

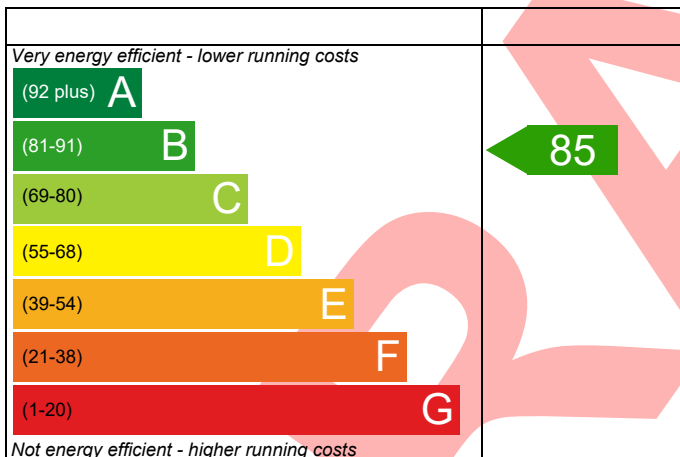
# PREDICTED ENERGY ASSESSMENT

Dwelling type: House, Semi-Detached  
 Date of assessment: 09/11/2022  
 Produced by: S J Roberts Construction Limited  
 Total floor area: 86 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.

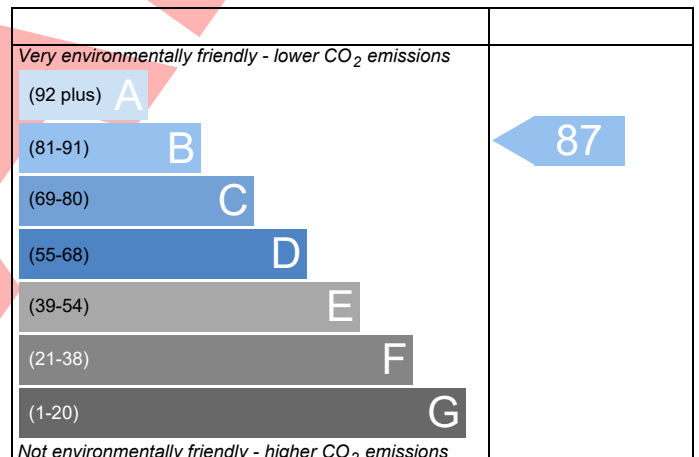
## Energy Efficiency Rating



**England** EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

## Environmental Impact (CO<sub>2</sub>) Rating



**England** EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

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

# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE B3	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	85 B	DER	16.14	TER	27.03
Environmental	87 B	% DER<TER	40.29		
CO <sub>2</sub> Emissions (t/year)	1.29	DFEE	50.47	TFEE	55.80
General Requirements Compliance	Pass	% DFEE<TFEE	9.56		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
------------------	---	-------------	-----------

Client	
--------	--

### 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	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	27.03	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	16.14	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-10.89 (-40.3%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.80	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.47	kWh/m <sup>2</sup> /yr	
	-5.3 (-9.5%)	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	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.38 (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	4.50 (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

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)

Main heating system

Heat pump with radiators or underfloor - Electric  
Grant AERONA3 HPID6R32

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.02 kWh/day  
Permitted by DBSCG 2.56

Pass

Primary pipework insulated

Yes

Pass

### 6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

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

0.1300 0.1600 0.1600

Maximum

0.7

Pass

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

### 9 Summertime temperature

Overheating risk (Midlands)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

4.04 m<sup>2</sup>, No overhang

Windows facing North East

5.38 m<sup>2</sup>, No overhang

Windows facing South

3.58 m<sup>2</sup>, No overhang

Windows facing South West

6.00 m<sup>2</sup>, No overhang

Windows facing West

0.88 m<sup>2</sup>, No overhang

Air change rate

8.00 ach

Blinds/curtains

None

## 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

4.50 (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

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE B3			Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref			
Property					
SAP Rating	85 B	DER	16.14	TER	27.03
Environmental	87 B	% DER<TER	40.29		
CO <sub>2</sub> Emissions (t/year)	1.29	DFEE	50.47	TFEE	55.80
General Requirements Compliance	Pass	% DFEE<TFEE	9.56		
Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com			Assessor ID	K559-0001
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

Semi-Detached House, total floor area 86 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:Electricity  
Fuel factor:1.55 (electricity)  
Target Carbon Dioxide Emission Rate (TER) 27.03 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 16.14 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)50.5 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.38 (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: 4.50 (design value)  
Maximum 10.0 OK

#### 4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric  
Grant AERONA3 HPID6R32

Secondary heating system: None

#### 5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.02 kWh/day  
Permitted by DBSCG 2.56 OK  
Primary pipework insulated: Yes OK

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK  
Independent timer for DHW OK

#### 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: 0.1300 0.1600 0.1600  
Maximum 0.7 OK

#### 9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average  
Windows facing North: 4.04 m<sup>2</sup>, No overhang  
Windows facing North East: 5.38 m<sup>2</sup>, No overhang  
Windows facing South: 3.58 m<sup>2</sup>, No overhang  
Windows facing South West: 6.00 m<sup>2</sup>, No overhang  
Windows facing West: 0.88 m<sup>2</sup>, No overhang  
Air change rate: 8.00 ach  
Blinds/curtains: None

#### 10 Key features

Party wall U-value 0.00 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5000
Infiltration rate					0.2250 (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) =		0.2081 (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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)
CEILING	43.0000		43.0000	0.1400	6.0200		(30)
Total net area of external elements Aum(A, m2)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)
Party Wall 1			45.9000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)
Total fabric heat loss						(33) + (36) =	75.2444 (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	37.3692	36.9919	36.6146	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555 (38)
Average = Sum(39)m / 12 =	112.6136	112.2363	111.8590	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
HLP	1.3095	1.3051	1.3007	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965 (40)
HLP (average)												1.2987 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Heat gains from water heating, kWh/month	97.2786	86.3873	92.2467	84.8027	84.6318	77.8170	76.8232	81.4200	80.3741	87.8322	90.2211	95.6499 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.6405	18.3327	14.9091	11.2872	8.4373	7.1231	7.6968	10.0046	13.4281	17.0501	19.9000	21.2141 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	123.9875	117.7815	113.7524	108.0791	103.2570	109.4354	111.6306	118.0540	125.3071	128.5617 (72)
Total internal gains	444.4185	442.3149	428.2722	405.5556	382.4069	360.1283	345.6644	351.7482	363.4211	386.3551	412.7277	432.5876 (73)

#### 6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains				
		m2	Table 6a	W/m2	or Table 6b	Specific data	factor	W				
						or Table 6c	Table 6d					
North		4.0400	10.6334	0.7200		0.7000	0.7700	15.0043 (74)				
Northeast		5.3800	11.2829	0.7200		0.7000	0.7700	21.2016 (75)				
South		0.7200	46.7521	0.7200		0.7000	0.7700	11.7570 (78)				
Southwest		3.1400	36.7938	0.7200		0.7000	0.7700	40.3523 (79)				
West		0.8800	19.6403	0.7200		0.7000	0.7700	6.0366 (80)				
South		2.8600	46.7521	0.7200		0.7000	0.7700	46.7015 (78)				
Southwest		2.8600	36.7938	0.7200		0.7000	0.7700	36.7540 (79)				
Solar gains	177.8074	310.7200	447.5877	594.8223	704.8719	717.2682	684.2058	599.0951	497.9260	349.3095	214.3627	151.2873 (83)
Total gains	622.2258	753.0348	875.8599	1000.3779	1087.2788	1077.3965	1029.8702	950.8433	861.3472	735.6646	627.0904	583.8749 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	21.2132	21.2845	21.3563	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250
alpha	2.4142	2.4190	2.4238	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283
util living area	0.9526	0.9261	0.8824	0.8050	0.6913	0.5536	0.4317	0.4763	0.6673	0.8467	0.9307	0.9587 (86)
Tweekday	18.5094	18.6379	18.8238	19.0371	19.2074	19.3092	19.3455	19.3401	19.2685	19.0476	18.7476	18.4991
Tweekend	20.3753	20.4319	20.5149	20.6125	20.6951	20.7488	20.7715	20.7671	20.7241	20.6147	20.4775	20.3666
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.0358	20.1212	20.2514	20.3949	20.5294	20.6142	20.6474	20.6405	20.5692	20.4054	20.1842	20.0224 (87)
Th 2	19.8334	19.8369	19.8403	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436 (88)
util rest of house	0.9453	0.9150	0.8646	0.7748	0.6422	0.4785	0.3327	0.3759	0.5980	0.8158	0.9184	0.9522 (89)
Tweekday	18.5094	18.6379	18.8238	19.0371	19.2074	19.3092	19.3455	19.3401	19.2685	19.0476	18.7476	18.4991
Tweekend	18.5094	18.6379	18.8238	19.0371	19.2074	19.3092	19.3455	19.3401	19.2685	19.0476	18.7476	18.4991
MIT 2	18.5094	18.6379	18.8238	19.0371	19.2074	19.3092	19.3455	19.3401	19.2685	19.0476	18.7476	18.4991 (90)
Living area fraction									fLA = Living area / (4) =			0.1756 (91)
MIT	18.7774	18.8984	19.0744	19.2755	19.4395	19.5384	19.5741	19.5684	19.4969	19.2860	18.9998	18.7665 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7774	18.8984	19.0744	19.2755	19.4395	19.5384	19.5741	19.5684	19.4969	19.2860	18.9998	18.7665 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9372	0.9044	0.8508	0.7578	0.6229	0.4567	0.3078	0.3497	0.5741	0.7980	0.9075	0.9449 (94)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Useful gains	583.1646	681.0169	745.2197	758.0832	677.2922	492.0107	316.9632	332.5263	494.4723	587.0676	569.0584	551.7290 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	1630.3522	1571.1248	1406.5648	1156.8632	862.9579	550.6273	331.6107	353.2779	601.7522	968.4909	1326.8267	1624.1648 (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	779.1076	598.1525	492.0408	287.1216	138.1352	0.0000	0.0000	0.0000	0.0000	283.7790	545.5932	797.8923 (98)
Space heating per m2												3921.8222 (98)
												(98) / (4) = 45.6026 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												334.5383 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1172.3091 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	779.1076	598.1525	492.0408	287.1216	138.1352	0.0000	0.0000	0.0000	0.0000	283.7790	545.5932	797.8923 (98)
Space heating efficiency (main heating system 1)	334.5383	334.5383	334.5383	334.5383	334.5383	0.0000	0.0000	0.0000	0.0000	334.5383	334.5383	334.5383 (210)
Space heating fuel (main heating system)	232.8904	178.7994	147.0806	85.8262	41.2913	0.0000	0.0000	0.0000	0.0000	84.8271	163.0884	238.5055 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Efficiency of water heater	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (217)
Fuel for water heating, kWh/month	106.4559	93.9261	98.8680	88.9406	87.3848	78.4062	75.6096	82.5414	82.2623	92.2110	97.1115	103.9999 (219)
Water heating fuel used												1087.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												1172.3091 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												49.2973 (230a)
Total electricity for the above, kWh/year												49.2973 (231)
Electricity for lighting (calculated in Appendix L)												364.5173 (232)
Total delivered energy for all uses												2673.8409 (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	1172.3091	0.5190	608.4284 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.7173	0.5190	564.5253 (264)
Space and water heating			1172.9537 (265)
Pumps and fans	49.2973	0.5190	25.5853 (267)
Energy for lighting	364.5173	0.5190	189.1845 (268)
Total CO2, kg/year			1387.7235 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1400 (273)

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

DER			16.1400 ZC1
Total Floor Area		TFA	86.0000
Assumed number of occupants		N	2.5669
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.9530 ZC2
CO2 emissions from cooking, equation (L16)			2.1001 ZC3
Total CO2 emissions			34.1931 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			34.1931 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	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (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)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1365 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3865 (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) =		0.3575 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4559	0.4469	0.4380	0.3933	0.3844	0.3397	0.3397	0.3307	0.3575	0.3844	0.4022	0.4201 (22b)
Effective ac	0.6039	0.5999	0.5959	0.5773	0.5739	0.5577	0.5577	0.5547	0.5639	0.5739	0.5809	0.5882 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Opaque door			2.1600	1.0000	2.1600		(26)					
TER Opening Type (Uw = 1.40)			19.3400	1.3258	25.6402		(27)					
Heat Loss Floor 1			42.3000	0.1300	5.4990		(28a)					
BRICK TF	112.4200	21.5000	90.9200	0.1800	16.3656		(29a)					
CEILING	43.0000		43.0000	0.1300	5.5900		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			197.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		55.2548 (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)							10.8333 (36)					
Total fabric heat loss							(33) + (36) = 66.0881 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.7898	Feb 43.4972	Mar 43.2105	Apr 41.8635	May 41.6115	Jun 40.4383	Jul 40.4383	Aug 40.2211	Sep 40.8902	Oct 41.6115	Nov 42.1213	Dec 42.6543 (38)
Heat transfer coeff	109.8779	109.5853	109.2985	107.9515	107.6995	106.5264	106.5264	106.3091	106.9782	107.6995	108.2094	108.7423 (39)
Average = Sum(39)m / 12 =												107.9503 (39)
HLP	Jan 1.2776	Feb 1.2742	Mar 1.2709	Apr 1.2553	May 1.2523	Jun 1.2387	Jul 1.2387	Aug 1.2362	Sep 1.2439	Oct 1.2523	Nov 1.2582	Dec 1.2644 (40)
HLP (average)												1.2552 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (45)
Distribution loss (46)m = 0.15 x (45)m												22.5510 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month	210.1453	185.3658	195.0120	175.2827	172.1098	154.2729	148.6254	162.4502	161.9635	181.7352	191.5787	205.2470 (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	210.1453	185.3658	195.0120	175.2827	172.1098	154.2729	148.6254	162.4502	161.9635	181.7352	191.5787	205.2470 (64)
Heat gains from water heating, kWh/month	95.5422	84.8190	90.5104	83.1224	82.8954	76.1366	75.0869	79.6836	78.6937	86.0959	88.5408	93.9136 (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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.6377	18.3302	14.9071	11.2857	8.4362	7.1222	7.6957	10.0032	13.4263	17.0478	19.8973	21.2113 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	128.4170	126.2187	121.6538	115.4478	111.4186	105.7453	100.9232	107.1017	109.2969	115.7203	122.9733	126.2279 (72)
Total internal gains	445.0819	442.9786	428.9364	406.2203	383.0720	360.7936	346.3296	352.4130	364.0855	387.0190	413.3912	433.2510 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
North	3.9300	10.6334	0.6300	0.7000	0.7700	12.7713 (74)						
Northeast	5.2300	11.2829	0.6300	0.7000	0.7700	18.0342 (75)						
South	3.4800	46.7521	0.6300	0.7000	0.7700	49.7224 (78)						
Southwest	5.8400	36.7938	0.6300	0.7000	0.7700	65.6689 (79)						
West	0.8600	19.6403	0.6300	0.7000	0.7700	5.1620 (80)						
Solar gains	151.3588	264.5045	381.0209	506.3613	600.0424	610.5931	582.4488	509.9983	423.8744	297.3563	182.4773	128.7830 (83)
Total gains	596.4406	707.4832	809.9573	912.5815	983.1144	971.3866	928.7784	862.4113	787.9599	684.3753	595.8685	562.0339 (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	54.3533	54.4984	54.6414	55.3232	55.4526	56.0633	56.0633	56.1779	55.8265	55.4526	55.1914	54.9209
alpha	4.6236	4.6332	4.6428	4.6882	4.6968	4.7376	4.7376	4.7452	4.7218	4.6968	4.6794	4.6614
util living area	0.9963	0.9913	0.9778	0.9355	0.8321	0.6568	0.4947	0.5497	0.7972	0.9591	0.9920	0.9972 (86)
MIT	19.6758	19.8648	20.1529	20.5152	20.8032	20.9530	20.9900	20.9840	20.8819	20.5029	20.0222	19.6452 (87)
Th 2	19.8584	19.8611	19.8637	19.8761	19.8784	19.8892	19.8892	19.8912	19.8850	19.8784	19.8737	19.8688 (88)
util rest of house	0.9950	0.9883	0.9701	0.9127	0.7763	0.5607	0.3749	0.4258	0.7135	0.9398	0.9888	0.9962 (89)
MIT 2	18.1138	18.3904	18.8075	19.3236	19.6938	19.8597	19.8858	19.8850	19.7959	19.3192	18.6298	18.0764 (90)
Living area fraction												fLA = Living area / (4) = 0.1756 (91)
MIT	18.3881	18.6493	19.0437	19.5328	19.8885	20.0516	20.0797	20.0780	19.9866	19.5270	18.8743	18.3519 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3881	18.6493	19.0437	19.5328	19.8885	20.0516	20.0797	20.0780	19.9866	19.5270	18.8743	18.3519 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9925	0.9838	0.9625	0.9040	0.7769	0.5757	0.3960	0.4475	0.7221	0.9318	0.9846	0.9942 (94)
Useful gains	591.9613	696.0179	779.6136	825.0053	763.7934	559.2021	367.7911	385.9418	569.0133	637.6873	586.6911	558.7627 (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	1547.9686	1506.7173	1371.0077	1147.8312	881.9025	580.7438	370.6761	391.0044	629.7354	961.4364	1274.0871	1538.9072 (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	711.2694	544.7900	439.9972	232.4347	87.8732	0.0000	0.0000	0.0000	0.0000	240.8693	494.9251	729.2275 (98)
Space heating												3481.3864 (98)
Space heating per m2												(98) / (4) = 40.4812 (99)

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3723.4079 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.2694	544.7900	439.9972	232.4347	87.8732	0.0000	0.0000	0.0000	0.0000	240.8693	494.9251	729.2275	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	760.7160	582.6631	470.5852	248.5933	93.9820	0.0000	0.0000	0.0000	0.0000	257.6143	529.3316	779.9225	(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	210.1453	185.3658	195.0120	175.2827	172.1098	154.2729	148.6254	162.4502	161.9635	181.7352	191.5787	205.2470	(64)
Efficiency of water heater (217)m	87.8146	87.5208	86.9208	85.5675	83.1217	79.8000	79.8000	79.8000	79.8000	85.5661	87.2358	79.8000	(216)
Fuel for water heating, kWh/month	239.3057	211.7964	224.3559	204.8473	207.0576	193.3245	186.2473	203.5717	202.9617	212.3915	219.6102	233.4714	(219)
Water heating fuel used													2538.9414 (219)
Annual totals kWh/year													
Space heating fuel - main system													3723.4079 (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)													364.4681 (232)
Total delivered energy for all uses													6701.8174 (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	3723.4079	0.2160	804.2561	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2538.9414	0.2160	548.4113	(264)
Space and water heating			1352.6675	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4681	0.5190	189.1589	(268)
Total CO2, kg/m2/year			1580.7514	(272)
Emissions per m2 for space and water heating			15.7287	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.1995	(272b)
Emissions per m2 for pumps and fans			0.4526	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7287 * 1.55) + 2.1995 + 0.4526, rounded to 2 d.p.			27.0300	(273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (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)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1365 (8)							
Pressure test					Yes							
Measured/design AP50					4.5000							
Infiltration rate					0.3615 (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) =		0.3344 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4264	0.4180	0.4097	0.3679	0.3595	0.3177	0.3177	0.3093	0.3344	0.3595	0.3762	0.3929 (22b)
	0.5909	0.5874	0.5839	0.5677	0.5646	0.5505	0.5505	0.5478	0.5559	0.5646	0.5708	0.5772 (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					
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)					
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)					
external door			2.1600	1.2000	2.5920		(26)					
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)					
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)					
CEILING	43.0000		43.0000	0.1400	6.0200		(30)					
Total net area of external elements Aum(A, m2)			197.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)					
Party Wall 1			45.9000	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)					
Total fabric heat loss						(33) + (36) =	75.2444 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.8467	Feb 42.5908	Mar 42.3399	Apr 41.1615	May 40.9411	Jun 39.9147	Jul 39.9147	Aug 39.7247	Sep 40.3101	Oct 40.9411	Nov 41.3871	Dec 41.8533 (38)
Heat transfer coeff	118.0911	117.8352	117.5843	116.4059	116.1854	115.1591	115.1591	114.9691	115.5544	116.1854	116.6314	117.0977 (39)
Average = Sum(39)m / 12 =												116.4049 (39)
HLP	Jan 1.3732	Feb 1.3702	Mar 1.3673	Apr 1.3536	May 1.3510	Jun 1.3391	Jul 1.3391	Aug 1.3368	Sep 1.3437	Oct 1.3510	Nov 1.3562	Dec 1.3616 (40)
HLP (average)												1.3535 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	32.9882	28.8517	29.7723	25.9563	24.9056	21.4917	19.9152	22.8530	23.1259	26.9510	29.4192	31.9473	(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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.6405	18.3327	14.9091	11.2872	8.4373	7.1231	7.6968	10.0046	13.4281	17.0501	19.9000	21.2141	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)	44.3390	42.9340	40.0166	36.0504	33.4753	29.8496	26.7677	30.7164	32.1193	36.2245	40.8599	42.9399	(72)
Total internal gains	358.0066	356.6964	344.3012	323.8244	302.1298	281.8987	269.1752	273.0291	283.9098	304.5256	328.2805	346.9658	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.0400	10.6334	0.7200	0.7200	0.7000	0.7700	15.0043 (74)
Northeast	5.3800	11.2829	0.7200	0.7200	0.7000	0.7700	21.2016 (75)
South	0.7200	46.7521	0.7200	0.7200	0.7000	0.7700	11.7570 (78)
Southwest	3.1400	36.7938	0.7200	0.7200	0.7000	0.7700	40.3523 (79)
West	0.8800	19.6403	0.7200	0.7200	0.7000	0.7700	6.0366 (80)
South	2.8600	46.7521	0.7200	0.7200	0.7000	0.7700	46.7015 (78)
Southwest	2.8600	36.7938	0.7200	0.7200	0.7000	0.7700	36.7540 (79)

Solar gains	177.8074	310.7200	447.5877	594.8223	704.8719	717.2682	684.2058	599.0951	497.9260	349.3095	214.3627	151.2873	(83)
Total gains	535.8140	667.4164	791.8889	918.6467	1007.0017	999.1670	953.3810	872.1242	781.8358	653.8350	542.6432	498.2532	(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	20.2292	20.2731	20.3164	20.5221	20.5610	20.7442	20.7442	20.7785	20.6733	20.5610	20.4824	20.4008	
alpha	2.3486	2.3515	2.3544	2.3681	2.3707	2.3829	2.3829	2.3852	2.3782	2.3707	2.3655	2.3601	
util living area	0.9654	0.9427	0.9047	0.8343	0.7277	0.5918	0.4689	0.5177	0.7109	0.8775	0.9487	0.9705	(86)
MIT	18.1946	18.5526	19.0901	19.7540	20.3246	20.7160	20.8837	20.8491	20.5298	19.7676	18.8549	18.1283	(87)
Th 2	19.7840	19.7863	19.7885	19.7991	19.8011	19.8104	19.8104	19.8121	19.8068	19.8011	19.7971	19.7929	(88)
util rest of house	0.9598	0.9335	0.8891	0.8062	0.6792	0.5139	0.3619	0.4104	0.6421	0.8504	0.9390	0.9656	(89)
MIT 2	17.2497	17.6031	18.1300	18.7744	19.3015	19.6417	19.7622	19.7450	19.5003	18.8048	17.9137	17.1901	(90)
Living area fraction									fLA = Living area / (4) =				0.1756 (91)
MIT	17.4156	17.7698	18.2986	18.9464	19.4811	19.8303	19.9591	19.9388	19.6810	18.9738	18.0790	17.3548	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4156	17.7698	18.2986	18.9464	19.4811	19.8303	19.9591	19.9388	19.6810	18.9738	18.0790	17.3548	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	505.9919	609.4781	684.7807	718.7605	669.2134	514.9316	358.7144	368.7572	495.4864	540.5971	499.1975	474.2214	(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	1548.8335	1516.5197	1387.3279	1169.4576	904.0553	602.3175	386.8358	406.8553	644.9140	972.9149	1280.4956	1540.4016	(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	775.8742	609.5320	522.6951	324.5020	174.7224	0.0000	0.0000	0.0000	0.0000	321.6444	562.5347	793.2381	(98)
Space heating												4084.7428	(98)
Space heating per m2												47.4970	(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	1082.4957	852.1775	873.7649	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7568	0.8150	0.7848	0.0000	0.0000	0.0000	0.0000	(101)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	819.2590	694.5402	685.7310	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1264.0942	1208.5553	1115.2076	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	320.2814	382.4273	319.5306	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1022.2392 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	80.0703	95.6068	79.8826	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												255.5598 (107)
Space cooling per m2												2.9716 (108)
Energy for space heating												47.4970 (99)
Energy for space cooling												2.9716 (108)
Total												50.4686 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.5 (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	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1365 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3865 (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) =	0.3575 (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	0.4559	0.4469	0.4380	0.3933	0.3844	0.3397	0.3397	0.3307	0.3575	0.3844	0.4022	0.4201 (22b)
Effective ac	0.6039	0.5999	0.5959	0.5773	0.5739	0.5577	0.5577	0.5547	0.5639	0.5739	0.5809	0.5882 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1600	1.0000	2.1600		(26)					
TER Opening Type (Uw = 1.40)			19.3400	1.3258	25.6402		(27)					
Heat Loss Floor 1			42.3000	0.1300	5.4990		(28a)					
BRICK TF	112.4200	21.5000	90.9200	0.1800	16.3656		(29a)					
CEILING	43.0000		43.0000	0.1300	5.5900		(30)					
Total net area of external elements Aum(A, m2)			197.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.2548		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8333 (36)					
Total fabric heat loss							(33) + (36) = 66.0881 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	43.7898	43.4972	43.2105	41.8635	41.6115	40.4383	40.4383	40.2211	40.8902	41.6115	42.1213	42.6543 (38)
Heat transfer coeff	109.8779	109.5853	109.2985	107.9515	107.6995	106.5264	106.5264	106.3091	106.9782	107.6995	108.2094	108.7423 (39)
Average = Sum(39)m / 12 =												107.9503 (39)
HLP	1.2776	1.2742	1.2709	1.2553	1.2523	1.2387	1.2387	1.2362	1.2439	1.2523	1.2582	1.2644 (40)
HLP (average)												1.2552 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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 (46)
If cylinder contains dedicated solar storage												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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 (57)
Heat gains from water heating, kWh/month	32.9882	28.8517	29.7723	25.9563	24.9056	21.4917	19.9152	22.8530	23.1259	26.9510	29.4192	31.9473	(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	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	128.3459	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.6377	18.3302	14.9071	11.2857	8.4362	7.1222	7.6957	10.0032	13.4263	17.0478	19.8973	21.2113	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	231.5234	233.9259	227.8717	214.9831	198.7134	183.4223	173.2069	170.8044	176.8586	189.7472	206.0168	221.3080	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	35.8346	(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)													
	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	(71)
Water heating gains (Table 5)													
	44.3390	42.9340	40.0166	36.0504	33.4753	29.8496	26.7677	30.7164	32.1193	36.2245	40.8599	42.9399	(72)
Total internal gains	358.0039	356.6940	344.2992	323.8228	302.1287	281.8978	269.1741	273.0277	283.9080	304.5233	328.2778	346.9630	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North		3.9300	10.6334	0.6300	0.7000	0.7700	12.7713 (74)						
Northeast		5.2300	11.2829	0.6300	0.7000	0.7700	18.0342 (75)						
South		3.4800	46.7521	0.6300	0.7000	0.7700	49.7224 (78)						
Southwest		5.8400	36.7938	0.6300	0.7000	0.7700	65.6689 (79)						
West		0.8600	19.6403	0.6300	0.7000	0.7700	5.1620 (80)						
Solar gains	151.3588	264.5045	381.0209	506.3613	600.0424	610.5931	582.4488	509.9983	423.8744	297.3563	182.4773	128.7830	(83)
Total gains	509.3626	621.1985	725.3201	830.1841	902.1711	892.4909	851.6229	783.0260	707.7824	601.8796	510.7551	475.7460	(84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)													21.0000 (85)
Utilisation factor for gains for living area, n <sub>l,m</sub> (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3533	54.4984	54.6414	55.3232	55.4526	56.0633	56.0633	56.1779	55.8265	55.4526	55.1914	54.9209	
alpha	4.6236	4.6332	4.6428	4.6882	4.6968	4.7376	4.7376	4.7452	4.7218	4.6968	4.6794	4.6614	
util living area													
	0.9981	0.9948	0.9854	0.9529	0.8646	0.6999	0.5353	0.5976	0.8421	0.9742	0.9958	0.9986	(86)
MIT													
	19.5842	19.7759	20.0703	20.4480	20.7625	20.9386	20.9862	20.9773	20.8474	20.4278	19.9339	19.5539	(87)
Th 2													
	19.8584	19.8611	19.8637	19.8761	19.8784	19.8892	19.8892	19.8912	19.8850	19.8784	19.8737	19.8688	(88)
util rest of house													
	0.9974	0.9930	0.9801	0.9349	0.8144	0.6029	0.4078	0.4667	0.7657	0.9611	0.9940	0.9981	(89)
MIT 2													
	18.5761	18.7690	19.0626	19.4381	19.7218	19.8620	19.8859	19.8850	19.8024	19.4272	18.9371	18.5541	(90)
Living area fraction													
	f <sub>LA</sub> = Living area / (4) = 0.1756 (91)												
MIT													
	18.7531	18.9458	19.2395	19.6154	19.9045	20.0510	20.0791	20.0768	19.9859	19.6029	19.1121	18.7296	(92)
Temperature adjustment													
	0.0000												
adjusted MIT													
	18.7531	18.9458	19.2395	19.6154	19.9045	20.0510	20.0791	20.0768	19.9859	19.6029	19.1121	18.7296	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9965	0.9910	0.9762	0.9297	0.8158	0.6182	0.4304	0.4898	0.7738	0.9568	0.9923	0.9974	(94)
Useful gains	507.5576	615.6318	708.0602	771.8570	735.9847	551.7430	366.5120	383.4997	547.6578	575.8486	506.8170	474.5089	(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													
	1588.0782	1539.2126	1392.4098	1156.7471	883.6237	580.6770	370.6112	390.8792	629.6623	969.6087	1299.8242	1579.9844	(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													
	803.9073	620.6463	509.1561	277.1208	109.8434	0.0000	0.0000	0.0000	0.0000	292.9575	570.9652	822.4738	(98)
Space heating													
													4007.0705 (98)
Space heating per m2													
													(98) / (4) = 46.5938 (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	1001.3478	788.2951	807.9492	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8745	0.9293	0.9043	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	875.6309	732.5607	730.6321	0.0000	0.0000	0.0000	0.0000	(102)
Total gains													
	0.0000	0.0000	0.0000	0.0000	0.0000	1139.4066	1089.6159	1011.0650	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													



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	189.9185	265.6491	208.6421	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												664.2097 (104)
Intermittency factor (Table 10b)												1.0000 (105)
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	47.4796	66.4123	52.1605	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												166.0524 (107)
Energy for space heating												1.9308 (108)
Energy for space cooling												46.5938 (99)
Total												1.9308 (108)
Target Fabric Energy Efficiency (TFEE)												48.5247 (109)
												55.8 (109)

-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5000
Infiltration rate					0.2250 (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) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)
CEILING	43.0000		43.0000	0.1400	6.0200		(30)
Total net area of external elements Aum(A, m2)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)
Party Wall 1			45.9000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)
Total fabric heat loss						(33) + (36) =	75.2444 (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	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555 (38)
Average = Sum(39)m / 12 =	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
HLP	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965 (40)
HLP (average)												1.2965 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
RHI water heating demand												2169.3434 (64)
Heat gains from water heating, kWh/month	97.2786	86.3873	92.2467	84.8027	84.6318	77.8170	76.8232	81.4200	80.3741	87.8322	90.2211	95.6499 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.6012	45.8317	37.2729	28.2180	21.0933	17.8078	19.2420	25.0114	33.5703	42.6252	49.7499	53.0354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	123.9875	117.7815	113.7524	108.0791	103.2570	109.4354	111.6306	118.0540	125.3071	128.5617 (72)
Total internal gains	632.2161	627.8342	605.6743	571.1765	535.7397	503.9583	485.3234	493.6856	513.4758	548.1909	586.8517	616.2143 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	4.0400	11.3201	0.7200	0.7200	0.7700	0.7700	15.9734 (74)					
Northeast	5.3800	12.1063	0.7200	0.7200	0.7700	0.7700	22.7487 (75)					
South	0.7200	49.0238	0.7200	0.7200	0.7700	0.7700	12.3283 (78)					
Southwest	3.1400	38.7358	0.7200	0.7200	0.7700	0.7700	42.4821 (79)					
West	0.8800	21.0039	0.7200	0.7200	0.7700	0.7700	6.4558 (80)					
South	2.8600	49.0238	0.7200	0.7200	0.7700	0.7700	48.9708 (78)					
Southwest	2.8600	38.7358	0.7200	0.7200	0.7700	0.7700	38.6939 (79)					
Solar gains	187.6529	333.1713	482.2568	655.9174	733.8300	807.3169	742.3083	662.6249	555.6600	384.8135	254.7105	176.4622 (83)
Total gains	819.8690	961.0054	1087.9310	1227.0940	1269.5696	1311.2752	1227.6318	1156.3105	1069.1358	933.0043	841.5622	792.6765 (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)	0.9188	0.8858	0.8299	0.7383	0.6297	0.4679	0.3726	0.3996	0.5909	0.7836	0.8817	0.9246 (86)
tweekday	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
tweekend	20.4320	20.4811	20.5617	20.6482	20.7139	20.7614	20.7756	20.7736	20.7387	20.6458	20.5281	20.4219
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1233	20.1973	20.3236	20.4507	20.5585	20.6335	20.6537	20.6505	20.5920	20.4533	20.2632	20.1078 (87)
Th 2	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436 (88)
util rest of house	0.9073	0.8704	0.8069	0.7031	0.5783	0.3957	0.2837	0.3081	0.5219	0.7463	0.8630	0.9139 (89)
tweekday	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
tweekend	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
MIT 2	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210 (90)
Living area fraction												fLA = Living area / (4) =
MIT	18.9030	19.0045	19.1712	19.3442	19.4728	19.5570	19.5786	19.5761	19.5199	19.3451	19.1034	18.8820 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9030	19.0045	19.1712	19.3442	19.4728	19.5570	19.5786	19.5761	19.5199	19.3451	19.1034	18.8820 (93)

#### 8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.8963	0.8574	0.7916	0.6861	0.5602	0.3765	0.2622	0.2855	0.5004	0.7277	0.8489	0.9033 (94)
Useful gains	734.8560	823.9619	861.2114	841.8663	711.2461	493.6890	321.8696	330.1773	535.0370	678.9386	714.3898	716.0357 (95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	1628.2356	1583.8030	1401.6856	1153.3756	855.5130	530.4102	332.1136	342.9886	615.4644	986.2309	1338.3762	1637.0436 (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)
RHI space heating demand	664.6744	510.6132	402.1128	224.2867	107.3345	0.0000	0.0000	0.0000	0.0000	228.6255	449.2702	685.2299 (98)
												3272.1472 (98)
												3272 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5000
Infiltration rate					0.2250 (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) =	0.2081 (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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)
CEILING	43.0000		43.0000	0.1400	6.0200		(30)
Total net area of external elements Aum(A, m2)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)
Party Wall 1			45.9000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)
Total fabric heat loss						(33) + (36) =	75.2444 (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	37.3692	36.9919	36.6146	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555 (38)
Average = Sum(39)m / 12 =	112.6136	112.2363	111.8590	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
HLP	1.3095	1.3051	1.3007	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965 (40)
HLP (average)												1.2987 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Heat gains from water heating, kWh/month	97.2786	86.3873	92.2467	84.8027	84.6318	77.8170	76.8232	81.4200	80.3741	87.8322	90.2211	95.6499 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.6012	45.8317	37.2729	28.2180	21.0933	17.8078	19.2420	25.0114	33.5703	42.6252	49.7499	53.0354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	123.9875	117.7815	113.7524	108.0791	103.2570	109.4354	111.6306	118.0540	125.3071	128.5617 (72)
Total internal gains	632.2161	627.8342	605.6743	571.1765	535.7397	503.9583	485.3234	493.6856	513.4758	548.1909	586.8517	616.2143 (73)

#### 6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains				
		m <sup>2</sup>	Table 6a	W/m <sup>2</sup>	or Table 6b	or Table 6c	factor	W				
							Table 6d					
North		4.0400	10.6334	0.7200		0.7000	0.7700	15.0043 (74)				
Northeast		5.3800	11.2829	0.7200		0.7000	0.7700	21.2016 (75)				
South		0.7200	46.7521	0.7200		0.7000	0.7700	11.7570 (78)				
Southwest		3.1400	36.7938	0.7200		0.7000	0.7700	40.3523 (79)				
West		0.8800	19.6403	0.7200		0.7000	0.7700	6.0366 (80)				
South		2.8600	46.7521	0.7200		0.7000	0.7700	46.7015 (78)				
Southwest		2.8600	36.7938	0.7200		0.7000	0.7700	36.7540 (79)				
Solar gains	177.8074	310.7200	447.5877	594.8223	704.8719	717.2682	684.2058	599.0951	497.9260	349.3095	214.3627	151.2873 (83)
Total gains	810.0235	938.5541	1053.2619	1165.9988	1240.6115	1221.2266	1169.5293	1092.7807	1011.4018	897.5003	801.2144	767.5016 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	21.2132	21.2845	21.3563	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250
alpha	2.4142	2.4190	2.4238	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283
util living area	0.9210	0.8897	0.8405	0.7580	0.6425	0.5060	0.3884	0.4265	0.6067	0.7924	0.8914	0.9291 (86)
Tweekday	18.6166	18.7331	18.8996	19.0872	19.2336	19.3192	19.3486	19.3446	19.2884	19.1040	18.8375	18.6071
Tweekend	20.4240	20.4757	20.5508	20.6376	20.7096	20.7557	20.7746	20.7713	20.7365	20.6430	20.5192	20.4155
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1111	20.1890	20.3067	20.4341	20.5518	20.6248	20.6521	20.6470	20.5885	20.4490	20.2493	20.0980 (87)
Th 2	19.8334	19.8369	19.8403	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436 (88)
util rest of house	0.9098	0.8745	0.8185	0.7242	0.5919	0.4334	0.2967	0.3329	0.5364	0.7555	0.8738	0.9189 (89)
Tweekday	18.6166	18.7331	18.8996	19.0872	19.2336	19.3192	19.3486	19.3446	19.2884	19.1040	18.8375	18.6071
Tweekend	18.6166	18.7331	18.8996	19.0872	19.2336	19.3192	19.3486	19.3446	19.2884	19.1040	18.8375	18.6071
MIT 2	18.6166	18.7331	18.8996	19.0872	19.2336	19.3192	19.3486	19.3446	19.2884	19.1040	18.8375	18.6071 (90)
Living area fraction												fLA = Living area / (4) =
MIT	18.8790	18.9887	19.1466	19.3237	19.4650	19.5484	19.5775	19.5733	19.5167	19.3402	19.0854	18.8689 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8790	18.9887	19.1466	19.3237	19.4650	19.5484	19.5775	19.5733	19.5167	19.3402	19.0854	18.8689 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8989	0.8617	0.8034	0.7072	0.5737	0.4133	0.2742	0.3093	0.5142	0.7369	0.8602	0.9087 (94)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	728.1334	808.7254	846.2227	824.5593	711.6936	504.7311	320.6677	338.0183	520.0688	661.3359	689.1857	697.3940 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	1641.7982	1581.2635	1414.6387	1162.2432	865.7990	551.7470	331.9898	353.8233	603.9606	974.5282	1336.3653	1635.5762 (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	679.7666	519.1456	422.9015	243.1325	114.6545	0.0000	0.0000	0.0000	0.0000	233.0150	465.9693	698.0075 (98)
Space heating per m2												3376.5925 (98)
												(98) / (4) = 39.2627 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												334.5383 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1009.3293 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	679.7666	519.1456	422.9015	243.1325	114.6545	0.0000	0.0000	0.0000	0.0000	233.0150	465.9693	698.0075 (98)
Space heating efficiency (main heating system 1)	334.5383	334.5383	334.5383	334.5383	334.5383	0.0000	0.0000	0.0000	0.0000	334.5383	334.5383	334.5383 (210)
Space heating fuel (main heating system)	203.1955	155.1827	126.4135	72.6770	34.2724	0.0000	0.0000	0.0000	0.0000	69.6527	139.2873	208.6481 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Efficiency of water heater	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (217)
Fuel for water heating, kWh/month	106.4559	93.9261	98.8680	88.9406	87.3848	78.4062	75.6096	82.5414	82.2623	92.2110	97.1115	103.9999 (219)
Water heating fuel used												1087.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												1009.3293 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)												
mechanical ventilation fans (SFP = 0.1839)												49.2973 (230a)
Total electricity for the above, kWh/year												49.2973 (231)
Electricity for lighting (calculated in Appendix L)												364.5173 (232)
Total delivered energy for all uses												2510.8612 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1009.3293	13.1900	133.1305 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1087.7173	13.1900	143.4699 (247)
Mechanical ventilation fans	49.2973	13.1900	6.5023 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	364.5173	13.1900	48.0798 (250)
Additional standing charges			0.0000 (251)
Total energy cost			331.1826 (255)

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

Energy cost deflator (Table 12):		
Energy cost factor (ECF)		0.4200 (256)
SAP value		1.0618 (257)
SAP rating (Section 12)		85.1878
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	1009.3293	0.5190	523.8419 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.7173	0.5190	564.5253 (264)
Space and water heating			1088.3672 (265)
Pumps and fans	49.2973	0.5190	25.5853 (267)
Energy for lighting	364.5173	0.5190	189.1845 (268)
Total kg/year			1303.1369 (272)
CO2 emissions per m2			15.1500 (273)
EI value			86.6702
EI rating			87 (274)
EI band			B

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

-----  
Calculation of stars for heating and DHW  
-----

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.75) / 3.3454 = 4.800$ , stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.75) / 3.3454 = 0.1889$ , stars = 5
Water heating energy efficiency	$13.19 / 1.9944 = 6.614$ , stars = 3
Water heating environmental impact	$0.519 / 1.9944 = 0.2602$ , stars = 4

-----



# 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	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5000
Infiltration rate					0.2250 (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) =		0.2081 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.5000	4.4000	3.9000	3.8000	3.4000	3.3000	3.3000	3.5000	3.8000	3.9000	4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)
CEILING	43.0000		43.0000	0.1400	6.0200		(30)
Total net area of external elements Aum(A, m2)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.5235		(33)
Party Wall 1			45.9000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)
Total fabric heat loss						(33) + (36) =	75.2444 (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	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555 (38)
Average = Sum(39)m / 12 =	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
HLP	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965 (40)
HLP (average)												1.2965 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (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:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Heat gains from water heating, kWh/month	97.2786	86.3873	92.2467	84.8027	84.6318	77.8170	76.8232	81.4200	80.3741	87.8322	90.2211	95.6499 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.6012	45.8317	37.2729	28.2180	21.0933	17.8078	19.2420	25.0114	33.5703	42.6252	49.7499	53.0354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	123.9875	117.7815	113.7524	108.0791	103.2570	109.4354	111.6306	118.0540	125.3071	128.5617 (72)
Total internal gains	632.2161	627.8342	605.6743	571.1765	535.7397	503.9583	485.3234	493.6856	513.4758	548.1909	586.8517	616.2143 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
North	4.0400	11.3201	0.7200	0.7000	0.7700	15.9734 (74)						
Northeast	5.3800	12.1063	0.7200	0.7000	0.7700	22.7487 (75)						
South	0.7200	49.0238	0.7200	0.7000	0.7700	12.3283 (78)						
Southwest	3.1400	38.7358	0.7200	0.7000	0.7700	42.4821 (79)						
West	0.8800	21.0039	0.7200	0.7000	0.7700	6.4558 (80)						
South	2.8600	49.0238	0.7200	0.7000	0.7700	48.9708 (78)						
Southwest	2.8600	38.7358	0.7200	0.7000	0.7700	38.6939 (79)						
Solar gains	187.6529	333.1713	482.2568	655.9174	733.8300	807.3169	742.3083	662.6249	555.6600	384.8135	254.7105	176.4622 (83)
Total gains	819.8690	961.0054	1087.9310	1227.0940	1269.5696	1311.2752	1227.6318	1156.3105	1069.1358	933.0043	841.5622	792.6765 (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	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250
alpha	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283
util living area	0.9188	0.8858	0.8299	0.7383	0.6297	0.4679	0.3726	0.3996	0.5909	0.7836	0.8817	0.9246 (86)
Tweekday	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
Tweekend	20.4320	20.4811	20.5617	20.6482	20.7139	20.7614	20.7756	20.7736	20.7387	20.6458	20.5281	20.4219
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1233	20.1973	20.3236	20.4507	20.5585	20.6335	20.6537	20.6505	20.5920	20.4533	20.2632	20.1078 (87)
Th 2	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436 (88)
util rest of house	0.9073	0.8704	0.8069	0.7031	0.5783	0.3957	0.2837	0.3081	0.5219	0.7463	0.8630	0.9139 (89)
Tweekday	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
Tweekend	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210
MIT 2	18.6431	18.7505	18.9258	19.1085	19.2415	19.3278	19.3496	19.3473	19.2915	19.1091	18.8564	18.6210 (90)
Living area fraction												fLA = Living area / (4) = 0.1756 (91)
MIT	18.9030	19.0045	19.1712	19.3442	19.4728	19.5570	19.5786	19.5761	19.5199	19.3451	19.1034	18.8820 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9030	19.0045	19.1712	19.3442	19.4728	19.5570	19.5786	19.5761	19.5199	19.3451	19.1034	18.8820 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8963	0.8574	0.7916	0.6861	0.5602	0.3765	0.2622	0.2855	0.5004	0.7277	0.8489	0.9033 (94)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Useful gains	734.8560	823.9619	861.2114	841.8663	711.2461	493.6890	321.8696	330.1773	535.0370	678.9386	714.3898	716.0357 (95)
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	1628.2356	1583.8030	1401.6856	1153.3756	855.5130	530.4102	332.1136	342.9886	615.4644	986.2309	1338.3762	1637.0436 (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	664.6744	510.6132	402.1128	224.2867	107.3345	0.0000	0.0000	0.0000	0.0000	228.6255	449.2702	685.2299 (98)
Space heating per m2												3272.1472 (98)
												(98) / (4) = 38.0482 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												334.0626 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												979.5012 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	664.6744	510.6132	402.1128	224.2867	107.3345	0.0000	0.0000	0.0000	0.0000	228.6255	449.2702	685.2299 (98)
Space heating efficiency (main heating system 1)	334.0626	334.0626	334.0626	334.0626	334.0626	0.0000	0.0000	0.0000	0.0000	334.0626	334.0626	334.0626 (210)
Space heating fuel (main heating system)	198.9670	152.8495	120.3705	67.1391	32.1301	0.0000	0.0000	0.0000	0.0000	68.4379	134.4868	205.1202 (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	212.3157	187.3262	197.1824	177.3831	174.2802	156.3733	150.7958	164.6206	164.0639	183.9056	193.6791	207.4174 (64)
Efficiency of water heater	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (216)
(217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400 (217)
Fuel for water heating, kWh/month	106.4559	93.9261	98.8680	88.9406	87.3848	78.4062	75.6096	82.5414	82.2623	92.2110	97.1115	103.9999 (219)
Water heating fuel used												1087.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												979.5012 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)												49.2973 (230a)
mechanical ventilation fans (SFP = 0.1839)												49.2973 (231)
Total electricity for the above, kWh/year												364.5173 (232)
Electricity for lighting (calculated in Appendix L)												2481.0331 (238)
Total delivered energy for all uses												

#### 10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	979.5012	20.4300	200.1121 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1087.7173	20.4300	222.2206 (247)
Mechanical ventilation fans	49.2973	20.4300	10.0714 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	364.5173	20.4300	74.4709 (250)
Additional standing charges			0.0000 (251)
Total energy cost			506.8751 (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	979.5012	0.5190	508.3611 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.7173	0.5190	564.5253 (264)
Space and water heating			1072.8864 (265)
Pumps and fans	49.2973	0.5190	25.5853 (267)
Energy for lighting	364.5173	0.5190	189.1845 (268)
Total kg/year			1287.6562 (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	979.5012	3.0700	3007.0686 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1087.7173	3.0700	3339.2921 (264)
Space and water heating			6346.3607 (265)
Pumps and fans	49.2973	3.0700	151.3426 (267)
Energy for lighting	364.5173	3.0700	1119.0683 (268)
Primary energy kWh/year			7616.7715 (272)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Primary energy kWh/m<sup>2</sup>/year

88.5671 (273)

-----  
SAP 2012 EPC IMPROVEMENTS  
-----

Current energy efficiency rating: B 85  
Current environmental impact rating: B 87

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.4	-£ 87	-220 kg (17.1%)
U Solar photovoltaic panels	+ 10.2	-£ 388	-985 kg (92.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£87	2.56 kg/m <sup>2</sup>	B 88 B 89
Solar photovoltaic panels	£388	11.45 kg/m <sup>2</sup>	A 98 A 98
<b>Total Savings</b>	<b>£474</b>	<b>14.00 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: A 98  
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 506 TEST (30 Sep 2022)  
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£507	£420	£87
Space heating	£210	£210	-£0
Water heating	£222	£135	£87
Lighting	£74	£74	£0
Generated (PV)	-£0	-£388	£388
<b>Total cost of fuels</b>	<b>£507</b>	<b>£32</b>	<b>£475</b>
<b>Total cost of uses</b>	<b>£506</b>	<b>£31</b>	<b>£475</b>
Delivered energy	29 kWh/m <sup>2</sup>	2 kWh/m <sup>2</sup>	27 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m <sup>2</sup>	15 kg/m <sup>2</sup>	1 kg/m <sup>2</sup>	14 kg/m <sup>2</sup>
Primary energy	89 kWh/m <sup>2</sup>	6 kWh/m <sup>2</sup>	83 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.5000
Infiltration rate					0.2250 (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) =	0.2081 (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	0.2654	0.2602	0.2550	0.2289	0.2237	0.1977	0.1977	0.1925	0.2081	0.2237	0.2341	0.2445 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5154	0.5102	0.5050	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)
CEILING	43.0000		43.0000	0.1400	6.0200		(30)
Total net area of external elements Aum(A, m2)			197.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)
Party Wall 1			45.9000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)
Total fabric heat loss						(33) + (36) =	75.2444 (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	37.3692	36.9919	36.6146	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555	36.2555 (38)
Average = Sum(39)m / 12 =	112.6136	112.2363	111.8590	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
HLP	1.3095	1.3051	1.3007	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965	1.2965 (40)
HLP (average)												1.2987 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (56)
If cylinder contains dedicated solar storage	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	212.3157	187.3262	195.7866	170.6295	161.4859	143.7666	137.7688	152.5242	158.6610	182.5098	193.6791	207.4174 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2112 (H8)
Utilisation factor												0.5620 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.1643 (H14)
Volume ratio Veff/V												0.7881 (H15)
Solar storage volume factor												0.9524 (H16)
Solar input	-24.7520	-41.3039	-70.3453	-94.2766	-116.4707	-114.5093	-112.9960	-98.7252	-77.3216	-52.8016	-29.3594	-853.5746 (H17)
Solar input (sum of months) = Sum(63)m =												-853.5746 (63)
Output from w/h	187.5638	146.0223	125.4413	76.3529	45.0152	29.2573	24.7728	53.7990	81.3394	129.7083	164.3197	186.7043 (64)
Total per year (kWh/year) = Sum(64)m =												1250.2963 (64)
Heat gains from water heating, kWh/month	97.2786	86.3873	91.1301	79.3998	74.3963	67.7316	66.4016	71.7428	76.0518	86.7156	90.2211	95.6499 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.6012	45.8317	37.2729	28.2180	21.0933	17.8078	19.2420	25.0114	33.5703	42.6252	49.7499	53.0354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	122.4867	110.2775	99.9950	94.0716	89.2495	96.4285	105.6274	116.5532	125.3071	128.5617 (72)
Total internal gains	632.2161	627.8342	604.1735	563.6725	521.9823	489.9509	471.3160	480.6786	507.4726	546.6901	586.8517	616.2143 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.0400	10.6334	0.7200	0.7000	0.7700	15.0043 (74)
Northeast	5.3800	11.2829	0.7200	0.7000	0.7700	21.2016 (75)
South	0.7200	46.7521	0.7200	0.7000	0.7700	11.7570 (76)
Southwest	3.1400	36.7938	0.7200	0.7000	0.7700	40.3523 (79)
West	0.8800	19.6403	0.7200	0.7000	0.7700	6.0366 (80)
South	2.8600	46.7521	0.7200	0.7000	0.7700	46.7015 (78)
Southwest	2.8600	36.7938	0.7200	0.7000	0.7700	36.7540 (79)

Solar gains	177.8074	310.7200	447.5877	594.8223	704.8719	717.2682	684.2058	599.0951	497.9260	349.3095	214.3627	151.2873 (83)
Total gains	810.0235	938.5541	1051.7611	1158.4948	1226.8542	1207.2191	1155.5218	1079.7738	1005.3986	895.9995	801.2144	767.5016 (84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (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	21.2132	21.2845	21.3563	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250
alpha	2.4142	2.4190	2.4238	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283
util living area	0.9210	0.8897	0.8408	0.7601	0.6467	0.5104	0.3923	0.4306	0.6090	0.7929	0.8914	0.9291 (86)
Tweekday	18.6166	18.7331	18.8990	19.0852	19.2315	19.3183	19.3484	19.3443	19.2877	19.1036	18.8375	18.6071
Tweekend	20.4240	20.4757	20.5505	20.6365	20.7084	20.7551	20.7743	20.7709	20.7361	20.6427	20.5192	20.4155
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1111	20.1890	20.3063	20.4324	20.5500	20.6238	20.6517	20.6465	20.5879	20.4486	20.2493	20.0980 (87)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Th 2	19.8334	19.8369	19.8403	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436 (88)
util rest of house													
	0.9098	0.8745	0.8189	0.7265	0.5962	0.4375	0.2999	0.3364	0.5387	0.7561	0.8738	0.9189	(89)
Tweekday	18.6166	18.7331	18.8990	19.0852	19.2315	19.3183	19.3484	19.3443	19.2877	19.1036	18.8375	18.6071	
Tweekend	18.6166	18.7331	18.8990	19.0852	19.2315	19.3183	19.3484	19.3443	19.2877	19.1036	18.8375	18.6071	
MIT 2	18.6166	18.7331	18.8990	19.0852	19.2315	19.3183	19.3484	19.3443	19.2877	19.1036	18.8375	18.6071	(90)
Living area fraction										fLA = Living area / (4) =			0.1756 (91)
MIT	18.8790	18.9887	19.1461	19.3217	19.4630	19.5476	19.5772	19.5729	19.5160	19.3397	19.0854	18.8689	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8790	18.9887	19.1461	19.3217	19.4630	19.5476	19.5772	19.5729	19.5160	19.3397	19.0854	18.8689	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8989	0.8617	0.8038	0.7094	0.5778	0.4172	0.2772	0.3127	0.5164	0.7374	0.8602	0.9087	(94)
Useful gains	728.1334	808.7254	845.4367	821.8236	708.9292	503.6499	320.3520	337.5950	519.1933	660.7224	689.1857	697.3940	(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	1641.7982	1581.2635	1414.5757	1162.0217	865.5706	551.6516	331.9574	353.7811	603.8849	974.4782	1336.3653	1635.5762	(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	679.7666	519.1456	423.4394	244.9426	116.5413	0.0000	0.0000	0.0000	0.0000	233.4343	465.9693	698.0075	(98)
Space heating												3381.2467	(98)
Space heating per m2												(98) / (4) =	39.3168 (99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													334.5383 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1010.7205 (211)
Space heating requirement	679.7666	519.1456	423.4394	244.9426	116.5413	0.0000	0.0000	0.0000	0.0000	233.4343	465.9693	698.0075	(98)
Space heating efficiency (main heating system 1)	334.5383	334.5383	334.5383	334.5383	334.5383	0.0000	0.0000	0.0000	0.0000	334.5383	334.5383	334.5383	(210)
Space heating fuel (main heating system)	203.1955	155.1827	126.5743	73.2181	34.8365	0.0000	0.0000	0.0000	0.0000	69.7781	139.2873	208.6481	(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	187.5638	146.0223	125.4413	76.3529	45.0152	29.2573	24.7728	53.7990	81.3394	129.7083	164.3197	186.7043	(64)
Efficiency of water heater (217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(216)
Fuel for water heating, kWh/month	94.0452	73.2162	62.8968	38.2837	22.5708	14.6697	12.4212	26.9750	40.7839	65.0362	82.3905	93.6143	(219)
Water heating fuel used												626.9035	(219)
Annual totals kWh/year													
Space heating fuel - main system													1010.7205 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)													
mechanical ventilation fans (SFP = 0.1839)													49.2973 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													99.2973 (231)
Electricity for lighting (calculated in Appendix L)													364.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394 (233)
Total delivered energy for all uses													374.1992 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1010.7205	13.1900	133.3140	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	626.9035	13.1900	82.6886	(247)
Mechanical ventilation fans	49.2973	13.1900	6.5023	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	364.5173	13.1900	48.0798	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			49.3569	(255)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1582 (257)
SAP value		97.7925
SAP rating (Section 12)		98 (258)
SAP band		A

-----  
 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	1010.7205	0.5190	524.5639 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	626.9035	0.5190	325.3629 (264)
Space and water heating			849.9269 (265)
Pumps and fans	99.2973	0.5190	51.5353 (267)
Energy for lighting	364.5173	0.5190	189.1845 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			194.2094 (272)
CO2 emissions per m2			2.2600 (273)
EI value			98.0134
EI rating			98 (274)
EI band			A

-----



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	43.0000 (1b)	2.4600 (2b)	105.7800 (1b) - (3b)
First floor	43.0000 (1c)	2.6500 (2c)	113.9500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.7300 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					4.5000							
Infiltration rate					0.2250 (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) =		0.2081 (21)							
Wind speed	Jan 4.5000	Feb 4.5000	Mar 4.4000	Apr 3.9000	May 3.8000	Jun 3.4000	Jul 3.3000	Aug 3.3000	Sep 3.5000	Oct 3.8000	Nov 3.9000	Dec 4.1000 (22)
Wind factor	1.1250	1.1250	1.1000	0.9750	0.9500	0.8500	0.8250	0.8250	0.8750	0.9500	0.9750	1.0250 (22a)
Adj infilt rate	0.2341	0.2341	0.2289	0.2029	0.1977	0.1769	0.1717	0.1717	0.1821	0.1977	0.2029	0.2133 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
upvc window (Uw = 1.40)			14.1600	1.3258	18.7727		(27)					
FRENCH DOOR (Uw = 1.40)			5.7200	1.3258	7.5833		(27)					
external door			2.1600	1.2000	2.5920		(26)					
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)					
BRICK TF	112.4200	22.0400	90.3800	0.2300	20.7874		(29a)					
CEILING	43.0000		43.0000	0.1400	6.0200		(30)					
Total net area of external elements Aum(A, m2)			197.7200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	62.5235	(33)					
Party Wall 1			45.9000	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7209 (36)					
Total fabric heat loss						(33) + (36) =	75.2444 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.2555	Feb 36.2555	Mar 36.2555	Apr 36.2555	May 36.2555	Jun 36.2555	Jul 36.2555	Aug 36.2555	Sep 36.2555	Oct 36.2555	Nov 36.2555	Dec 36.2555 (38)
Heat transfer coeff	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998	111.4998 (39)
Average = Sum(39)m / 12 =												111.4998 (39)
HLP	Jan 1.2965	Feb 1.2965	Mar 1.2965	Apr 1.2965	May 1.2965	Jun 1.2965	Jul 1.2965	Aug 1.2965	Sep 1.2965	Oct 1.2965	Nov 1.2965	Dec 1.2965 (40)
HLP (average)												1.2965 (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												2.5669 (42)
Average daily hot water use (litres/day)												95.1643 (43)
Daily hot water use	104.6808	100.8742	97.0676	93.2610	89.4545	85.6479	85.6479	89.4545	93.2610	97.0676	100.8742	104.6808 (44)
Energy conte	155.2385	135.7726	140.1052	122.1471	117.2030	101.1373	93.7186	107.5434	108.8279	126.8284	138.4431	150.3402 (45)
Energy content (annual)												Total = Sum(45)m = 1497.3054 (45)
Distribution loss (46)m = 0.15 x (45)m												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	23.2858	20.3659	21.0158	18.3221	17.5805	15.1706	14.0578	16.1315	16.3242	19.0243	20.7665	22.5510 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0908 (55)
Total storage loss												
33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148 (56)
If cylinder contains dedicated solar storage												
33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
212.3157	187.3262	195.7866	170.6295	161.4859	143.7666	137.7688	152.5242	158.6610	182.5098	193.6791	207.4174 (62)	
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1185.6484 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1991.8893 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3303 (H8)
Utilisation factor												0.5284 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.1643 (H14)
Volume ratio Veff/V												0.7881 (H15)
Solar storage volume factor												0.9524 (H16)
Solar input												-881.4555 (H17)
Solar input	-24.7210	-41.8937	-71.5767	-97.9186	-113.9997	-121.0971	-115.2127	-102.7601	-81.4031	-54.9968	-33.0117	-22.8642 (63)
Solar input (sum of months) = Sum(63)m =												-881.4555 (63)
Output from w/h												
187.5947	145.4325	124.2099	72.7109	47.4862	22.6695	22.5562	49.7641	77.2578	127.5130	160.6674	184.5532 (64)	
Total per year (kWh/year) = Sum(64)m =												1222.4155 (64)
Heat gains from water heating, kWh/month												
97.2786	86.3873	91.1301	79.3998	74.3963	67.7316	66.4016	71.7428	76.0518	86.7156	90.2211	95.6499 (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	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151	154.0151 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.6012	45.8317	37.2729	28.2180	21.0933	17.8078	19.2420	25.0114	33.5703	42.6252	49.7499	53.0354 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.5573	349.1431	340.1070	320.8702	296.5872	273.7646	258.5177	254.9319	263.9680	283.2048	307.4878	330.3104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684	52.9684 (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)	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768	-102.6768 (71)
Water heating gains (Table 5)	130.7508	128.5525	122.4867	110.2775	99.9950	94.0716	89.2495	96.4285	105.6274	116.5532	125.3071	128.5617 (72)
Total internal gains	632.2161	627.8342	604.1735	563.6725	521.9823	489.9509	471.3160	480.6786	507.4726	546.6901	586.8517	616.2143 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	4.0400	11.3201	0.7200	0.7000	0.7700	15.9734 (74)						
Northeast	5.3800	12.1063	0.7200	0.7000	0.7700	22.7487 (75)						
South	0.7200	49.0238	0.7200	0.7000	0.7700	12.3283 (76)						
Southwest	3.1400	38.7358	0.7200	0.7000	0.7700	42.4821 (79)						
West	0.8800	21.0039	0.7200	0.7000	0.7700	6.4558 (80)						
South	2.8600	49.0238	0.7200	0.7000	0.7700	48.9708 (78)						
Southwest	2.8600	38.7358	0.7200	0.7000	0.7700	38.6939 (79)						
Solar gains	187.6529	333.1713	482.2568	655.9174	733.8300	807.3169	742.3083	662.6249	555.6600	384.8135	254.7105	176.4622 (83)
Total gains	819.8690	961.0054	1086.4302	1219.5900	1255.8123	1297.2678	1213.6243	1143.3036	1063.1326	931.5035	841.5622	792.6765 (84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250	21.4250
alpha	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283	2.4283
util living area	0.9188	0.8858	0.8303	0.7404	0.6338	0.4719	0.3763	0.4034	0.5931	0.7841	0.8817	0.9246 (86)
Tweekday	18.6431	18.7505	18.9252	19.1066	19.2396	19.3271	19.3494	19.3470	19.2909	19.1087	18.8564	18.6210
Tweekend	20.4320	20.4811	20.5614	20.6472	20.7128	20.7609	20.7754	20.7733	20.7383	20.6455	20.5281	20.4219
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1233	20.1973	20.3231	20.4492	20.5568	20.6328	20.6534	20.6501	20.5914	20.4529	20.2632	20.1078 (87)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Th 2	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	19.8436	(88)
util rest of house														
	0.9073	0.8704	0.8073	0.7052	0.5825	0.3993	0.2868	0.3113	0.5240	0.7468	0.8630	0.9139	0.9139	(89)
Tweekday	18.6431	18.7505	18.9252	19.1066	19.2396	19.3271	19.3494	19.3470	19.2909	19.1087	18.8564	18.6210	18.6210	
Tweekend	18.6431	18.7505	18.9252	19.1066	19.2396	19.3271	19.3494	19.3470	19.2909	19.1087	18.8564	18.6210	18.6210	
MIT 2	18.6431	18.7505	18.9252	19.1066	19.2396	19.3271	19.3494	19.3470	19.2909	19.1087	18.8564	18.6210	18.6210	(90)
Living area fraction									fLA = Living area / (4) =				0.1756	(91)
MIT	18.9030	19.0045	19.1706	19.3424	19.4709	19.5564	19.5783	19.5758	19.5192	19.3447	19.1034	18.8820	18.8820	(92)
Temperature adjustment													0.0000	
adjusted MIT	18.9030	19.0045	19.1706	19.3424	19.4709	19.5564	19.5783	19.5758	19.5192	19.3447	19.1034	18.8820	18.8820	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8963	0.8574	0.7920	0.6882	0.5643	0.3799	0.2650	0.2885	0.5025	0.7282	0.8489	0.9033	(94)	
Useful gains	734.8560	823.9619	860.4586	839.3581	708.6653	492.8711	321.5948	329.8459	534.2286	678.3466	714.3898	716.0357	(95)	
Ext temp.	4.3000	4.8000	6.6000	9.0000	11.8000	14.8000	16.6000	16.5000	14.0000	10.5000	7.1000	4.2000	(96)	
Heat loss rate W	1628.2356	1583.8030	1401.6254	1153.1724	855.2995	530.3373	332.0852	342.9550	615.3946	986.1827	1338.3762	1637.0436	(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	664.6744	510.6132	402.6281	225.9463	109.0958	0.0000	0.0000	0.0000	0.0000	229.0300	449.2702	685.2299	(98)	
Space heating												3276.4878	(98)	
Space heating per m2												(98) / (4) =	38.0987	(99)

#### 8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													334.0626	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													980.8005	(211)
Space heating requirement	664.6744	510.6132	402.6281	225.9463	109.0958	0.0000	0.0000	0.0000	0.0000	229.0300	449.2702	685.2299	(98)	
Space heating efficiency (main heating system 1)	334.0626	334.0626	334.0626	334.0626	334.0626	0.0000	0.0000	0.0000	0.0000	334.0626	334.0626	334.0626	(210)	
Space heating fuel (main heating system)	198.9670	152.8495	120.5247	67.6359	32.6573	0.0000	0.0000	0.0000	0.0000	68.5590	134.4868	205.1202	(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	187.5947	145.4325	124.2099	72.7109	47.4862	22.6695	22.5562	49.7641	77.2578	127.5130	160.6674	184.5532	(64)	
Efficiency of water heater (217)m	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	199.4400	(216)	
Fuel for water heating, kWh/month	94.0607	72.9204	62.2794	36.4575	23.8098	11.3666	11.3098	24.9519	38.7374	63.9355	80.5593	92.5357	(219)	
Water heating fuel used												612.9239	(219)	
Annual totals kWh/year														
Space heating fuel - main system													980.8005	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 5.3330, total flow = 29.0000, SFP = 0.1839)														
mechanical ventilation fans (SFP = 0.1839)													49.2973	(230a)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													99.2973	(231)
Electricity for lighting (calculated in Appendix L)													364.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1186 * 0.80) =										-1897.0374			-1897.0374	(233)
Total delivered energy for all uses													160.5016	(238)

#### 10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year		
Space heating - main system 1	980.8005	20.4300	200.3775	(240)	
Space heating - secondary	0.0000	0.0000	0.0000	(242)	
Water heating (other fuel)	612.9239	20.4300	125.2204	(247)	
Mechanical ventilation fans	49.2973	20.4300	10.0714	(249)	
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)	
Pump for solar water heating	50.0000	20.4300	10.2150	(249)	
Energy for lighting	364.5173	20.4300	74.4709	(250)	
Additional standing charges			0.0000	(251)	
Energy saving/generation technologies					
PV Unit		-1897.0374	20.4300	-387.5647	(252)
Total energy cost			32.7905	(255)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	980.8005	0.5190	509.0355 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	612.9239	0.5190	318.1075 (264)
Space and water heating			827.1430 (265)
Pumps and fans	99.2973	0.5190	51.5353 (267)
Energy for lighting	364.5173	0.5190	189.1845 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	0.5190	-984.5624 (269)
Total kg/year			83.3004 (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	980.8005	3.0700	3011.0576 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	612.9239	3.0700	1881.6764 (264)
Space and water heating			4892.7341 (265)
Pumps and fans	99.2973	3.0700	304.8426 (267)
Energy for lighting	364.5173	3.0700	1119.0683 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	3.0700	-5823.9049 (269)
Primary energy kWh/year			492.7400 (272)
Primary energy kWh/m2/year			5.7295 (273)

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	HOUSE TYPE B3	<b>Issued on Date</b>	09/11/2022
<b>Assessment Reference</b>	GRANT ASHP	<b>Prop Type Ref</b>	
<b>Property</b>			

<b>SAP Rating</b>	85 B	<b>DER</b>	16.14	<b>TER</b>	27.03
<b>Environmental</b>	87 B	<b>% DER&lt;TER</b>	40.29		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.29	<b>DFEE</b>	50.47	<b>TFEE</b>	55.80
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	9.56		

<b>Assessor Details</b>	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	<b>Assessor ID</b>	K559-0001
<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	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	27.03	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	16.14	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-10.89 (-40.3%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.80	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.47	kWh/m <sup>2</sup> /yr	
	-5.3 (-9.5%)	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	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.38 (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	4.50 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Grant AERONA3 HPID6R32	
Secondary heating system	None	

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

### 5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.02 kWh/day Permitted by DBSCG 2.56	Pass
Primary pipework insulated	Yes	Pass

### 6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	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	0.1300 0.1600 0.1600	
Maximum	0.7	Pass

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

### 9 Summertime temperature

Overheating risk (Midlands)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing North	4.04 m <sup>2</sup> , No overhang	
Windows facing North East	5.38 m <sup>2</sup> , No overhang	
Windows facing South	3.58 m <sup>2</sup> , No overhang	
Windows facing South West	6.00 m <sup>2</sup> , No overhang	
Windows facing West	0.88 m <sup>2</sup> , No overhang	
Air change rate	8.00 ach	
Blinds/curtains	None	

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

### Party Walls

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

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

### 10 Key features

Party wall U-value	0.00	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.

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE B3	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	85 B	DER	16.14	TER	27.03
Environmental	87 B	% DER<TER	40.29		
CO <sub>2</sub> Emissions (t/year)	1.29	DFEE	50.47	TFEE	55.80
General Requirements Compliance	Pass	% DFEE<TFEE	9.56		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
------------------	---	-------------	-----------

Client	
--------	--

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

Orientation	North
Property Tenure	Rented (social)
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

#### 6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	22.00 m	43.00 m <sup>2</sup>	2.46 m
1st Storey:	22.00 m	43.00 m <sup>2</sup>	2.65 m

7.0 Living Area	15.10	m <sup>2</sup>
-----------------	-------	----------------

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

#### 9.0 External Walls

Description	Type	U-Value (W/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
BRICK TF	Timber Frame	0.23	112.42	90.38

#### 9.1 Party Walls

Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Party Wall 1	Filled Cavity with Edge Sealing		0.00	45.90

#### 10.0 External Roofs

Description	Type	U-Value (W/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
CEILING	External Plane Roof	0.14	43.00	43.00

#### 11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Heat Loss Floor 1	Ground Floor - Solid		0.16	42.30

#### 12.0 Opening Types

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
upvc window	Manufacturer	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
FRENCH DOOR	Manufacturer	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
external door	Manufacturer	Solid Door							1.20
REAR DOOR	Manufacturer	Half Glazed Door	Double Low-E Hard	0.15		0.72		0.70	1.40

### 13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m <sup>2</sup> )	Curtain Closed
FRONT 1	Window	[1] BRICK TF	North	None	0.00					4.04	
FRONT 2	Window	[1] BRICK TF	North East	None	0.00					5.38	
GABLE WINDOW	Window	[1] BRICK TF	West	None	0.00					0.88	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.16	
FRENCH DOOR R1	Window	[1] BRICK TF	South	None	0.00					2.86	
FRENCH DOOR R2	Window	[1] BRICK TF	South West	None	0.00					2.86	
REAR 1	Window	[1] BRICK TF	South	None	0.00					0.72	
REAR 2	Window	[1] BRICK TF	South West	None	0.00					3.14	

### 14.0 Conservatory

### 15.0 Draught Proofing

 %

### 16.0 Draught Lobby

### 17.0 Thermal Bridging

### 17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	15.67	0.141	Yes	TRADA
Independently assessed	E3 Sill	14.64	0.027	Yes	TRADA
Independently assessed	E4 Jamb	38.58	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	22.00	0.131	Yes	TRADA
Independently assessed	E6 Intermediate floor within a dwelling	22.00	0.094	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	13.16	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	8.87	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	15.33	0.060	No	TRADA
Independently assessed	E18 Party wall between dwellings	10.22	0.034	Yes	TRADA
Independently assessed	P1 Party wall - Ground floor	5.07	0.119	No	TRADA
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	5.07	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	5.07	0.142	No	TRADA
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.11	-0.045	No	TRADA

Y-value  W/m<sup>2</sup>K

### 18.0 Pressure Testing

Designed AP<sub>50</sub>  m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Property Tested ?

As Built AP<sub>50</sub>  m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

### 19.0 Mechanical Ventilation

#### Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation



# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Air change rate

### Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Duct Type

### 19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.13	In Room Fan Kitchen	1
0.16	Through Wall Fan Other Wet Room	1
0.16	In Room Fan Other Wet Room	1

### 20.0 Fans, Open Fireplaces, Flues

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

### 21.0 Fixed Cooling System

### 22.0 Lighting

#### Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings  %

#### External

External lights fitted

Light and motion sensor

### 23.0 Electricity Tariff

### 24.0 Main Heating 1

Description

Percentage of Heat  %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Sap Code

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in Concrete
Flow Temperature	36° - 45°C
<b>25.0 Main Heating 2</b>	None
Community Heating	None
<b>28.0 Water Heating</b>	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Only Heating Hot Water	No
<b>29.0 Hot Water Cylinder</b>	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	250.00
Loss	2.02
Pipes insulation	Fully insulated primary pipework
<b>31.0 Thermal Store</b>	None

L  
kWh/day

### Recommendations

#### Lower cost measures

None

#### Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£87	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£388	A 98	