

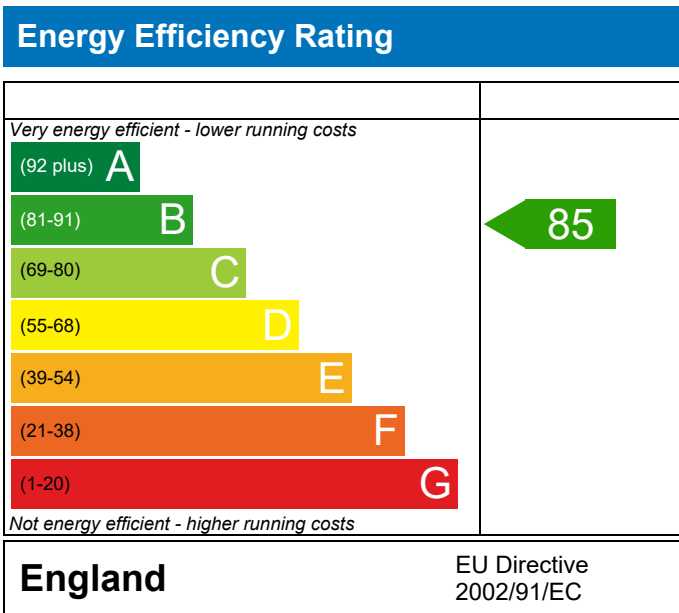
# PREDICTED ENERGY ASSESSMENT

Plot 119 - PRJ010789

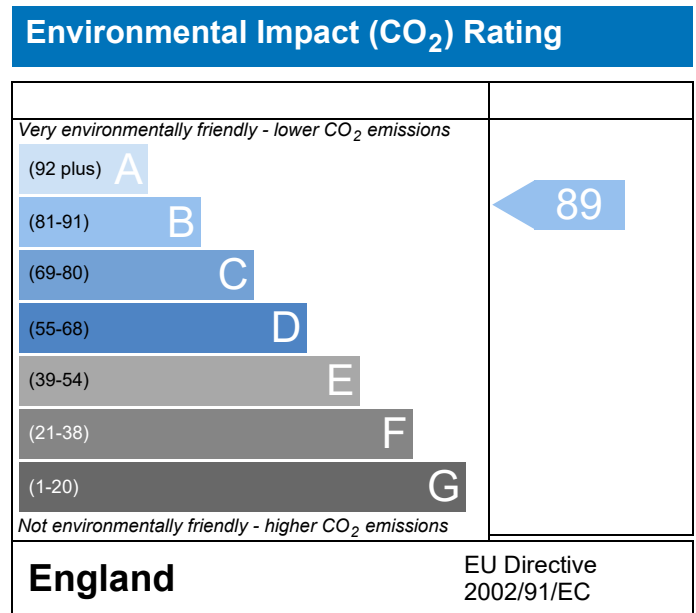
Dwelling type: Flat, Semi-Detached  
 Date of assessment: 05/10/2020  
 Produced by: Gareth Thomas  
 Total floor area: 70.947 m<sup>2</sup>

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.



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.



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	Plot 119 - PRJ010789		Issued on Date	05/10/2020
Assessment Reference	119 S	Prop Type Ref	Plot 119 - PRJ010789	
Property	Plot 119 - PRJ010789			

SAP Rating	85 B	DER	15.42	TER	17.00
Environmental	89 B	% DER<TER	9.28		
CO <sub>2</sub> Emissions (t/year)	0.93	DFEE	38.08	TFEE	42.65
General Requirements Compliance	Pass	% DFEE<TFEE	10.70		

Assessor Details	Mr. Gareth Thomas, Gareth Thomas, Tel: 02033971373, gareth@briaryenergy.co.uk	Assessor ID	W933-0001
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Client	
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### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.00	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	15.42	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.58 (-9.3%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.65	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	38.08	kWh/m <sup>2</sup> /yr	
	-4.5 (-10.6%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Openings	1.40 (max. 2.00)	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	5.01 (design value)	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa	
Maximum	10.0	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

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# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

### 5 Cylinder insulation

Hot water storage	No cylinder	
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### 6 Controls

Space heating controls	Programmer, room thermostat and TRVs	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

### 7 Low energy lights

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

### 8 Mechanical ventilation

Continuous extract system (decentralised)		
Specific fan power	0.1900 0.1800	
Maximum	0.7	Pass

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (East Anglia)	Slight	Pass
Based on:		
Overshading	Average	
Windows facing North East	6.80 m <sup>2</sup> , No overhang	
Windows facing South West	1.60 m <sup>2</sup> , No overhang	
Windows facing North West	6.98 m <sup>2</sup> , No overhang	
Air change rate	4.21 ach	
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m <sup>2</sup> K	Pass

### Air permeability and pressure testing

#### 3 Air permeability

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

### 10 Key features

Party wall U-value	0.00	W/m <sup>2</sup> K
Door U-value	1.00	W/m <sup>2</sup> K

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	Plot 119 - PRJ010789			Issued on Date	05/10/2020
Assessment Reference	119 S	Prop Type Ref	Plot 119 - PRJ010789		
Property	Plot 119 - PRJ010789				
SAP Rating	85 B	DER	15.42	TER	17.00
Environmental	89 B	% DER<TER	9.28		
CO <sub>2</sub> Emissions (t/year)	0.93	DFEE	38.08	TFEE	42.65
General Requirements Compliance	Pass	% DFEE<TFEE	10.70		
Assessor Details	Mr. Gareth Thomas, Gareth Thomas, Tel: 02033971373, gareth@briaryenergy.co.uk			Assessor ID	W933-0001
Client					

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 71 m<sup>2</sup>

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

1a TER and DER

Fuel for main heating:Mains gas  
Fuel factor:1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 17.00 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 15.42 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.6 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)38.1 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.40 (max. 2.00)	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: 5.01 (design value)  
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from database  
Ideal LOGIC COMBI ESP1 30  
Combi boiler  
Efficiency: 89.6% SEDBUK2009  
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)  
Specific fan power: 0.1900 0.1800  
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (East Anglia): Slight OK

Based on:

Overshading: Average  
Windows facing North East: 6.80 m<sup>2</sup>, No overhang  
Windows facing South West: 1.60 m<sup>2</sup>, No overhang  
Windows facing North West: 6.98 m<sup>2</sup>, No overhang  
Air change rate: 4.21 ach  
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K  
Door U-value 1.00 W/m<sup>2</sup>K

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	70.9470 (1b)	2.4250 (2b)	172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 172.0465 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.2505	(18)
Number of sides sheltered				1	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2317 (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				0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			15.3800	1.3258	20.3902		(27)
Wl - Brick	15.8370	6.9770	8.8600	0.2500	2.2150	60.0000	531.6000 (29a)
Wl - Clad	41.3070	8.4000	32.9070	0.2400	7.8977	60.0000	1974.4200 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			57.1470				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 30.5028		(33)
Party Wall			27.2170	0.0000	0.0000	54.0300	1470.5345 (32)
Party Floor			70.9470			40.0000	2837.8800 (32d)
Party Ceiling			70.9470			70.0000	4966.2900 (32b)
1st Floor Stud			123.3161			5.8200	717.6997 (32c)

Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12498.4242 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							176.1656 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6442 (36)
Total fabric heat loss							(33) + (36) = 38.1471 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.9672	30.6383	30.3094	28.6649	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.9938	29.6516 (38)
Heat transfer coeff	69.1142	68.7853	68.4564	66.8120	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	67.1409	67.7987 (39)
Average = Sum(39)m / 12 =												67.2763 (39)
HLP	0.9742	0.9695	0.9649	0.9417	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9464	0.9556 (40)
HLP (average)												0.9483 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	21.5538	18.8511	19.4527	16.9593	16.2729	14.0422	13.0122	14.9317	15.1100	17.6093	19.2219	20.8737 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6346	13.1931	14.5665	14.0511	14.4864	13.9809	14.4232	14.4642	14.0192	14.5333	14.1173	14.6214 (61)
Total heat required for water heating calculated for each month	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (64)
Heat gains from water heating, kWh/month	51.4363	45.0849	46.7617	41.1059	39.6931	34.6222	32.4495	36.7146	36.9987	42.6672	46.1379	49.9255 (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	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8016	15.8112	12.8586	9.7348	7.2769	6.1434	6.6382	8.6286	11.5812	14.7051	17.1630	18.2964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4971	201.5673	196.3506	185.2448	171.2257	158.0497	149.2474	147.1773	152.3940	163.4998	177.5188	190.6948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	69.1349	67.0907	62.8518	57.0916	53.3510	48.0864	43.6150	49.3476	51.3871	57.3484	64.0804	67.1042 (72)
Total internal gains	346.4670	344.5026	332.0943	312.1045	291.8869	272.3130	259.5340	265.1869	275.3957	295.5867	318.7956	336.1288 (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
Northeast	6.7980	11.2829	0.5000	0.0000	0.7700	29.5301 (75)
Southwest	1.6020	36.7938	0.5000	0.0000	0.7700	22.6933 (79)
Northwest	6.9770	11.2829	0.5000	0.0000	0.7700	30.3076 (81)
Solar gains	82.5310	160.4564	272.3369	425.9282	557.8443	589.3380
Total gains	428.9980	504.9591	604.4312	738.0327	849.7313	861.6510

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	50.2326	50.4727	50.7152	51.9635	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	51.7089	51.2073
tau	4.3488	4.3648	4.3810	4.4642	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4473	4.4138
alpha	0.9915	0.9821	0.9522	0.8521	0.6702	0.4833	0.3577	0.4227	0.6947	0.9280	0.9838	0.9933 (86)
util living area	19.6864	19.8966	20.2466	20.6738	20.9103	20.9830	20.9965	20.9928	20.9232	20.5638	20.0585	19.6650 (87)
MIT	20.1049	20.1088	20.1127	20.1322	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1283	20.1205 (88)
Th 2	0.9895	0.9780	0.9416	0.8237	0.6215	0.4219	0.2886	0.3457	0.6280	0.9070	0.9795	0.9918 (89)
util rest of house	18.9013	19.1123	19.4574	19.8733	20.0752	20.1269	20.1343	20.1329	20.0905	19.7852	19.2897	18.8924 (90)
Living area fraction	19.1973	19.4080	19.7550	20.1751	20.3901	20.4497	20.4594	20.4571	20.4045	20.0788	19.5796	19.1837 (92)
MIT	19.0473	19.2580	19.6050	20.0251	20.2401	20.2997	20.3094	20.3071	20.2545	19.9288	19.4296	19.0337 (93)
Temperature adjustment adjusted MIT												-0.1500

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9864	0.9731	0.9343	0.8199	0.6276	0.4338	0.3026	0.3612	0.6378	0.9011	0.9750	0.9892 (94)
Ext temp.	423.1760	491.3846	564.7318	605.0986	533.3184	373.7863	245.9759	258.1672	382.6964	438.9583	410.7458	400.0479 (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	1019.2484	987.6212	897.1183	743.2921	568.2114	379.2253	246.8024	259.9580	409.4857	620.6874	827.8174	1005.7042 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	443.4778	333.4710	247.2955	99.4993	25.9604	0.0000	0.0000	0.0000	0.0000	135.2065	300.2915	450.6083 (98)
												2035.8103 (98)
												(98) / (4) = 28.6948 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Not applicable

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

	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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2249.5142 (211)
Space heating requirement	443.4778	333.4710	247.2955	99.4993	25.9604	0.0000	0.0000	0.0000	0.0000	135.2065	300.2915	450.6083	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	490.0307	368.4763	273.2547	109.9440	28.6855	0.0000	0.0000	0.0000	0.0000	149.3994	331.8138	497.9097	(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	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797	(64)
Efficiency of water heater (217)m	89.6356	89.5351	89.2941	88.6767	87.8414	87.3000	87.3000	87.3000	87.3000	88.8908	89.4460	89.6638	(216)
Fuel for water heating, kWh/month	176.6339	155.0982	161.5458	143.3445	139.9934	123.2485	115.8892	130.5943	131.4464	148.4164	159.0493	171.5071	(219)
Water heating fuel used													1756.7670 (219)
Annual totals kWh/year													
Space heating fuel - main system													2249.5142 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													50.8050 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													125.8050 (231)
Electricity for lighting (calculated in Appendix L)													314.3823 (232)
Total delivered energy for all uses													4446.4685 (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	2249.5142	0.2160	485.8951	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1756.7670	0.2160	379.4617	(264)
Space and water heating			865.3567	(265)
Pumps and fans	125.8050	0.5190	65.2928	(267)
Energy for lighting	314.3823	0.5190	163.1644	(268)
Total CO2, kg/year			1093.8140	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4200	(273)

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

DER			15.4200	ZC1
Total Floor Area		TFA	70.9470	
Assumed number of occupants		N	2.2689	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.6628	ZC2
CO2 emissions from cooking, equation (L16)			2.4448	ZC3
Total CO2 emissions			34.5277	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			34.5277	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	70.9470 (1b)	2.4250 (2b)	172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	172.0465 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1744 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4244 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3925 (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	0.5005	0.4907	0.4809	0.4318	0.4220	0.3729	0.3729	0.3631	0.3925	0.4220	0.4416	0.4612 (22b)
Effective ac	0.6252	0.6204	0.6156	0.5932	0.5890	0.5695	0.5695	0.5659	0.5770	0.5890	0.5975	0.6064 (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 Opening Type (Uw = 1.40)			15.3800	1.3258	20.3902		(27)					
W1 - Brick	15.8370	6.9770	8.8600	0.1800	1.5948		(29a)					
W1 - Clad	41.3070	8.4000	32.9070	0.1800	5.9233		(29a)					
Total net area of external elements Aum, m <sup>2</sup>			57.1470				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.9082	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0937 (36)					
Total fabric heat loss						(33) + (36) =	35.0019 (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	35.4986	35.2225	34.9518	33.6805	33.4427	32.3354	32.3354	32.1304	32.7619	33.4427	33.9239	34.4269 (38)
Average = Sum(39)m / 12 =	70.5005	70.2244	69.9537	68.6824	68.4446	67.3374	67.3374	67.1323	67.7638	68.4446	68.9258	69.4288 (39)
HLP	0.9937	0.9898	0.9860	0.9681	0.9647	0.9491	0.9491	0.9462	0.9551	0.9647	0.9715	0.9786 (40)
HLP (average)												0.9681 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m	21.5538	18.8511	19.4527	16.9593	16.2729	14.0422	13.0122	14.9317	15.1100	17.6093	19.2219	20.8737 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Combi loss	49.3766	42.9764	45.7855	42.5710	42.1945	39.0958	40.3990	42.1945	42.5710	45.7855	46.0462	49.3766 (61)
Total heat required for water heating calculated for each month												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Solar input	193.0689	168.6506	175.4701	155.6331	150.6803	132.7108	127.1470	141.7392	143.3045	163.1807	174.1922	188.5349 (62)
	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	193.0689	168.6506	175.4701	155.6331	150.6803	132.7108	127.1470	141.7392	143.3045	163.1807	174.1922	188.5349 (64)
Heat gains from water heating, kWh/month	60.1218	52.5308	54.5665	48.2359	46.6202	40.9009	38.9435	43.6472	44.1366	50.4803	54.1201	58.6143 (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	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8016	15.8112	12.8586	9.7348	7.2769	6.1434	6.6382	8.6286	11.5812	14.7051	17.1630	18.2964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4971	201.5673	196.3506	185.2448	171.2257	158.0497	149.2474	147.1773	152.3940	163.4998	177.5188	190.6948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	80.8089	78.1708	73.3421	66.9943	62.6615	56.8069	52.3434	58.6656	61.3009	67.8499	75.1668	78.7826 (72)
Total internal gains	358.1411	355.5828	342.5846	322.0073	301.1975	281.0334	268.2624	274.5049	285.3095	306.0881	329.8820	347.8072 (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
Northeast	6.7980	11.2829	0.6300	0.7000	0.7700	23.4410 (75)
Southwest	1.6020	36.7938	0.6300	0.7000	0.7700	18.0140 (79)
Northwest	6.9770	11.2829	0.6300	0.7000	0.7700	24.0582 (81)

Solar gains	65.5131	127.3703	216.1810	338.1018	442.8168	467.8165	439.2887	356.8550	257.7216	152.0707	81.3428	54.2064 (83)
Total gains	423.6542	482.9531	558.7656	660.1091	744.0143	748.8499	707.5511	631.3599	543.0311	458.1588	411.2248	402.0136 (84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	69.8843	70.1590	70.4305	71.7341	71.9834	73.1670	73.1670	73.3905	72.7065	71.9834	71.4809	70.9630
alpha	5.6590	5.6773	5.6954	5.7823	5.7989	5.8778	5.8778	5.8927	5.8471	5.7989	5.7654	5.7309
util living area	0.9980	0.9954	0.9847	0.9313	0.7791	0.5658	0.4173	0.4854	0.7832	0.9709	0.9956	0.9985 (86)
MIT	19.9719	20.1139	20.3667	20.7038	20.9220	20.9900	20.9986	20.9968	20.9420	20.6342	20.2493	19.9547 (87)
Th 2	20.0886	20.0918	20.0950	20.1100	20.1128	20.1259	20.1259	20.1284	20.1209	20.1128	20.1071	20.1012 (88)
util rest of house	0.9974	0.9939	0.9795	0.9096	0.7259	0.4928	0.3352	0.3954	0.7105	0.9575	0.9939	0.9981 (89)
MIT 2	18.7105	18.9199	19.2882	19.7701	20.0412	20.1197	20.1254	20.1271	20.0763	19.6866	19.1296	18.6947 (90)
Living area fraction									fLA = Living area / (4) =			0.3770 (91)
MIT	19.1861	19.3701	19.6948	20.1222	20.3733	20.4479	20.4546	20.4550	20.4027	20.0439	19.5518	19.1698 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1861	19.3701	19.6948	20.1222	20.3733	20.4479	20.4546	20.4550	20.4027	20.0439	19.5518	19.1698 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	422.1610	479.2136	545.6656	600.6428	552.3494	389.4571	259.1082	271.1284	399.3445	438.0953	408.1234	400.9458 (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	1049.4769	1016.1505	923.0257	770.7653	593.6409	393.7791	259.5615	272.2206	427.0939	646.3830	858.2488	1039.3362 (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	466.7230	360.8216	280.7560	122.4882	30.7208	0.0000	0.0000	0.0000	0.0000	154.9661	324.0903	474.9625 (98)
Space heating per m2												2215.5285 (98)
												31.2279 (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)
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2372.0862 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.7230	360.8216	280.7560	122.4882	30.7208	0.0000	0.0000	0.0000	0.0000	154.9661	324.0903	474.9625	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	499.7035	386.3186	300.5952	131.1437	32.8917	0.0000	0.0000	0.0000	0.0000	165.9166	346.9917	508.5251	(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	193.0689	168.6506	175.4701	155.6331	150.6803	132.7108	127.1470	141.7392	143.3045	163.1807	174.1922	188.5349	(64)
Efficiency of water heater	87.1909	86.9178	86.2286	84.4557	81.8487	80.3000	80.3000	80.3000	80.3000	84.9215	86.5925	80.3000	(216)
Fuel for water heating, kWh/month	221.4323	194.0347	203.4940	184.2778	184.0962	165.2687	158.3400	176.5120	178.4614	192.1549	201.1632	216.0101	(219)
Water heating fuel used													2275.2455 (219)
Annual totals kWh/year													
Space heating fuel - main system													2372.0862 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													314.3823 (232)
Total delivered energy for all uses													5036.7141 (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	2372.0862	0.2160	512.3706 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2275.2455	0.2160	491.4530 (264)
Space and water heating			1003.8237 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	314.3823	0.5190	163.1644 (268)
Total CO2, kg/m2/year			1205.9131 (272)
Emissions per m2 for space and water heating			14.1489 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2998 (272b)
Emissions per m2 for pumps and fans			0.5486 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1489 * 1.00) + 2.2998 + 0.5486, rounded to 2 d.p.			17.0000 (273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	70.9470 (1b)	2.4250 (2b)	172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	172.0465 (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				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1744 (8)
Pressure test					Yes
Measured/design AP50					5.0100
Infiltration rate					0.4249 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3930 (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	0.5011	0.4913	0.4814	0.4323	0.4225	0.3734	0.3734	0.3635	0.3930	0.4225	0.4421	0.4618 (22b)
Effective ac	0.6255	0.6207	0.6159	0.5934	0.5892	0.5697	0.5697	0.5661	0.5772	0.5892	0.5977	0.6066 (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
Windows (U <sub>w</sub> = 1.40)			15.3800	1.3258	20.3902		(27)
W1 - Brick	15.8370	6.9770	8.8600	0.2500	2.2150	60.0000	531.6000 (29a)
W1 - Clad	41.3070	8.4000	32.9070	0.2400	7.8977	60.0000	1974.4200 (29a)
Total net area of external elements A <sub>um</sub> , m <sup>2</sup>			57.1470				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.5028		(33)
Party Wall			27.2170	0.0000	0.0000	54.0300	1470.5345 (32)
Party Floor			70.9470			40.0000	2837.8800 (32d)
Party Ceiling			70.9470			70.0000	4966.2900 (32b)
1st Floor Stud			123.3161			5.8200	717.6997 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		12498.4242 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							176.1656 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6442 (36)
Total fabric heat loss						(33) + (36) =	38.1471 (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	35.5154	35.2386	34.9673	33.6930	33.4546	32.3448	32.3448	32.1392	32.7723	33.4546	33.9369	34.4411 (38)
Heat transfer coeff	73.6624	73.3856	73.1143	71.8401	71.6017	70.4918	70.4918	70.2863	70.9193	71.6017	72.0840	72.5882 (39)
Average = Sum(39)m / 12 =												71.8389 (39)
HLP	1.0383	1.0344	1.0305	1.0126	1.0092	0.9936	0.9936	0.9907	0.9996	1.0092	1.0160	1.0231 (40)
HLP (average)												1.0126 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	30.5346	26.7058	27.5580	24.0257	23.0532	19.8932	18.4340	21.1532	21.4059	24.9465	27.2310	29.5711	29.5711	29.5711	(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	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8016	15.8112	12.8586	9.7348	7.2769	6.1434	6.6382	8.6286	11.5812	14.7051	17.1630	18.2964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4971	201.5673	196.3506	185.2448	171.2257	158.0497	149.2474	147.1773	152.3940	163.4998	177.5188	190.6948	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	(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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	(71)
Water heating gains (Table 5)	41.0411	39.7407	37.0403	33.3690	30.9855	27.6294	24.7768	28.4318	29.7304	33.5302	37.8209	39.7462	(72)
Total internal gains	315.3733	314.1527	303.2828	285.3820	266.5215	248.8560	237.6958	241.2710	250.7390	268.7685	289.5361	305.7708	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Northeast	6.7980	11.2829	0.5000	0.0000	0.7700	29.5301	(75)						
Southwest	1.6020	36.7938	0.5000	0.7700	22.6933	(79)							
Northwest	6.9770	11.2829	0.5000	0.0000	30.3076	(81)							
Solar gains	82.5310	160.4564	272.3369	425.9282	557.8443	589.3380	553.3997	449.5528	324.6682	191.5730	102.4727	68.2872	(83)
Total gains	397.9043	474.6091	575.6197	711.3102	824.3658	838.1940	791.0955	690.8238	575.4072	460.3415	392.0088	374.0580	(84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)	47.1310	47.3088	47.4843	48.3266	48.4875	49.2509	49.2509	49.3949	48.9540	48.4875	48.1631	47.8285	21.0000	(85)
alpha	4.1421	4.1539	4.1656	4.2218	4.2325	4.2834	4.2834	4.2930	4.2636	4.2325	4.2109	4.1886		
util living area	0.9937	0.9863	0.9625	0.8799	0.7143	0.5200	0.3877	0.4583	0.7393	0.9458	0.9882	0.9951	(86)	
MIT	19.5191	19.7332	20.1004	20.5656	20.8623	20.9727	20.9938	20.9879	20.8855	20.4474	19.9038	19.4913	(87)	
Th 2	20.0516	20.0548	20.0580	20.0729	20.0757	20.0887	20.0887	20.0911	20.0837	20.0757	20.0700	20.0641	(88)	
util rest of house	0.9922	0.9831	0.9536	0.8539	0.6639	0.4524	0.3094	0.3720	0.6713	0.9283	0.9849	0.9939	(89)	
MIT 2	18.6935	18.9085	19.2717	19.7243	19.9820	20.0748	20.0866	20.0867	20.0155	19.6270	19.0910	18.6756	(90)	
Living area fraction									fLA = Living area / (4) =				0.3770	(91)
MIT	19.0048	19.2194	19.5842	20.0415	20.3139	20.4133	20.4287	20.4265	20.3435	19.9363	19.3974	18.9832	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0048	19.2194	19.5842	20.0415	20.3139	20.4133	20.4287	20.4265	20.3435	19.9363	19.3974	18.9832	(93)	

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9899	0.9795	0.9483	0.8530	0.6775	0.4770	0.3389	0.4044	0.6919	0.9252	0.9818	0.9921	(94)	
Useful gains	393.9051	464.8650	545.8321	606.7280	558.5091	399.7955	268.1090	279.3537	398.1467	425.8961	384.8666	371.0962	(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	1083.1893	1050.8404	956.6405	800.4058	616.7681	409.7931	269.8911	283.0093	442.7849	668.4943	886.4488	1073.0842	(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	512.8275	393.7754	305.6415	139.4480	43.3447	0.0000	0.0000	0.0000	0.0000	180.4930	361.1392	522.2791	(98)	
Space heating												2458.9485	(98)	
Space heating per m2												(98) / (4) =	34.6589	(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	662.6230	521.6394	534.1757	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9460	0.9703	0.9523	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	626.8108	506.1458	508.7216	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1063.9799	1007.2206	891.3822	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	314.7617	372.7996	284.6995	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												972.2608 (104)
Intermittency factor (Table 10b)												1.0000 (105)
									FC = cooled area / (4) =			
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	78.6904	93.1999	71.1749	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												243.0652 (107)
Energy for space heating												3.4260 (108)
Energy for space cooling												34.6589 (99)
Total												3.4260 (108)
Dwelling Fabric Energy Efficiency (DFEE)												38.0850 (109)
												38.1 (109)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	70.9470 (1b)	x 2.4250 (2b)	= 172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.0465 (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				3 * 10 =	30.0000 (7a)	
Number of passive vents				0 * 10 =	0.0000 (7b)	
Number of flueless gas fires				0 * 40 =	0.0000 (7c)	
Air changes per hour						
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) =	0.1744 (8)
Pressure test					Yes	
Measured/design AP50					5.0000	
Infiltration rate					0.4244	(18)
Number of sides sheltered					1	(19)
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.3925 (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	0.5005	0.4907	0.4809	0.4318	0.4220	0.3729	0.3729	0.3631	0.3925	0.4220	0.4416	0.4612 (22b)
Effective ac	0.6252	0.6204	0.6156	0.5932	0.5890	0.5695	0.5695	0.5659	0.5770	0.5890	0.5975	0.6064 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			15.3800	1.3258	20.3902		(27)					
W1 - Brick	15.8370	6.9770	8.8600	0.1800	1.5948		(29a)					
W1 - Clad	41.3070	8.4000	32.9070	0.1800	5.9233		(29a)					
Total net area of external elements Aum, m2			57.1470				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.9082		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0937 (36)					
Total fabric heat loss							(33) + (36) =	35.0019 (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	35.4986	35.2225	34.9518	33.6805	33.4427	32.3354	32.3354	32.1304	32.7619	33.4427	33.9239	34.4269 (38)
Average = Sum(39)m / 12 =	70.5005	70.2244	69.9537	68.6824	68.4446	67.3374	67.3374	67.1323	67.7638	68.4446	68.9258	69.4288 (39)
HLP	0.9937	0.9898	0.9860	0.9681	0.9647	0.9491	0.9491	0.9462	0.9551	0.9647	0.9715	0.9786 (40)
HLP (average)												0.9681 (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												2.2689 (42)	
Average daily hot water use (litres/day)												88.0862 (43)	
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)	
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)	
Energy content (annual)												Total = Sum(45)m =	1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	

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### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

30.5346 26.7058 27.5580 24.0257 23.0532 19.8932 18.4340 21.1532 21.4059 24.9465 27.2310 29.5711 (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	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447	113.4447 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.8016	15.8112	12.8586	9.7348	7.2769	6.1434	6.6382	8.6286	11.5812	14.7051	17.1630	18.2964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	199.4971	201.5673	196.3506	185.2448	171.2257	158.0497	149.2474	147.1773	152.3940	163.4998	177.5188	190.6948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445	34.3445 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	41.0411	39.7407	37.0403	33.3690	30.9855	27.6294	24.7768	28.4318	29.7304	33.5302	37.8209	39.7462 (72)
Total internal gains	315.3733	314.1527	303.2828	285.3820	266.5215	248.8560	237.6958	241.2710	250.7390	268.7685	289.5361	305.7708 (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			
Northeast	6.7980		11.2829		0.6300		0.7000		0.7700		23.4410 (75)	
Southwest	1.6020		36.7938		0.6300		0.7000		0.7700		18.0140 (79)	
Northwest	6.9770		11.2829		0.6300		0.7000		0.7700		24.0582 (81)	
Solar gains	65.5131	127.3703	216.1810	338.1018	442.8168	467.8165	439.2887	356.8550	257.7216	152.0707	81.3428	54.2064 (83)
Total gains	380.8864	441.5230	519.4638	623.4838	709.3383	716.6725	676.9845	598.1260	508.4606	420.8391	370.8789	359.9771 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	69.8843	70.1590	70.4305	71.7341	71.9834	73.1670	73.1670	73.3905	72.7065	71.9834	71.4809	70.9630
alpha	5.6590	5.6773	5.6954	5.7823	5.7989	5.8778	5.8778	5.8927	5.8471	5.7989	5.7654	5.7309
util living area	0.9989	0.9971	0.9891	0.9447	0.8030	0.5889	0.4357	0.5112	0.8159	0.9800	0.9974	0.9992 (86)
MIT	19.9142	20.0586	20.3170	20.6686	20.9083	20.9878	20.9982	20.9958	20.9276	20.5898	20.1953	19.8977 (87)
Th 2	20.0886	20.0918	20.0950	20.1100	20.1128	20.1259	20.1259	20.1284	20.1209	20.1128	20.1071	20.1012 (88)
util rest of house	0.9985	0.9961	0.9853	0.9262	0.7516	0.5139	0.3502	0.4170	0.7462	0.9703	0.9964	0.9989 (89)
MIT 2	19.0901	19.2368	19.4957	19.8465	20.0544	20.1207	20.1255	20.1272	20.0817	19.7803	19.3861	19.0840 (90)
Living area fraction	fLA = Living area / (4) =											0.3770 (91)
MIT	19.4008	19.5467	19.8054	20.1565	20.3763	20.4476	20.4545	20.4547	20.4006	20.0855	19.6912	19.3908 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4008	19.5467	19.8054	20.1565	20.3763	20.4476	20.4545	20.4547	20.4006	20.0855	19.6912	19.3908 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9981	0.9953	0.9837	0.9273	0.7678	0.5420	0.3826	0.4527	0.7702	0.9699	0.9957	0.9986 (94)
Useful gains	380.1573	439.4442	511.0076	578.1595	544.6523	388.4238	258.9829	270.7606	391.6355	408.1927	369.2946	359.4761 (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	1064.6159	1028.5545	930.7601	773.1226	593.8489	393.7618	259.5552	272.2007	426.9544	649.2320	867.8575	1054.6799 (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	509.2372	395.8821	312.2959	140.3734	36.6023	0.0000	0.0000	0.0000	0.0000	179.3332	358.9653	517.2316 (98)
Space heating												2449.9209 (98)
Space heating per m2												(98) / (4) = 34.5317 (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	632.9712	498.2965	510.2056	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9628	0.9838	0.9705	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.4441	490.2414	495.1780	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	921.9418	873.8441	783.0341	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	224.9983	285.4004	214.1649	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												724.5636 (104)
Cooled fraction												fC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.2496	71.3501	53.5412	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													181.1409 (107)
Space cooling per m2													2.5532 (108)
Energy for space heating													34.5317 (99)
Energy for space cooling													2.5532 (108)
Total													37.0849 (109)
Target Fabric Energy Efficiency (TFEE)													42.6 (109)

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# 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	70.9470 (1b)	2.4250 (2b)	172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		172.0465 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	172.0465 (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				5.0100	
Infiltration rate				0.2505	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infiltr rate	0.2838	0.2781	0.2723	0.2433	0.2433	0.2143	0.2201	0.2201	0.2317	0.2433	0.2491	0.2607 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5338	0.5281	0.5223	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107 (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
Windows (Uw = 1.40)			15.3800	1.3258	20.3902		(27)
Wl - Brick	15.8370	6.9770	8.8600	0.2500	2.2150	60.0000	531.6000 (29a)
Wl - Clad	41.3070	8.4000	32.9070	0.2400	7.8977	60.0000	1974.4200 (29a)
Total net area of external elements Aum(A, m2)			57.1470				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.5028		(33)
Party Wall			27.2170	0.0000	0.0000	54.0300	1470.5345 (32)
Party Floor			70.9470			40.0000	2837.8800 (32d)
Party Ceiling			70.9470			70.0000	4966.2900 (32b)
1st Floor Stud			123.3161			5.8200	717.6997 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12498.4242 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							176.1656 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6442 (36)
Total fabric heat loss						(33) + (36) =	38.1471 (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	30.3094	29.9805	29.6516	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.9938 (38)
Average = Sum(39)m / 12 =	68.4564	68.1276	67.7987	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	67.1409 (39)
HLP	0.9649	0.9603	0.9556	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9464 (40)
HLP (average)												0.9441 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	21.5538	18.8511	19.4527	16.9593	16.2729	14.0422	13.0122	14.9317	15.1100	17.6093	19.2219	20.8737 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6346	13.1931	14.5665	14.0511	14.4864	13.9809	14.4232	14.4642	14.0192	14.5333	14.1173	14.6214 (61)
Total heat required for water heating calculated for each month	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1557.0309 (64)											
Heat gains from water heating, kWh/month	51.4363	45.0849	46.7617	41.1059	39.6931	34.6222	32.4495	36.7146	36.9987	42.6672	46.1379	49.9255 (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	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.5041	39.5281	32.1464	24.3369	18.1921	15.3586	16.5955	21.5714	28.9531	36.7626	42.9074	45.7410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.7569	300.8467	293.0605	276.4847	255.5607	235.8951	222.7573	219.6675	227.4537	244.0295	264.9535	284.6191 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	69.1349	67.0907	62.8518	57.0916	53.3510	48.0864	43.6150	49.3476	51.3871	57.3484	64.0804	67.1042 (72)
Total internal gains	510.6560	506.7257	487.3189	457.1734	426.3640	398.6003	382.2279	389.8467	407.0540	437.4007	471.2014	496.7244 (73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	6.7980	12.9465	0.5000	0.0000	0.7700	33.8841 (75)						
Southwest	1.6020	40.9830	0.5000	0.0000	0.7700	25.2771 (79)						
Northwest	6.9770	12.9465	0.5000	0.0000	0.7700	34.7763 (81)						
Solar gains	93.9374	170.8249	285.8674	469.7678	592.4487	651.3509	605.9974	497.1858	361.3864	213.4470	119.6241	76.8859 (83)
Total gains	604.5934	677.5506	773.1863	926.9412	1018.8127	1049.9512	988.2253	887.0326	768.4404	650.8477	590.8256	573.6103 (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	50.7152	50.9601	51.2073	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	51.7089
alpha	4.3810	4.3973	4.4138	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4473
util living area	0.9675	0.9473	0.8882	0.7316	0.5367	0.3526	0.2287	0.2546	0.5058	0.8097	0.9389	0.9723 (86)
MIT	20.0410	20.2140	20.5248	20.8418	20.9659	20.9958	20.9996	20.9993	20.9809	20.7968	20.3995	20.0260 (87)
Th 2	20.1127	20.1166	20.1205	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1283 (88)
util rest of house	0.9608	0.9369	0.8675	0.6936	0.4873	0.2991	0.1707	0.1901	0.4380	0.7684	0.9248	0.9664 (89)
MIT 2	19.2561	19.4267	19.7243	20.0178	20.1145	20.1337	20.1354	20.1353	20.1262	19.9880	19.6245	19.2545 (90)
Living area fraction	fLA = Living area / (4) = 0.3770 (91)											
MIT	19.5520	19.7236	20.0261	20.3285	20.4355	20.4587	20.4612	20.4611	20.4485	20.2930	19.9167	19.5454 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.4020	19.5736	19.8761	20.1785	20.2855	20.3087	20.3112	20.3111	20.2985	20.1430	19.7667	19.3954 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9542	0.9293	0.8611	0.6956	0.4961	0.3099	0.1825	0.2032	0.4511	0.7688	0.9178	0.9604 (94)
Useful gains	576.9229	629.6587	665.8110	644.7581	505.3855	325.3927	180.3178	180.2673	346.6292	500.3877	542.2600	550.9046 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	1006.4497	979.2363	872.9853	710.4901	518.0057	326.5992	180.3904	180.3820	352.5322	581.7108	802.8550	986.6606 (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	319.5679	234.9162	154.1377	47.3270	9.3894	0.0000	0.0000	0.0000	0.0000	60.5044	187.6284	324.2025 (98)
Space heating	1337.6736 (98)											
RHI space heating demand	1338 (98)											

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	70.9470 (1b)	2.4250 (2b)	172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		172.0465 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 172.0465 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.2505	(18)
Number of sides sheltered				1	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2317 (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				0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5454	0.5396	0.5338	0.5049	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107	0.5223 (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
Windows (Uw = 1.40)			15.3800	1.3258	20.3902		(27)
Wl - Brick	15.8370	6.9770	8.8600	0.2500	2.2150	60.0000	531.6000 (29a)
Wl - Clad	41.3070	8.4000	32.9070	0.2400	7.8977	60.0000	1974.4200 (29a)
Total net area of external elements Aum(A, m2)			57.1470				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.5028		(33)
Party Wall			27.2170	0.0000	0.0000	54.0300	1470.5345 (32)
Party Floor			70.9470			40.0000	2837.8800 (32d)
Party Ceiling			70.9470			70.0000	4966.2900 (32b)
1st Floor Stud			123.3161			5.8200	717.6997 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12498.4242 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		176.1656 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.6442 (36)
Total fabric heat loss	(33) + (36) =	38.1471 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.9672	30.6383	30.3094	28.6649	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.9938	29.6516 (38)
Heat transfer coeff	69.1142	68.7853	68.4564	66.8120	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	67.1409	67.7987 (39)
Average = Sum(39)m / 12 =												67.2763 (39)
HLP	0.9742	0.9695	0.9649	0.9417	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9464	0.9556 (40)
HLP (average)												0.9483 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	21.5538	18.8511	19.4527	16.9593	16.2729	14.0422	13.0122	14.9317	15.1100	17.6093	19.2219	20.8737 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6346	13.1931	14.5665	14.0511	14.4864	13.9809	14.4232	14.4642	14.0192	14.5333	14.1173	14.6214 (61)
Total heat required for water heating calculated for each month	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (64)
Heat gains from water heating, kWh/month	51.4363	45.0849	46.7617	41.1059	39.6931	34.6222	32.4495	36.7146	36.9987	42.6672	46.1379	49.9255 (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	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.5041	39.5281	32.1464	24.3369	18.1921	15.3586	16.5955	21.5714	28.9531	36.7626	42.9074	45.7410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.7569	300.8467	293.0605	276.4847	255.5607	235.8951	222.7573	219.6675	227.4537	244.0295	264.9535	284.6191 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	69.1349	67.0907	62.8518	57.0916	53.3510	48.0864	43.6150	49.3476	51.3871	57.3484	64.0804	67.1042 (72)
Total internal gains	510.6560	506.7257	487.3189	457.1734	426.3640	398.6003	382.2279	389.8467	407.0540	437.4007	471.2014	496.7244 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	6.7980	11.2829	0.5000	0.0000	0.7700	29.5301 (75)						
Southwest	1.6020	36.7938	0.5000	0.0000	0.7700	22.6933 (79)						
Northwest	6.9770	11.2829	0.5000	0.0000	0.7700	30.3076 (81)						
Solar gains	82.5310	160.4564	272.3369	425.9282	557.8443	589.3380	553.3997	449.5528	324.6682	191.5730	102.4727	68.2872 (83)
Total gains	593.1870	667.1821	759.6558	883.1016	984.2083	987.9382	935.6276	839.3995	731.7222	628.9737	573.6741	565.0116 (84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	50.2326	50.4727	50.7152	51.9635	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	51.7089	51.2073
tau	4.3488	4.3648	4.3810	4.4642	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4473	4.4138
alpha	0.9723	0.9534	0.9047	0.7792	0.5970	0.4253	0.3117	0.3621	0.5960	0.8542	0.9524	0.9766 (86)
util living area	19.9593	20.1495	20.4484	20.7814	20.9433	20.9897	20.9980	20.9961	20.9582	20.7187	20.2979	19.9368 (87)
MIT	20.1049	20.1088	20.1127	20.1322	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1283	20.1205 (88)
Th 2	0.9666	0.9441	0.8868	0.7450	0.5495	0.3700	0.2510	0.2952	0.5313	0.8210	0.9414	0.9718 (89)
util rest of house	19.1696	19.3578	19.6463	19.9641	20.0983	20.1304	20.1348	20.1341	20.1122	19.9208	19.5209	19.1603 (90)
Living area fraction	19.4674	19.6563	19.9487	20.2722	20.4169	20.4544	20.4603	20.4591	20.4312	20.2216	19.8139	19.4531 (92)
MIT 2	19.3174	19.5063	19.7987	20.1222	20.2669	20.3044	20.3103	20.3091	20.2812	20.0716	19.6639	19.3031 (93)
Temperature adjustment												-0.1500
adjusted MIT												19.3031 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9604	0.9367	0.8796	0.7446	0.5569	0.3809	0.2633	0.3087	0.5426	0.8183	0.9344	0.9662 (94)
Ext temp.	569.6993	624.9469	668.2180	657.5522	548.1210	376.3030	246.3961	259.1469	397.0139	514.6664	536.0242	545.8914 (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	1037.9136	1004.6997	910.3813	749.7797	569.9961	379.5409	246.8618	260.0928	411.2618	630.1916	843.5486	1023.9686 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	348.3514	255.1939	180.1695	66.4038	16.2751	0.0000	0.0000	0.0000	0.0000	85.9507	221.4175	355.6894 (98)
(98) / (4) =												1529.4514 (98)
												21.5577 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

	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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1690.0015 (211)
Space heating requirement	348.3514	255.1939	180.1695	66.4038	16.2751	0.0000	0.0000	0.0000	0.0000	85.9507	221.4175	355.6894	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	384.9187	281.9822	199.0823	73.3744	17.9835	0.0000	0.0000	0.0000	0.0000	94.9732	244.6603	393.0270	(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	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797	(64)
Efficiency of water heater (217)m	89.4751	89.3459	89.0486	88.3722	87.6623	87.3000	87.3000	87.3000	87.3000	88.5350	89.2207	89.5097	(216)
Fuel for water heating, kWh/month	176.9507	155.4266	161.9912	143.8384	140.2795	123.2485	115.8892	130.5943	131.4464	149.0130	159.4510	171.8024	(219)
Water heating fuel used													1759.9311 (219)
Annual totals kWh/year													
Space heating fuel - main system													1690.0015 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													50.8050 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													125.8050 (231)
Electricity for lighting (calculated in Appendix L)													314.3823 (232)
Total delivered energy for all uses													3890.1200 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1690.0015	3.4800	58.8121	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1759.9311	3.4800	61.2456	(247)
Mechanical ventilation fans	50.8050	13.1900	6.7012	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	314.3823	13.1900	41.4670	(250)
Additional standing charges			120.0000	(251)
Total energy cost			298.1184	(255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0799 (257)
SAP value		84.9356
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1690.0015	0.2160	365.0403	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1759.9311	0.2160	380.1451	(264)
Space and water heating			745.1854	(265)
Pumps and fans	125.8050	0.5190	65.2928	(267)
Energy for lighting	314.3823	0.5190	163.1644	(268)
Total kg/year			973.6427	(272)
CO2 emissions per m2			13.7200	(273)
EI value			88.7476	
EI rating			89	(274)
EI band			B	

#### Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$ , stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$ , stars = 4
Water heating energy efficiency	$3.48 / 0.8836 = 3.938$ , stars = 4
Water heating environmental impact	$0.216 / 0.8836 = 0.2444$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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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	70.9470 (1b)	x 2.4250 (2b)	= 172.0465 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.9470		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 172.0465 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.2505	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2838	0.2781	0.2723	0.2433	0.2433	0.2143	0.2201	0.2201	0.2317	0.2433	0.2491	0.2607 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5338	0.5281	0.5223	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5107 (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
Windows (Uw = 1.40)			15.3800	1.3258	20.3902		(27)
Wl - Brick	15.8370	6.9770	8.8600	0.2500	2.2150	60.0000	531.6000 (29a)
Wl - Clad	41.3070	8.4000	32.9070	0.2400	7.8977	60.0000	1974.4200 (29a)
Total net area of external elements Aum(A, m2)			57.1470				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.5028		(33)
Party Wall			27.2170	0.0000	0.0000	54.0300	1470.5345 (32)
Party Floor			70.9470			40.0000	2837.8800 (32d)
Party Ceiling			70.9470			70.0000	4966.2900 (32b)
1st Floor Stud			123.3161			5.8200	717.6997 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12498.4242 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							176.1656 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6442 (36)
Total fabric heat loss						(33) + (36) =	38.1471 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.3094	29.9805	29.6516	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.3877	28.9938 (38)
Heat transfer coeff	68.4564	68.1276	67.7987	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	66.5347	67.1409 (39)
Average = Sum(39)m / 12 =												66.9834 (39)
HLP	0.9649	0.9603	0.9556	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9378	0.9464 (40)
HLP (average)												0.9441 (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												2.2689 (42)
Average daily hot water use (litres/day)												88.0862 (43)
Daily hot water use	96.8949	93.3714	89.8480	86.3245	82.8011	79.2776	79.2776	82.8011	86.3245	89.8480	93.3714	96.8949 (44)
Energy conte	143.6923	125.6742	129.6845	113.0621	108.4858	93.6150	86.7480	99.5446	100.7335	117.3952	128.1460	139.1583 (45)
Energy content (annual)												Total = Sum(45)m = 1385.9396 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	21.5538	18.8511	19.4527	16.9593	16.2729	14.0422	13.0122	14.9317	15.1100	17.6093	19.2219	20.8737 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.6346	13.1931	14.5665	14.0511	14.4864	13.9809	14.4232	14.4642	14.0192	14.5333	14.1173	14.6214 (61)
Total heat required for water heating calculated for each month	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797 (64)
Heat gains from water heating, kWh/month	51.4363	45.0849	46.7617	41.1059	39.6931	34.6222	32.4495	36.7146	36.9987	42.6672	46.1379	49.9255 (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	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337	136.1337 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.5041	39.5281	32.1464	24.3369	18.1921	15.3586	16.5955	21.5714	28.9531	36.7626	42.9074	45.7410 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	297.7569	300.8467	293.0605	276.4847	255.5607	235.8951	222.7573	219.6675	227.4537	244.0295	264.9535	284.6191 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823	50.8823 (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)	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558	-90.7558 (71)
Water heating gains (Table 5)	69.1349	67.0907	62.8518	57.0916	53.3510	48.0864	43.6150	49.3476	51.3871	57.3484	64.0804	67.1042 (72)
Total internal gains	510.6560	506.7257	487.3189	457.1734	426.3640	398.6003	382.2279	389.8467	407.0540	437.4007	471.2014	496.7244 (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						
Northeast	6.7980	12.9465	0.5000	0.0000	0.7700	33.8841 (75)						
Southwest	1.6020	40.9830	0.5000	0.0000	0.7700	25.2771 (79)						
Northwest	6.9770	12.9465	0.5000	0.0000	0.7700	34.7763 (81)						
Solar gains	93.9374	170.8249	285.8674	469.7678	592.4487	651.3509	605.9974	497.1858	361.3864	213.4470	119.6241	76.8859 (83)
Total gains	604.5934	677.5506	773.1863	926.9412	1018.8127	1049.9512	988.2253	887.0326	768.4404	650.8477	590.8256	573.6103 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	50.7152	50.9601	51.2073	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800	52.1800 (85)
tau	4.3810	4.3973	4.4138	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4787	4.4473
alpha	0.9675	0.9473	0.8882	0.7316	0.5367	0.3526	0.2287	0.2546	0.5058	0.8097	0.9389	0.9723 (86)
util living area	20.0410	20.2140	20.5248	20.8418	20.9659	20.9958	20.9996	20.9993	20.9809	20.7968	20.3995	20.0260 (87)
MIT	20.1127	20.1166	20.1205	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1355	20.1283 (88)
util rest of house	0.9608	0.9369	0.8675	0.6936	0.4873	0.2991	0.1707	0.1901	0.4380	0.7684	0.9248	0.9664 (89)
MIT 2	19.2561	19.4267	19.7243	20.0178	20.1145	20.1337	20.1354	20.1353	20.1262	19.9880	19.6245	19.2545 (90)
Living area fraction	19.5520	19.7236	20.0261	20.3285	20.4355	20.4587	20.4612	20.4611	20.4485	20.2930	19.9167	19.5454 (91)
MIT	19.5520	19.7236	20.0261	20.3285	20.4355	20.4587	20.4612	20.4611	20.4485	20.2930	19.9167	19.5454 (92)
Temperature adjustment	19.4020	19.5736	19.8761	20.1785	20.2855	20.3087	20.3112	20.3111	20.2985	20.1430	19.7667	-0.1500 (93)
adjusted MIT	19.4020	19.5736	19.8761	20.1785	20.2855	20.3087	20.3112	20.3111	20.2985	20.1430	19.7667	19.3954 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9542	0.9293	0.8611	0.6956	0.4961	0.3099	0.1825	0.2032	0.4511	0.7688	0.9178	0.9604 (94)
Ext temp.	576.9229	629.6587	665.8110	644.7581	505.3855	325.3927	180.3178	180.2673	346.6292	500.3877	542.2600	550.9046 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	1006.4497	979.2363	872.9853	710.4901	518.0057	326.5992	180.3904	180.3820	352.5322	581.7108	802.8550	986.6606 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	319.5679	234.9162	154.1377	47.3270	9.3894	0.0000	0.0000	0.0000	0.0000	60.5044	187.6284	324.2025 (98)
												1337.6736 (98)
												(98) / (4) = 18.8545 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Not applicable

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

	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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1478.0923 (211)
Space heating requirement	319.5679	234.9162	154.1377	47.3270	9.3894	0.0000	0.0000	0.0000	0.0000	60.5044	187.6284	324.2025	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	353.1137	259.5759	170.3179	52.2950	10.3751	0.0000	0.0000	0.0000	0.0000	66.8557	207.3242	358.2348	(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	158.3269	138.8673	144.2510	127.1132	122.9722	107.5959	101.1713	114.0088	114.7527	131.9286	142.2633	153.7797	(64)
Efficiency of water heater (217)m	89.4142	89.2841	88.9242	88.1456	87.5195	87.3000	87.3000	87.3000	87.3000	88.2815	89.0917	89.4452	(216)
Fuel for water heating, kWh/month	177.0714	155.5342	162.2179	144.2082	140.5083	123.2485	115.8892	130.5943	131.4464	149.4408	159.6819	171.9262	(219)
Water heating fuel used													1761.7672 (219)
Annual totals kWh/year													
Space heating fuel - main system													1478.0923 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													50.8050 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													125.8050 (231)
Electricity for lighting (calculated in Appendix L)													314.3823 (232)
Total delivered energy for all uses													3680.0469 (238)

#### 10a. Fuel costs - using BEDF prices (465)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1478.0923	3.9500	58.3846 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1761.7672	3.9500	69.5898 (247)
Mechanical ventilation fans	50.8050	18.7000	9.5005 (249)
Pumps and fans for heating	75.0000	18.7000	14.0250 (249)
Energy for lighting	314.3823	18.7000	58.7895 (250)
Additional standing charges			91.0000 (251)
Total energy cost			301.2895 (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	1478.0923	0.2160	319.2679 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1761.7672	0.2160	380.5417 (264)
Space and water heating			699.8097 (265)
Pumps and fans	125.8050	0.5190	65.2928 (267)
Energy for lighting	314.3823	0.5190	163.1644 (268)
Total kg/year			928.2669 (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	1478.0923	1.2200	1803.2727 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1761.7672	1.2200	2149.3560 (264)
Space and water heating			3952.6286 (265)
Pumps and fans	125.8050	3.0700	386.2213 (267)
Energy for lighting	314.3823	3.0700	965.1538 (268)
Primary energy kWh/year			5304.0038 (272)
Primary energy kWh/m2/year			74.7601 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85  
 Current environmental impact rating: B 89

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	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	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
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: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m <sup>2</sup>	

Potential energy efficiency rating: B 85  
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 465 TEST (04 Sep 2020)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£82	£82	£0
Mains gas	£219	£219	£0
Space heating	£173	£173	£0
Water heating	£70	£70	£0
Lighting	£59	£59	£0
Total cost of fuels	£301	£301	£0
Total cost of uses	£302	£302	£0
Delivered energy	52 kWh/m <sup>2</sup>	52 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	13 kg/m <sup>2</sup>	13 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	75 kWh/m <sup>2</sup>	75 kWh/m <sup>2</sup>	0 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

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable

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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

No improvements selected / applicable

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

#### Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	176.2 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.21 (Calculated rate)

#### Overheating Calculation

Summer ventilation heat loss coefficient	238.99 (P1)
Transmission heat loss coefficient	38.15 (37)
Summer heat loss coefficient	277.14 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	6.7980	100.0415	0.5000	0.0000	0.7650	260.1313
South West	1.6020	122.3147	0.5000	0.0000	0.7650	74.9501
North West	6.9770	100.0415	0.5000	0.0000	0.7650	266.9809

total: 602.0624

	Jun	Jul	Aug	
Solar gains	647	602	494	(P4)
Internal gains	396	379	387	
Total summer gains	1043	981	881	(P5)

	3.76	3.54	3.18	
Summer gain/loss ratio				(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 176.2)	0.77	0.77	0.77	
Threshold temperature	19.93	21.91	21.55	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	Plot 119 - PRJ010789		<b>Issued on Date</b>	05/10/2020	
<b>Assessment Reference</b>	119 S	<b>Prop Type Ref</b>	Plot 119 - PRJ010789		
<b>Property</b>	Plot 119 - PRJ010789				
<b>SAP Rating</b>	85 B	<b>DER</b>	15.42	<b>TER</b>	17.00
<b>Environmental</b>	89 B	<b>% DER&lt;TER</b>	9.28		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.93	<b>DFEE</b>	38.08	<b>TFEE</b>	42.65
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	10.70		
<b>Assessor Details</b>	Mr. Gareth Thomas, Gareth Thomas, Tel: 02033971373, gareth@briaryenergy.co.uk			<b>Assessor ID</b>	W933-0001
<b>Client</b>					

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

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.00	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	15.42	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.58 (-9.3%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.65	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	38.08	kWh/m <sup>2</sup> /yr	
	-4.5 (-10.6%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Openings	1.40 (max. 2.00)	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	5.01 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

### 5 Cylinder insulation

Hot water storage

### 6 Controls

Space heating controls

Hot water controls

Boiler interlock

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings  %

Minimum  %

### 8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

Maximum

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (East Anglia)

Based on:

Overshading

Windows facing North East

Windows facing South West

Windows facing North West

Air change rate

Blinds/curtains

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	<input type="text" value="0.00"/>	W/m <sup>2</sup> K	<input type="text" value="Pass"/>

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

Maximum

### 10 Key features

Party wall U-value  W/m<sup>2</sup>K

Door U-value  W/m<sup>2</sup>K

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