	763.9091	632.1867	425.4012	244.3795	151.9787	(83)
Total gains	1008.1898	1194.6287	1385.3991	1530.8671	1653.4589	1544.5809	1480.8878	1389.1869	1284.4542	1124.3463	995.2550	942.8074	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	
util living area	0.9618	0.9427	0.9080	0.8562	0.7842	0.7081	0.6358	0.6666	0.7810	0.8962	0.9489	0.9687	(86)
MIT	18.6152	18.8642	19.3044	19.7899	20.2146	20.5523	20.7302	20.6913	20.4028	19.7656	19.0667	18.4669	(87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	(88)
util rest of house	0.9565	0.9350	0.8957	0.8365	0.7540	0.6616	0.5738	0.6061	0.7404	0.8781	0.9409	0.9644	(89)
MIT 2	16.7881	17.1461	17.7768	18.4646	19.0518	19.5077	19.7330	19.6897	19.3236	18.4464	17.4448	16.5732	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	17.1546	17.4908	18.0832	18.7304	19.2851	19.7173	19.9330	19.8907	19.5401	18.7111	17.7701	16.9530	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0046	17.3408	17.9332	18.5804	19.1351	19.5673	19.7830	19.7407	19.3901	18.5611	17.6201	16.8030	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	941.3837	1083.8186	1195.7414	1228.6881	1197.2080	987.6439	828.4911	818.2734	914.2544	949.6844	909.9988	890.1509	(95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000	(96)
Heat loss rate W	2281.3348	2287.3498	2152.9263	1911.0866	1637.1867	1226.3869	962.6663	972.2624	1230.1925	1624.8688	1984.2814	2314.3638	(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	996.9236	808.7730	712.1455	491.3269	327.3442	0.0000	0.0000	0.0000	0.0000	502.3372	773.4835	1059.6144	(98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating  
RHI space heating demand

5671.9484 (98)  
5672 (98)

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# 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	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 387.1930 (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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross 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 to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m2)			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	87.0088	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)
HLP	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (40)
HLP (average)												1.1075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m													
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	238.4963	210.3102	221.1045	198.5280	194.7845	174.3828	167.7953	183.6833	183.2210	205.8463	217.2560	232.8670	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
FGHRS	-34.8096	-29.8897	-29.9297	-25.4308	-23.1323	-10.2193	-9.9102	-10.7427	-10.6824	-26.0145	-30.0108	-34.4401	eq. (G6)
Output from w/h	203.6867	180.4205	191.1748	173.0972	171.6522	164.1635	157.8851	172.9407	172.5386	179.8318	187.2452	198.4269	(64)
Heat gains from water heating, kWh/month	107.3923	95.3018	101.6095	93.1966	92.8581	85.1683	83.8842	89.1670	88.1071	96.5362	99.4237	105.5205	(65)
												Total per year (kWh/year) = Sum(64)m =	2153.0632 (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	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.0135	63.9617	52.0172	39.3803	29.4373	24.8522	26.8537	34.9054	46.8500	59.4868	69.4299	74.0150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	478.8788	483.8480	471.3256	444.6670	411.0152	379.3873	358.2579	353.2886	365.8110	392.4696	426.1214	457.7494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	(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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	144.3445	141.8181	136.5719	129.4397	124.8093	118.2894	112.7476	119.8481	122.3709	129.7529	138.0884	141.8287	(72)
Total internal gains	812.4724	806.8636	777.1504	730.7228	682.4975	639.7645	615.0948	625.2778	652.2676	698.9450	750.8754	790.8287	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	9.9900	10.6334	0.6300	0.7000	0.7700	32.4645	(74)						
East	4.5600	19.6403	0.6300	0.7000	0.7700	27.3706	(76)						
South	11.1900	46.7521	0.6300	0.7000	0.7700	159.8832	(78)						
West	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300	(80)						
Solar gains	245.6483	428.1561	610.6840	796.7515	927.8657	936.4367	896.4884	796.5382	674.8923	480.0011	296.0248	209.0496	(83)
Total gains	1058.1207	1235.0197	1387.8344	1527.4743	1610.3632	1576.2012	1511.5832	1421.8160	1327.1599	1178.9461	1046.9003	999.8783	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	
util living area	0.9517	0.9278	0.8885	0.8191	0.7132	0.5751	0.4458	0.4855	0.6732	0.8489	0.9304	0.9579	(86)
MIT	18.8611	19.1490	19.5757	20.0794	20.5179	20.8082	20.9293	20.9091	20.6922	20.1187	19.3837	18.7816	(87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	(88)
util rest of house	0.9448	0.9177	0.8727	0.7926	0.6696	0.5073	0.3565	0.3957	0.6110	0.8208	0.9190	0.9518	(89)
MIT 2	17.1448	17.5574	18.1656	18.8705	19.4603	19.8208	19.9483	19.9314	19.6937	18.9412	17.9018	17.0305	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	17.4891	17.8767	18.4484	19.1130	19.6724	20.0189	20.1451	20.1275	19.8940	19.1774	18.1991	17.3818	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3391	17.7267	18.2984	18.9630	19.5224	19.8689	19.9951	19.9775	19.7440	19.0274	18.0491	17.2318	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	972.4792	1095.7980	1164.4278	1161.3711	1041.3273	785.1619	538.9190	560.2543	787.8193	928.4042	930.4158	927.6301	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2170.5461	2135.1937	1964.0213	1675.1369	1302.1560	877.0799	565.1651	595.5306	939.5270	1402.8710	1822.6345	2169.3247	(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	891.3617	698.4740	594.8975	369.9114	194.0565	0.0000	0.0000	0.0000	0.0000	353.0033	642.3974	923.8208	(98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 4667.9227 (98)  
 Space heating per m2 (98) / (4) = 31.0574 (99)

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													91.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	891.3617	698.4740	594.8975	369.9114	194.0565	0.0000	0.0000	0.0000	0.0000	353.0033	642.3974	923.8208	(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)	977.3703	765.8706	652.2999	405.6046	212.7812	0.0000	0.0000	0.0000	0.0000	387.0650	704.3831	1012.9614	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	203.6867	180.4205	191.1748	173.0972	171.6522	164.1635	157.8851	172.9407	172.5386	179.8318	187.2452	198.4269	(64)
Efficiency of water heater (217)m	88.9996	88.7776	88.3442	87.4928	85.8443	80.5000	80.5000	80.5000	80.5000	87.2844	88.5438	80.5000	(216)
Fuel for water heating, kWh/month	228.8625	203.2274	216.3978	197.8416	199.9576	203.9298	196.1306	214.8331	214.3337	206.0297	211.4719	222.6867	(219)
Water heating fuel used													2515.7025 (219)
Annual totals kWh/year													5118.3362 (211)
Space heating fuel - main system													0.0000 (215)
Space heating fuel - secondary													
Electricity for pumps and fans: (MEV)Decentralised, Database: total watage = 11.0240, total flow = 45.0000, SFP = 0.2450)													115.7215 (230a)
mechanical ventilation fans (SFP = 0.2450)													30.0000 (230c)
central heating pump													45.0000 (230e)
main heating flue fan													190.7215 (231)
Total electricity for the above, kWh/year													508.7122 (232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.68 * 1068 * 1.00) =													-1435.4867 (233)
Total delivered energy for all uses													6897.9857 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5118.3362	7.6000	388.9936	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2515.7025	7.6000	191.1934	(247)
Mechanical ventilation fans	115.7215	13.1900	15.2637	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	508.7122	13.1900	67.0991	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1435.4867	13.1900	-189.3407	(252)
Total energy cost			553.1015	(255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1895 (257)
SAP value		83.4070
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5118.3362	0.2410	1233.5190	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.7025	0.2410	606.2843	(264)
Space and water heating			1839.8033	(265)
Pumps and fans	190.7215	0.5190	98.9845	(267)
Energy for lighting	508.7122	0.5190	264.0216	(268)
Energy saving/generation technologies				
PV Unit	-1435.4867	0.5190	-745.0176	(269)
Total kg/year			1457.7918	(272)
CO2 emissions per m2			9.7000	(273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value  
EI rating  
EI band

89.9977  
90 (274)  
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	$7.60 / 0.8553 = 8.885$ , stars = 3
Water heating environmental impact	$0.241 / 0.8553 = 0.2818$ , stars = 5

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# 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	79.3000 (1b)	x 2.5100 (2b)	= 199.0430 (1b) - (3b)
First floor	71.0000 (1c)	x 2.6500 (2c)	= 188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 387.1930 (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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross 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 to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m2)			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	87.0088	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m													
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1880	(55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	238.4963	210.3102	221.1045	198.5280	194.7845	174.3828	167.7953	183.6833	183.2210	205.8463	217.2560	232.8670	(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)
													(63)
FGHRS	-35.8399	-30.8997	-31.0200	-26.4842	-24.5746	-10.2193	-9.9102	-10.7427	-10.6824	-27.3357	-31.2227	-35.4947	eq. (G6)
Output from w/h	202.6564	179.4105	190.0845	172.0438	170.2100	164.1635	157.8851	172.9407	172.5386	178.5106	186.0332	197.3723	(64)
													(64)
Heat gains from water heating, kWh/month	107.3923	95.3018	101.6095	93.1966	92.8581	85.1683	83.8842	89.1670	88.1071	96.5362	99.4237	105.5205	(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	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.0135	63.9617	52.0172	39.3803	29.4373	24.8522	26.8537	34.9054	46.8500	59.4868	69.4299	74.0150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	478.8788	483.8480	471.3256	444.6670	411.0152	379.3873	358.2579	353.2886	365.8110	392.4696	426.1214	457.7494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	(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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	144.3445	141.8181	136.5719	129.4397	124.8093	118.2894	112.7476	119.8481	122.3709	129.7529	138.0884	141.8287	(72)
Total internal gains	812.4724	806.8636	777.1504	730.7228	682.4975	639.7645	615.0948	625.2778	652.2676	698.9450	750.8754	790.8287	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
North	9.9900	8.2005	0.6300	0.7000	0.7700	25.0368 (74)							
East	4.5600	14.7869	0.6300	0.7000	0.7700	20.6070 (76)							
South	11.1900	38.1750	0.6300	0.7000	0.7700	130.5511 (78)							
West	4.3200	14.7869	0.6300	0.7000	0.7700	19.5224 (80)							
Solar gains	195.7173	387.7651	608.2486	800.1444	970.9614	904.8164	865.7930	763.9091	632.1867	425.4012	244.3795	151.9787	(83)
Total gains	1008.1898	1194.6287	1385.3991	1530.8671	1653.4589	1544.5809	1480.8878	1389.1869	1284.4542	1124.3463	995.2550	942.8074	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	
util living area	0.9618	0.9427	0.9080	0.8562	0.7842	0.7081	0.6358	0.6666	0.7810	0.8962	0.9489	0.9687	(86)
MIT	18.6152	18.8642	19.3044	19.7899	20.2146	20.5523	20.7302	20.6913	20.4028	19.7656	19.0667	18.4669	(87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	(88)
util rest of house	0.9565	0.9350	0.8957	0.8365	0.7540	0.6616	0.5738	0.6061	0.7404	0.8781	0.9409	0.9644	(89)
MIT 2	16.7881	17.1461	17.7768	18.4646	19.0518	19.5077	19.7330	19.6897	19.3236	18.4464	17.4448	16.5732	(90)
Living area fraction													(91)
MIT	17.1546	17.4908	18.0832	18.7304	19.2851	19.7173	19.9330	19.8907	19.5401	18.7111	17.7701	16.9530	(92)
Temperature adjustment													(93)
adjusted MIT	17.0046	17.3408	17.9332	18.5804	19.1351	19.5673	19.7830	19.7407	19.3901	18.5611	17.6201	16.8030	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	941.3837	1083.8186	1195.7414	1228.6881	1197.2080	987.6439	828.4911	818.2734	914.2544	949.6844	909.9988	890.1509	(95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000	(96)
Heat loss rate W	2281.3348	2287.3498	2152.9263	1911.0866	1637.1867	1226.3869	962.6663	972.2624	1230.1925	1624.8688	1984.2814	2314.3638	(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	996.9236	808.7730	712.1455	491.3269	327.3442	0.0000	0.0000	0.0000	0.0000	502.3372	773.4835	1059.6144	(98)

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

Space heating 5671.9484 (98)  
 Space heating per m2 (98) / (4) = 37.7375 (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	996.9236	808.7730	712.1455	491.3269	327.3442	0.0000	0.0000	0.0000	0.0000	502.3372	773.4835	1059.6144	(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)	1093.1180	886.8125	780.8613	538.7356	358.9300	0.0000	0.0000	0.0000	0.0000	550.8084	848.1179	1161.8579	(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	202.6564	179.4105	190.0845	172.0438	170.2100	164.1635	157.8851	172.9407	172.5386	178.5106	186.0332	197.3723	(64)
Efficiency of water heater (217)m	89.1971	89.0510	88.7156	88.1609	87.2334	80.5000	80.5000	80.5000	80.5000	88.1287	88.9088	80.5000	(216)
Fuel for water heating, kWh/month	227.2008	201.4693	214.2627	195.1476	195.1201	203.9298	196.1306	214.8331	214.3337	202.5567	209.2406	220.9338	(219)
Water heating fuel used												2495.1588	(219)
Annual totals kWh/year												6219.2416	(211)
Space heating fuel - main system												0.0000	(215)
Space heating fuel - secondary													

#### Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 11.0240, total flow = 45.0000, SFP = 0.2450)  
 mechanical ventilation fans (SFP = 0.2450) 115.7215 (230a)  
 central heating pump 30.0000 (230c)  
 main heating flue fan 45.0000 (230e)  
 Total electricity for the above, kWh/year 190.7215 (231)  
 Electricity for lighting (calculated in Appendix L) 508.7122 (232)

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

PV Unit 0 (0.80 \* 1.68 \* 1017 \* 1.00) = -1366.9468 -1366.9468 (233)  
 Total delivered energy for all uses 8046.8873 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6219.2416	9.4500	587.7183	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2495.1588	9.4500	235.7925	(247)
Mechanical ventilation fans	115.7215	25.0500	28.9882	(249)
Pumps and fans for heating	75.0000	25.0500	18.7875	(249)
Energy for lighting	508.7122	25.0500	127.4324	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1366.9468	25.0500	-342.4202	(252)
Total energy cost			726.2988	(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	6219.2416	0.2410	1498.8372	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2495.1588	0.2410	601.3333	(264)
Space and water heating			2100.1705	(265)
Pumps and fans	190.7215	0.5190	98.9845	(267)
Energy for lighting	508.7122	0.5190	264.0216	(268)
Energy saving/generation technologies				
PV Unit	-1366.9468	0.5190	-709.4454	(269)
Total kg/year			1753.7312	(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	6219.2416	1.0900	6778.9734	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2495.1588	1.0900	2719.7231	(264)
Space and water heating			9498.6964	(265)

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Pumps and fans	190.7215	3.0700	585.5150 (267)
Energy for lighting	508.7122	3.0700	1561.7465 (268)
Energy saving/generation technologies			
PV Unit	-1366.9468	3.0700	-4196.5266 (269)
Primary energy kWh/year			7449.4313 (272)
Primary energy kWh/m <sup>2</sup> /year			49.5637 (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	+ 2.6	-£ 101	-262 kg (15.0%)

Current energy efficiency rating: B 83  
 Current environmental impact rating: B 90

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£101	1.75 kg/m <sup>2</sup>	B 86 A 92
<b>Total Savings</b>	<b>£101</b>	<b>1.75 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: B 86  
 Potential environmental impact rating: A 92

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

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

	Current	Potential	Saving
Electricity	£175	£188	-£13
Bulk LPG	£894	£780	£113
Space heating	£705	£710	-£4
Water heating	£236	£131	£105
Lighting	£127	£127	£0
Generated (PV)	-£342	-£342	£0
<b>Total cost of fuels</b>	<b>£727</b>	<b>£626</b>	<b>£100</b>
<b>Total cost of uses</b>	<b>£726</b>	<b>£626</b>	<b>£101</b>
Delivered energy	54 kWh/m <sup>2</sup>	46 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.8 tonnes	1.5 tonnes	0.3 tonnes
CO2 emissions per m <sup>2</sup>	12 kg/m <sup>2</sup>	10 kg/m <sup>2</sup>	2 kg/m <sup>2</sup>
Primary energy	50 kWh/m <sup>2</sup>	42 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	79.3000 (1b)	2.5100 (2b)	199.0430 (1b) - (3b)
First floor	71.0000 (1c)	2.6500 (2c)	188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 387.1930 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Half hour door to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	87.0088	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)
HLP	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (40)
HLP (average)												1.1075 (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												2.9347 (42)
Average daily hot water use (litres/day)												109.3664 (43)
Daily hot water use	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
Energy conte	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m														
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	(46)	
Water storage loss:														
Store volume														250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.2000 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)	
If cylinder contains dedicated solar storage	25.7796	23.2848	25.7796	24.9480	25.7796	24.9480	25.7796	25.7796	24.9480	25.7796	24.9480	25.7796	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	227.4479	200.3310	208.6604	181.0824	170.9418	151.0841	143.7200	160.5385	167.1262	193.4022	206.5640	221.8186	(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														1.0540 (H8)
Utilisation factor														0.6128 (H9)
Collector performance factor														0.8793 (H10)
Dedicated solar storage volume														75.0000 (H11)
Effective solar volume														127.5000 (H13)
Daily hot water demand														109.3664 (H14)
Volume ratio Veff/V														1.1658 (H15)
Solar storage volume factor														1.0000 (H16)
Solar input														-977.2209 (H17)
Solar input	-28.3375	-47.2871	-80.5353	-107.9332	-133.3423	-131.0968	-129.3643	-113.0262	-88.5222	-60.4502	-33.6123	-23.7136	(63)	
FGHRS	-30.5811	-23.3602	-19.1359	-8.7013	-2.7965	0.0000	0.0000	Solar input (sum of months) = Sum(63)m =					-977.2209 (63)	
Output from w/h	168.5293	129.6837	108.9891	64.4479	34.8030	19.9873	14.3557	-3.1768	-4.9011	-18.2486	-25.2638	-30.7461	eq. (G6)	
										Total per year (kWh/year) = Sum(64)m =			1088.5844 (64)	
Heat gains from water heating, kWh/month	98.5536	87.3184	91.6542	79.2401	73.7839	66.5294	64.6239	70.6511	75.2312	86.5808	90.8701	96.6818	(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	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.0135	63.9617	52.0172	39.3803	29.4373	24.8522	26.8537	34.9054	46.8500	59.4868	69.4299	74.0150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	478.8788	483.8480	471.3256	444.6670	411.0152	379.3873	358.2579	353.2886	365.8110	392.4696	426.1214	457.7494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	(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)	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	(71)
Water heating gains (Table 5)	132.4645	129.9381	123.1911	110.0557	99.1720	92.4019	86.8601	94.9612	104.4877	116.3721	126.2084	129.9487	(72)
Total internal gains	800.5924	794.9836	763.7696	711.3388	656.8601	613.8770	589.2073	600.3909	634.3844	685.5642	738.9954	778.9487	(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 Specific data or Table 6c	Access factor Table 6d	Gains W						
North	9.9900	10.6334	0.6300	0.7000	0.7700	32.4645	(74)						
East	4.5600	19.6403	0.6300	0.7000	0.7700	27.3706	(76)						
South	11.1900	46.7521	0.6300	0.7000	0.7700	159.8832	(78)						
West	4.3200	19.6403	0.6300	0.7000	0.7700	25.9300	(80)						
Solar gains	245.6483	428.1561	610.6840	796.7515	927.8657	936.4367	896.4884	796.5382	674.8923	480.0011	296.0248	209.0496	(83)
Total gains	1046.2407	1223.1397	1374.4536	1508.0903	1584.7258	1550.3137	1485.6957	1396.9290	1309.2767	1165.5653	1035.0203	987.9983	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	
util living area	0.9529	0.9292	0.8905	0.8228	0.7191	0.5817	0.4522	0.4923	0.6785	0.8518	0.9321	0.9590	(86)
MIT	18.8490	19.1378	19.5647	20.0670	20.5072	20.8027	20.9269	20.9059	20.6860	20.1092	19.3724	18.7692	(87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	(88)
util rest of house	0.9461	0.9193	0.8750	0.7966	0.6758	0.5138	0.3620	0.4018	0.6164	0.8241	0.9208	0.9531	(89)
MIT 2	17.1274	17.5416	18.1503	18.8541	19.4474	19.8153	19.9465	19.9290	19.6869	18.9286	17.8859	17.0127	(90)
Living area fraction												fLA = Living area / (4) =	0.2006 (91)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.4727	17.8618	18.4340	19.0974	19.6600	20.0134	20.1432	20.1250	19.8874	19.1655	18.1841	17.3650 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3227	17.7118	18.2840	18.9474	19.5100	19.8634	19.9932	19.9750	19.7374	19.0155	18.0341	17.2150 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9207	0.8891	0.8413	0.7642	0.6523	0.5042	0.3619	0.3999	0.5986	0.7907	0.8908	0.9293 (94)
Useful gains	963.2495	1087.4337	1156.3466	1152.4169	1033.7783	781.6049	537.6455	558.5778	783.7053	921.6018	922.0090	918.1509 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
2167.8234	2132.7092	1961.6246	1672.5413	1300.0811	876.1655	564.8463	595.1079	938.4195	1400.8747	1820.1361	2166.5377 (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												
896.2030	702.4251	599.1268	374.4895	198.1292	0.0000	0.0000	0.0000	0.0000	356.5790	646.6515	928.7998 (98)	
Space heating												
Space heating per m2												(98) / (4) = 31.2868 (99)

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												91.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	896.2030	702.4251	599.1268	374.4895	198.1292	0.0000	0.0000	0.0000	0.0000	356.5790	646.6515	928.7998 (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)	982.6787	770.2030	656.9373	410.6245	217.2470	0.0000	0.0000	0.0000	0.0000	390.9858	709.0477	1018.4208 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	168.5293	129.6837	108.9891	64.4479	34.8030	19.9873	14.3557	44.3355	73.7029	114.7033	147.6879	167.3589 (64)
Efficiency of water heater (217)m	89.3208	89.3491	89.3716	89.4542	89.4241	80.5000	80.5000	80.5000	80.5000	88.3421	89.0005	89.3860 (217)
Fuel for water heating, kWh/month	188.6787	145.1427	121.9505	72.0457	38.9190	24.8289	17.8332	55.0751	91.5563	129.8399	165.9404	187.2316 (219)
Water heating fuel used												1239.0422 (219)
Annual totals kWh/year												
Space heating fuel - main system												5156.1447 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 11.0240, total flow = 45.0000, SFP = 0.2450)												
mechanical ventilation fans (SFP = 0.2450)												115.7215 (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												240.7215 (231)
Electricity for lighting (calculated in Appendix L)												508.7122 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.68 * 1068 * 1.00) =									-1435.4867			-1435.4867 (233)
Total delivered energy for all uses												5709.1338 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5156.1447	7.6000	391.8670 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1239.0422	7.6000	94.1672 (247)
Mechanical ventilation fans	115.7215	13.1900	15.2637 (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	508.7122	13.1900	67.0991 (250)
Additional standing charges			70.0000 (251)
Energy saving/generation technologies			
PV Unit	-1435.4867	13.1900	-189.3407 (252)
Total energy cost			465.5438 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0012 (257)
SAP value		86.0337

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)  
SAP band

86 (258)  
B

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5156.1447	0.2410	1242.6309 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1239.0422	0.2410	298.6092 (264)
Space and water heating			1541.2400 (265)
Pumps and fans	240.7215	0.5190	124.9345 (267)
Energy for lighting	508.7122	0.5190	264.0216 (268)
Energy saving/generation technologies			
PV Unit	-1435.4867	0.5190	-745.0176 (269)
Total kg/year			1185.1785 (272)
CO2 emissions per m2			7.8900 (273)
EI value			91.8682
EI rating			92 (274)
EI band			A

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	79.3000 (1b)	x 2.5100 (2b)	= 199.0430 (1b) - (3b)
First floor	71.0000 (1c)	x 2.6500 (2c)	= 188.1500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	150.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 387.1930 (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)							
Wind speed	Jan 5.7000	Feb 5.8000	Mar 5.7000	Apr 5.0000	May 4.6000	Jun 4.4000	Jul 4.0000	Aug 4.1000	Sep 4.6000	Oct 5.2000	Nov 5.3000	Dec 5.1000 (22)
Wind factor	1.4250	1.4500	1.4250	1.2500	1.1500	1.1000	1.0000	1.0250	1.1500	1.3000	1.3250	1.2750 (22a)
Adj infilt rate	0.2423	0.2465	0.2423	0.2125	0.1955	0.1870	0.1700	0.1743	0.1955	0.2210	0.2253	0.2168 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross 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 to garage			1.8900	1.4000	2.6460		(26)
Part glazed door			4.2000	1.4000	5.8800		(26a)
Windows / Patios (Uw = 1.40)			30.0600	1.3258	39.8523		(27)
Insulated slab			79.0000	0.1200	9.4800		(28a)
Main T/Frame ACDS	141.0300	34.2600	106.7700	0.1600	17.0832		(29a)
House to garage wall	14.5600	1.8900	12.6700	0.1900	2.4073		(29a)
Granite feature nominal area	5.0000		5.0000	0.1600	0.8000		(29a)
Render /lathe nominal area	6.0000		6.0000	0.1600	0.9600		(29a)
Horizontal ceiling	79.0000		79.0000	0.1000	7.9000		(30)
Total net area of external elements Aum(A, m2)			324.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	87.0088	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5689 (36)
Total fabric heat loss							(33) + (36) = 102.5776 (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	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868	63.8868 (38)
Average = Sum(39)m / 12 =	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645	166.4645 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075	1.1075 (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	2.9347 (42)											
Average daily hot water use (litres/day)	109.3664 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	120.3030	115.9284	111.5537	107.1791	102.8044	98.4298	98.4298	102.8044	107.1791	111.5537	115.9284	120.3030 (44)
	178.4059	156.0350	161.0141	140.3760	134.6941	116.2308	107.7049	123.5929	125.0690	145.7559	159.1040	172.7766 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)													Total = Sum(45)m =	1720.7592 (45)
Distribution loss (46)m = 0.15 x (45)m														
	26.7609	23.4052	24.1521	21.0564	20.2041	17.4346	16.1557	18.5389	18.7604	21.8634	23.8656	25.9165	25.9165 (46)	
Water storage loss:														
Store volume														250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														2.2000 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														1.1880 (55)
Total storage loss														
	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280 (56)	
If cylinder contains dedicated solar storage														
	25.7796	23.2848	25.7796	24.9480	25.7796	24.9480	25.7796	25.7796	24.9480	25.7796	24.9480	25.7796	25.7796 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	23.2624 (59)	
Total heat required for water heating calculated for each month														
	227.4479	200.3310	208.6604	181.0824	170.9418	151.0841	143.7200	160.5385	167.1262	193.4022	206.5640	221.8186	221.8186 (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														0.9931 (H8)
Utilisation factor														0.6347 (H9)
Collector performance factor														0.8793 (H10)
Dedicated solar storage volume														75.0000 (H11)
Effective solar volume														127.5000 (H13)
Daily hot water demand														109.3664 (H14)
Volume ratio Veff/V														1.1658 (H15)
Solar storage volume factor														1.0000 (H16)
Solar input														-953.6556 (H17)
Solar input	-22.7458	-43.1309	-81.0523	-110.4232	-143.2330	-130.4509	-128.4860	-110.7939	-84.0254	-53.9916	-27.9469	-17.3756	-17.3756 (63)	
FGHRS	-32.2413	-24.7455	-19.7735	-8.5317	0.0000	0.0000	0.0000						-32.5200 eq. (G6)	
Output from w/h														
	172.4608	132.4546	107.8346	62.1275	27.7087	20.6331	15.2339	46.4508	77.9640	119.3841	151.5600	171.9230	171.9230 (64)	
Heat gains from water heating, kWh/month														
	98.5536	87.3184	91.6542	79.2401	73.7839	66.5294	64.6239	70.6511	75.2312	86.5808	90.8701	96.6818	96.6818 (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	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793	176.0793 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	72.0135	63.9617	52.0172	39.3803	29.4373	24.8522	26.8537	34.9054	46.8500	59.4868	69.4299	74.0150	74.0150 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	478.8788	483.8480	471.3256	444.6670	411.0152	379.3873	358.2579	353.2886	365.8110	392.4696	426.1214	457.7494	457.7494 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426	55.5426 (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)													
	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862	-117.3862 (71)
Water heating gains (Table 5)													
	132.4645	129.9381	123.1911	110.0557	99.1720	92.4019	86.8601	94.9612	104.4877	116.3721	126.2084	129.9487	129.9487 (72)
Total internal gains	800.5924	794.9836	763.7696	711.3388	656.8601	613.8770	589.2073	600.3909	634.3844	685.5642	738.9954	778.9487	778.9487 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
North	9.9900	8.2005	0.6300	0.7000	0.7700	25.0368 (74)							
East	4.5600	14.7869	0.6300	0.7000	0.7700	20.6070 (76)							
South	11.1900	38.1750	0.6300	0.7000	0.7700	130.5511 (78)							
West	4.3200	14.7869	0.6300	0.7000	0.7700	19.5224 (80)							
Solar gains	195.7173	387.7651	608.2486	800.1444	970.9614	904.8164	865.7930	763.9091	632.1867	425.4012	244.3795	151.9787	151.9787 (83)
Total gains	996.3098	1182.7487	1372.0183	1511.4831	1627.8215	1518.6935	1455.0003	1364.3000	1266.5710	1110.9655	983.3750	930.9274	930.9274 (84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804	25.0804 (86)
alpha	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720	2.6720 (87)
util living area	0.9628	0.9439	0.9097	0.8594	0.7892	0.7144	0.6428	0.6736	0.7856	0.8986	0.9502	0.9696	0.9696 (86)
MIT	18.6026	18.8524	19.2926	19.7757	20.2003	20.5417	20.7226	20.6829	20.3929	19.7542	19.0547	18.4540	18.4540 (87)
Th 2	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947	19.9947 (88)
util rest of house	0.9576	0.9364	0.8976	0.8400	0.7594	0.6682	0.5809	0.6133	0.7454	0.8808	0.9424	0.9654	0.9654 (89)
MIT 2	16.7700	17.1293	17.7603	18.4452	19.0332	19.4952	19.7249	19.6805	19.3114	18.4309	17.4276	16.5546	16.5546 (90)
Living area fraction													FLA = Living area / (4) = 0.2006 (91)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

MIT	17.1376	17.4749	18.0677	18.7121	19.2673	19.7051	19.9250	19.8816	19.5283	18.6963	17.7540	16.9356 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9876	17.3249	17.9177	18.5621	19.1173	19.5551	19.7750	19.7316	19.3783	18.5463	17.6040	16.7856 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9352	0.9088	0.8652	0.8060	0.7291	0.6455	0.5660	0.5957	0.7164	0.8474	0.9161	0.9455 (94)
Useful gains	931.7297	1074.9203	1187.0098	1218.3038	1186.8430	980.2548	823.4645	812.6540	907.3635	941.4465	900.9001	880.1838 (95)
Ext temp.	3.3000	3.6000	5.0000	7.1000	9.3000	12.2000	14.0000	13.9000	12.0000	8.8000	5.7000	2.9000 (96)
Heat loss rate W												
2278.5043	2284.7162	2150.3312	1908.0328	1634.2303	1224.3613	961.3379	970.7543	1228.2306	1622.4205	1981.5927	2311.4577 (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												
1002.0003	812.9828	716.7111	496.6049	332.8561	0.0000	0.0000	0.0000	0.0000	506.6446	778.0986	1064.8678 (98)	
Space heating												5710.7662 (98)
Space heating per m2												(98) / (4) = 37.9958 (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	1002.0003	812.9828	716.7111	496.6049	332.8561	0.0000	0.0000	0.0000	0.0000	506.6446	778.0986	1064.8678 (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)	1098.6846	891.4285	785.8674	544.5229	364.9738	0.0000	0.0000	0.0000	0.0000	555.5314	853.1783	1167.6182 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	172.4608	132.4546	107.8346	62.1275	27.7087	20.6331	15.2339	46.4508	77.9640	119.3841	151.5600	171.9230 (64)
Efficiency of water heater (217)m	89.4540	89.5327	89.6417	89.8717	90.2778	80.5000	80.5000	80.5000	80.5000	88.9454	89.2657	80.5000 (216)
Fuel for water heating, kWh/month	192.7927	147.9398	120.2950	69.1291	30.6927	25.6312	18.9241	57.7029	96.8497	134.2217	169.7854	191.9951 (219)
Water heating fuel used												1255.9594 (219)
Annual totals kWh/year												
Space heating fuel - main system												6261.8051 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 11.0240, total flow = 45.0000, SFP = 0.2450)												
mechanical ventilation fans (SFP = 0.2450)												115.7215 (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												240.7215 (231)
Electricity for lighting (calculated in Appendix L)												508.7122 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.68 * 1017 * 1.00) =									-1366.9468			-1366.9468 (233)
Total delivered energy for all uses												6900.2514 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6261.8051	9.4500	591.7406 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1255.9594	9.4500	118.6882 (247)
Mechanical ventilation fans	115.7215	25.0500	28.9882 (249)
Pumps and fans for heating	75.0000	25.0500	18.7875 (249)
Pump for solar water heating	50.0000	25.0500	12.5250 (249)
Energy for lighting	508.7122	25.0500	127.4324 (250)
Additional standing charges			70.0000 (251)
Energy saving/generation technologies			
PV Unit		-1366.9468	-342.4202 (252)
Total energy cost			625.7417 (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	6261.8051	0.2410	1509.0950 (261)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1255.9594	0.2410	302.6862 (264)
Space and water heating			1811.7812 (265)
Pumps and fans	240.7215	0.5190	124.9345 (267)
Energy for lighting	508.7122	0.5190	264.0216 (268)
Energy saving/generation technologies			
PV Unit	-1366.9468	0.5190	-709.4454 (269)
Total kg/year			1491.2920 (272)

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 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6261.8051	1.0900	6825.3675 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1255.9594	1.0900	1368.9958 (264)
Space and water heating			8194.3633 (265)
Pumps and fans	240.7215	3.0700	739.0150 (267)
Energy for lighting	508.7122	3.0700	1561.7465 (268)
Energy saving/generation technologies			
PV Unit	-1366.9468	3.0700	-4196.5266 (269)
Primary energy kWh/year			6298.5982 (272)
Primary energy kWh/m2/year			41.9068 (273)

# U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref		
Project	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

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

## Building Elements

### Roof Horizontal ceiling

Roof Type: Pitched Roof, insulated flat ceiling

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

Total resistance: Upper limit = 9.805 m<sup>2</sup> K/W Lower limit = 9.450 m<sup>2</sup> K/W Average = 9.628 m<sup>2</sup> K/W  
 Total correction = 0.0019 m<sup>2</sup> K/W U-value (unrounded) = 0.1 W/m<sup>2</sup> K

Unheated space: None

**Total thickness: 413 mm**

**U-value: 0.10 W/m<sup>2</sup> K**

**Kappa: n/a**

# U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref		
Project	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	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 <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>Render - Cement and Sand</b>				
	Main construction	20	1.0000	0.0200	100.00
Layer 2	<b>Blockwork, dense</b>				
	Main construction	100	1.5900	0.0629	100.00
Layer 3	<b>Low E perp vented cavity</b>				
	Main construction	50	0.0648	0.7717	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	<b>Reflective breather membrane</b>				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 5	<b>Orientated Strand Board</b>				
	Main construction	9	0.1300	0.0692	100.00
Layer 6	<b>Earthwool Frametherm Roll 35 in T/Frame</b>				
	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	<b>Reflective VCL</b>				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 8	<b>PIR over T/Frame</b>				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 9	<b>Low E battened cavity</b>				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	<b>Plasterboard</b>				
	Main construction	12.5	0.2500	0.0500	100.00
Int surface				0.1300	

<b>Total resistance:</b>	<b>Upper limit =</b> 6.451 m <sup>2</sup> K/W	<b>Lower limit =</b> 5.926 m <sup>2</sup> K/W	<b>Average =</b> 6.189 m <sup>2</sup> K/W
	<b>Total correction =</b> 0.0021 m <sup>2</sup> K/W	<b>U-value (unrounded) =</b> 0.16 W/m <sup>2</sup> K	

# U-VALUE CALCULATOR REPORT

Unheated space: None

**Total thickness: 400 mm**

**U-value: 0.16 W/m<sup>2</sup> K**

**Kappa: n/a**

# U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref		
Project	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	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 Party wall to garage

#### Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>Plasterboard</b>				
	Main construction	12.5	0.2500	0.0500	100.00
Layer 2	<b>Orientated Strand Board</b>				
	Main construction	9	0.1300	0.0692	100.00
Layer 3	<b>Frametherm Roll 35 in T/Frame</b>				
	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	<b>Reflective VCL</b>				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 5	<b>PIR over T/Frame</b>				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 6	<b>Low E battened cavity</b>				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 7	<b>Plasterboard</b>				
	Main construction	12.5	0.2500	0.0500	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.597 m <sup>2</sup> K/W	Lower limit = 5.121 m <sup>2</sup> K/W	Average = 5.359 m <sup>2</sup> K/W
	Total correction = 0.0028 m <sup>2</sup> K/W	U-value (unrounded) = 0.19 W/m <sup>2</sup> K	

Unheated space: None

Total thickness: 242 mm

U-value: 0.19 W/m<sup>2</sup> K

Kappa: n/a

# U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 94 cairnwell	Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref	
Project	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

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

### Wall Granite wall cladding

#### Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>Granite</b>				
	Main construction	100	2.8000	0.0357	100.00
Layer 2	<b>Low E cavity</b>				
	Main construction	50	0.0649	0.7700	100.00
Layer 3	<b>Reflective breather membrane</b>				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 4	<b>Orientated Strand Board</b>				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	<b>Earthwool Frametherm Roll 35 in T/F</b>				
	Main construction	140	0.0350	4.0000	85.00
	Main construction	140	0.1300	1.0769	15.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	<b>Reflective VCL</b>				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 7	<b>PIR over T/Frame</b>				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 8	<b>Low E battened cavity</b>				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 9	<b>Plasterboard</b>				
	Main construction	12.5	0.2500	0.0500	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.400 m <sup>2</sup> K/W	Lower limit = 5.877 m <sup>2</sup> K/W	Average = 6.138 m <sup>2</sup> K/W
	Total correction = 0.0021 m <sup>2</sup> K/W	U-value (unrounded) = 0.16 W/m <sup>2</sup> K	

Unheated space: None

Total thickness: 380 mm

U-value: 0.16 W/m<sup>2</sup> K

Kappa: n/a



# U-VALUE CALCULATOR REPORT

<b>Property Reference</b>	ajc 4A 94 cairnwell	<b>Issued on Date</b>	31/01/2023
<b>Assessment Reference</b>	Cairnwell	<b>Prop Type Ref</b>	
<b>Project</b>	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne		
<b>Calculation Type</b>	New Build (As Designed)		

<b>SAP Rating</b>	83 B	<b>DER</b>	10.76	<b>TER</b>	11.80
<b>Environmental</b>	90 B	<b>% DER&lt;TER</b>	8.81		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.75	<b>FEE</b>	45.03	<b>TFEE</b>	N/A
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	N/A		

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

### Wall Render infil on gables

Wall Type: Standard Wall

# U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
<b>Ext surface</b>				0.0400	
<b>Layer 1</b>	<b>Render - on lathe</b>				
	Main construction	19	1.0000	0.0190	100.00
<b>Layer 2</b>	<b>Orientated Strand Board</b>				
	Main construction	9	0.1300	0.0692	100.00
<b>Layer 3</b>	<b>Frame cavity</b>				
	Main construction	90	0.5000	0.1800	85.00
	Main construction	90	0.1300	0.6923	15.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
<b>Layer 4</b>	<b>Standard cavity</b>				
	Main construction	50	0.0648	0.7717	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
<b>Layer 5</b>	<b>Reflective breather membrane</b>				
	Main construction	0.5	0.0000	0.0000	100.00
<b>Layer 6</b>	<b>Orientated Strand Board</b>				
	Main construction	9	0.1300	0.0692	100.00
<b>Layer 7</b>	<b>Earthwool Frametherm Roll 35 in T/F</b>				
	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				
<b>Layer 8</b>	<b>Reflective VCL</b>				
	Main construction	0.4	0.0000	0.0000	100.00
<b>Layer 9</b>	<b>PIR over T/Frame</b>				
	Main construction	30	0.0220	1.3636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
<b>Layer 10</b>	<b>Low E battened cavity</b>				
	Main construction	38	0.0571	0.6651	87.85
	Main construction	38	0.1300	0.2923	12.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
<b>Layer 11</b>	<b>Plasterboard</b>				
	Main construction	12.5	0.2500	0.0500	100.00
<b>Int surface</b>				0.1300	

**Total resistance:**    **Upper limit =** 6.721 m<sup>2</sup> K/W    **Lower limit =** 6.134 m<sup>2</sup> K/W    **Average =** 6.427 m<sup>2</sup> K/W  
**Total correction =** 0.0020 m<sup>2</sup> K/W    **U-value (unrounded) =** 0.16 W/m<sup>2</sup> K

**Unheated space:** None

**Total thickness: 398 mm**

**U-value: 0.16 W/m<sup>2</sup> K**

**Kappa: n/a**

# U-VALUE CALCULATOR REPORT

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023
Assessment Reference	Cairnwell	Prop Type Ref		
Project	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	TFEE	N/A
General Requirements Compliance	Pass	% DFEE<TFEE	N/A		

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

### Floor Ground floor

Floor Type: Slab On Ground Floor

Area = 79.00 m<sup>2</sup>, Perimeter = 40.50 m, Wall thickness = 382.00 mm, Soil: Unknown

Horizontal edge insulation: none

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

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>Sand blinded hardcore</b>				
	Main construction	200	2.3000	0.0870	100.00
Layer 2	<b>Polythene,1000 gauge</b>				
	Main construction	0.4	0.0000	0.0000	100.00
Layer 3	<b>Thermafloort TF70</b>				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	<b>Concrete, reinforced (1% steel)</b>				
	Main construction	150	2.3000	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 6.970 m<sup>2</sup> K/W Lower limit = 6.970 m<sup>2</sup> K/W Average = 6.970 m<sup>2</sup> K/W  
 Total correction = 0.0096 m<sup>2</sup> K/W U-value (unrounded) = 0.12 W/m<sup>2</sup> K

Unheated space: None

Total thickness: 500 mm

U-value: 0.12 W/m<sup>2</sup> K

Kappa: n/a

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Property Reference	ajc 4A 94 cairnwell		Issued on Date	31/01/2023	
Assessment Reference	Cairnwell	Prop Type Ref			
Property	Cairnwell, Plot 94, Phase 4A , Tarland Road, Aboyne				
SAP Rating	83 B	DER	10.76	TER	11.80
Environmental	90 B	% DER<TER	8.81		
CO <sub>2</sub> Emissions (t/year)	1.75	FEE	45.03	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	North
Property Tenure	Owner-occupied
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	40.50 m	79.30 m <sup>2</sup>	2.51 m
1st Storey:	34.50 m	71.00 m <sup>2</sup>	2.65 m

7.0 Living Area	30.15	m <sup>2</sup>
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m <sup>2</sup> K

9.0 External Walls		U-Value (W/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
Description	Type			
Main T/Frame ACDS	Timber Frame	0.16	141.03	106.77
House to garage wall	Timber Frame	0.19	14.56	12.67
Granite feature - nominal area	Timber Frame	0.16	5.00	5.00
Render /lathe nominal area	Timber Frame	0.16	6.00	6.00

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

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

### 12.0 Opening Types

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

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

### 13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m <sup>2</sup> )	Curtain Closed
Front door	Half Glazed Door	[1] Main T/Frame ACDS	North							2.10	
Front glass	Window	[1] Main T/Frame ACDS	North	None	0.00					9.99	
House to garage door	Solid Door	[2] House to garage wall	East							1.89	
Rear glass	Window	[1] Main T/Frame ACDS	South	None	0.00					11.19	
RHS glass	Window	[1] Main T/Frame ACDS	West	None	0.00					4.32	
LHS glass	Window	[1] Main T/Frame ACDS	East	None	0.00					4.56	
Rear door	Half Glazed Door	[1] Main T/Frame ACDS	South							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)	25.10	0.037	No
Scotland ACD 2015	E3 Sill	16.70	0.033	No
Scotland ACD 2015	E4 Jamb	57.50	0.031	No
Scotland ACD 2015	E5 Ground floor (normal)	40.50	0.173	No
Scotland ACD 2015	E6 Intermediate floor within a dwelling	34.50	0.065	No
Scotland ACD 2015	E10 Eaves (insulation at ceiling level)	19.84	0.043	No
Scotland ACD 2015	E12 Gable (insulation at ceiling level)	20.66	0.051	No
Scotland ACD 2015	E16 Corner (normal)	29.50	0.038	No
Scotland ACD 2015	E17 Corner (inverted – internal area greater than external area)	9.93	0.003	No

Y-value	<input type="text" value="0.048"/>	W/m <sup>2</sup> K
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### 18.0 Pressure Testing

Designed AP <sub>50</sub>	<input type="text" value="4.00"/>	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa
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Property Tested ?	<input type="text"/>
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As Built AP <sub>50</sub>	<input type="text"/>	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa
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### 19.0 Mechanical Ventilation

#### Summer Overheating

Windows open in hot weather	<input type="text" value="Windows half open"/>
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Cross ventilation possible	<input type="text" value="Yes"/>
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Night Ventilation	<input type="text" value="No"/>
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Air change rate	<input type="text" value="4.00"/>
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#### Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
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Approved Installation	<input type="text" value="Yes"/>
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# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500339
Duct Type	Rigid

### 19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	In Room Fan Kitchen	1
0.20	In Room Fan Other Wet Room	4

### 20.0 Fans, Open Fireplaces, Flues

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

### 21.0 Fixed Cooling System

No

### 22.0 Lighting

#### Internal

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

#### External

External lights fitted	Yes
Light and motion sensor	Yes

### 23.0 Electricity Tariff

Standard

### 24.0 Main Heating 1

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

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

25.0 Main Heating 2

Community Heating

**28.0 Water Heating**

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

SAP Code

### 28.1 Flue Gas Heat Recovery System

Database ID

Brand Model

Details

### 29.0 Hot Water Cylinder

Cylinder Stat

Cylinder In Heated Space

Independent Time Control

Insulation Type

Cylinder Volume  L

Loss  kWh/day

Pipes insulation

31.0 Thermal Store

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.68	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	£101	B 86	