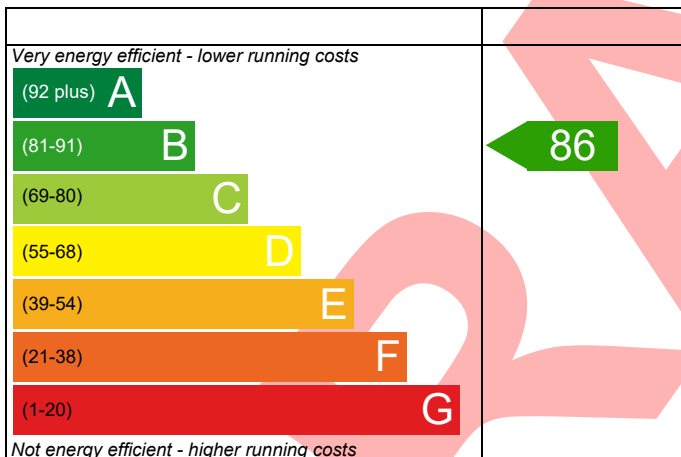


Dwelling type: House, Semi-Detached  
 Date of assessment: 09/11/2022  
 Produced by: S J Roberts Construction Limited  
 Total floor area: 97.2 m<sup>2</sup>

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.

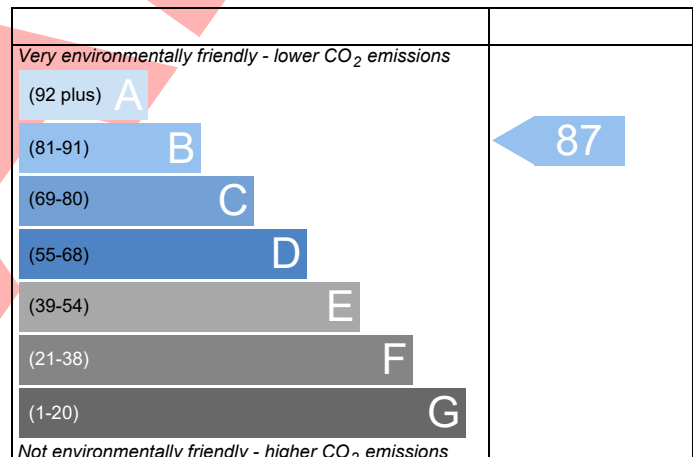
## Energy Efficiency Rating



**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 B1	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	86 B	DER	14.82	TER	24.32
Environmental	87 B	% DER<TER	39.06		
CO <sub>2</sub> Emissions (t/year)	1.33	DFEE	43.69	TFEE	48.28
General Requirements Compliance	Pass	% DFEE<TFEE	9.50		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
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Client	
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### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

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

##### 1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	24.32	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	14.82	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-9.50 (-39.1%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.28	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.69	kWh/m <sup>2</sup> /yr	
	-4.6 (-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	1.37 (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	
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Secondary heating system	None	
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### 5 Cylinder insulation

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

Continuous extract system (decentralised)		
Specific fan power	0.1300 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	5.55 m <sup>2</sup> , No overhang
----------------------	-----------------------------------

Windows facing South	8.63 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	
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This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE B1		Issued on Date	09/11/2022	
Assessment Reference	GRANT ASHP	Prop Type Ref			
Property					
SAP Rating	86 B	DER	14.82	TER	24.32
Environmental	87 B	% DER<TER	39.06		
CO <sub>2</sub> Emissions (t/year)	1.33	DFEE	43.69	TFEE	48.28
General Requirements Compliance	Pass	% DFEE<TFEE	9.50		
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 97 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) 24.32 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 14.82 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.3 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)43.7 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	1.37 (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  
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Midlands): Not significant OK

Based on:

Overshading: Average  
Windows facing North: 5.55 m<sup>2</sup>, No overhang  
Windows facing South: 8.63 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	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1913 (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 inflt rate	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.1802		(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)							11.7489 (36)
Total fabric heat loss							(33) + (36) = 66.9291 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771 (38)
Heat transfer coeff	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)
Average = Sum(39)m / 12 =												107.9062 (39)
HLP	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101 (40)
HLP (average)												1.1101 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)												Total = Sum(45)m = 1551.5378 (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

24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (46)
Water storage loss:											
Store volume											
a) If manufacturer declared loss factor is known (kWh/day):											
Temperature factor from Table 2b											
Enter (49) or (54) in (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											
217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (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											
217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (64)
Heat gains from water heating, kWh/month											
99.1481	88.0224	93.9340	86.2737	86.0433	79.0350	77.9519	82.7151	81.6847	89.3596	91.8884	97.4605 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	23.8623	21.1943	17.2364	13.0490	9.7543	8.2350	8.8982	11.5662	15.5242	19.7115	23.0062	24.5255 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602 (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)												
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)												
	133.2636	130.9857	126.2554	119.8246	115.6495	109.7708	104.7740	111.1762	113.4510	120.1070	127.6228	130.9952 (72)
Total internal gains												
	472.5268	470.1929	454.9224	430.2913	405.1325	381.1094	365.6693	372.1275	384.9425	409.7988	438.2982	459.8150 (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		5.5500	10.6334	0.7200		0.7000	0.7700	20.6124 (74)				
South		5.3000	46.7521	0.7200		0.7000	0.7700	86.5447 (78)				
South		3.3300	46.7521	0.7200		0.7000	0.7700	54.3762 (78)				
Solar gains	161.5333	270.1835	360.9237	439.7861	491.0798	488.2635	470.3289	431.0216	387.5836	295.8212	192.4674	138.9521 (83)
Total gains	634.0600	740.3764	815.8461	870.0774	896.2123	869.3729	835.9982	803.1490	772.5260	705.6200	630.7656	598.7672 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217 (85)
alpha	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
util living area												
	0.9592	0.9384	0.9073	0.8541	0.7671	0.6394	0.5059	0.5392	0.7138	0.8684	0.9400	0.9645 (86)
Tweekday												
	18.8076	18.9090	19.0546	19.2272	19.3846	19.4923	19.5344	19.5297	19.4613	19.2649	19.0016	18.7798
Tweekend												
	20.4454	20.4909	20.5566	20.6355	20.7098	20.7644	20.7894	20.7859	20.7468	20.6515	20.5318	20.4329
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												
	20.1440	20.2126	20.3158	20.4309	20.5521	20.6381	20.6749	20.6696	20.6047	20.4622	20.2689	20.1248 (87)
Th 2												
	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house												
	0.9532	0.9295	0.8935	0.8309	0.7268	0.5709	0.4093	0.4443	0.6534	0.8427	0.9299	0.9593 (89)
Tweekday												
	18.8076	18.9090	19.0546	19.2272	19.3846	19.4923	19.5344	19.5297	19.4613	19.2649	19.0016	18.7798
Tweekend												
	18.8076	18.9090	19.0546	19.2272	19.3846	19.4923	19.5344	19.5297	19.4613	19.2649	19.0016	18.7798
MIT 2												
	18.8076	18.9090	19.0546	19.2272	19.3846	19.4923	19.5344	19.5297	19.4613	19.2649	19.0016	18.7798 (90)
Living area fraction												
									fLA = Living area / (4) =			0.2037 (91)
MIT												
	19.0798	19.1745	19.3115	19.4724	19.6224	19.7257	19.7667	19.7619	19.6942	19.5088	19.2598	19.0537 (92)
Temperature adjustment												
												0.0000
adjusted MIT												
	19.0798	19.1745	19.3115	19.4724	19.6224	19.7257	19.7667	19.7619	19.6942	19.5088	19.2598	19.0537 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9468	0.9211	0.8827	0.8171	0.7100	0.5507	0.3857	0.4203	0.6328	0.8282	0.9211	0.9535 (94)
Useful gains	600.3142	681.9456	720.1461	710.9499	636.3022	478.7392	322.4193	337.5370	488.8818	584.3742	580.9735	570.9017 (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												
	1594.8347	1540.3077	1382.4415	1140.8312	854.8773	553.0995	341.7112	362.7661	603.6455	961.3098	1312.1132	1602.8100 (97)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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	739.9232	576.8193	492.7478	309.5145	162.6199	0.0000	0.0000	0.0000	0.0000	280.4401	526.4206	767.7398 (98)
Space heating												3856.2253 (98)
Space heating per m2												(98) / (4) = 39.6731 (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 %)												324.7350 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1187.4991 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	739.9232	576.8193	492.7478	309.5145	162.6199	0.0000	0.0000	0.0000	0.0000	280.4401	526.4206	767.7398 (98)
Space heating efficiency (main heating system 1)	324.7350	324.7350	324.7350	324.7350	324.7350	0.0000	0.0000	0.0000	0.0000	324.7350	324.7350	324.7350 (210)
Space heating fuel (main heating system)	227.8545	177.6277	151.7384	95.3130	50.0777	0.0000	0.0000	0.0000	0.0000	86.3597	162.1077	236.4204 (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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (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)
Fuel for water heating, kWh/month	109.2752	96.3918	101.4124	91.1589	89.5133	80.2429	77.3116	84.4945	84.2387	94.5143	99.6257	106.7302 (219)
Water heating fuel used												1114.9096 (219)
Annual totals kWh/year												
Space heating fuel - main system												1187.4991 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.8875, total flow = 29.0000, SFP = 0.1685)												
mechanical ventilation fans (SFP = 0.1685)												51.0629 (230a)
Total electricity for the above, kWh/year												51.0629 (231)
Electricity for lighting (calculated in Appendix L)												421.4162 (232)
Total delivered energy for all uses												2774.8878 (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	1187.4991	0.5190	616.3120 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1114.9096	0.5190	578.6381 (264)
Space and water heating			1194.9501 (265)
Pumps and fans	51.0629	0.5190	26.5017 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Total CO2, kg/year			1440.1668 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8200 (273)

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

DER		14.8200	ZC1
Total Floor Area		97.2000	
Assumed number of occupants		2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		32.0600	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		32.0600	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	48.6000 (1b)	x 2.4600 (2b)	= 119.5560 (1b) - (3b)
First floor	48.6000 (1c)	x 2.6500 (2c)	= 128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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) =	0.1208 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3708 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3152 (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	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2915	0.3152	0.3388	0.3546	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (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)			14.1800	1.3258	18.7992		(27)					
Heat Loss Floor 1			42.3000	0.1300	5.4990		(28a)					
BRICK TF	104.2400	16.3400	87.9000	0.1800	15.8220		(29a)					
CEILING	48.6000		48.6000	0.1300	6.3180		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			195.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.5982	(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)							9.8114 (36)					
Total fabric heat loss							(33) + (36) = 58.4096 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.5943	Feb 47.3374	Mar 47.0855	Apr 45.9025	May 45.6812	Jun 44.6508	Jul 44.6508	Aug 44.4600	Sep 45.0477	Oct 45.6812	Nov 46.1289	Dec 46.5970 (38)
Heat transfer coeff	106.0040	105.7470	105.4952	104.3121	104.0908	103.0604	103.0604	102.8696	103.4573	104.0908	104.5386	105.0067 (39)
Average = Sum(39)m / 12 =												104.3111 (39)
HLP	Jan 1.0906	Feb 1.0879	Mar 1.0853	Apr 1.0732	May 1.0709	Jun 1.0603	Jul 1.0603	Aug 1.0583	Sep 1.0644	Oct 1.0709	Nov 1.0755	Dec 1.0803 (40)
HLP (average)												1.0732 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)												Total = Sum(45)m = 1551.5378 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)

# 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	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	30.6236	31.6444 (57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month													
215.7681	190.2835	200.0866	179.7069	176.3549	157.9361	152.0199	166.3455	165.9052	186.3289	196.5931	210.6923	210.6923 (62)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
											Solar input (sum of months) = Sum(63)m =	0.0000 (63)	
Output from w/h													
215.7681	190.2835	200.0866	179.7069	176.3549	157.9361	152.0199	166.3455	165.9052	186.3289	196.5931	210.6923	210.6923 (64)	
											Total per year (kWh/year) = Sum(64)m =	2198.0209 (64)	
Heat gains from water heating, kWh/month													
97.4118	86.4541	92.1977	84.5934	84.3069	77.3547	76.2155	80.9788	80.0044	87.6233	90.2081	95.7241	95.7241 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025 (66)
23.8623	21.1943	17.2364	13.0490	9.7543	8.2350	8.8982	11.5662	15.5242	19.7115	23.0062	24.5255	24.5255 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	240.6135 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602 (69)	
3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)													
-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)	
Water heating gains (Table 5)													
130.9298	128.6519	123.9217	117.4909	113.3158	107.4370	102.4402	108.8425	111.1172	117.7732	125.2890	128.6615	128.6615 (72)	
473.1930	470.8591	455.5886	430.9575	405.7988	381.7756	366.3355	372.7937	385.6087	410.4650	438.9645	460.4813	460.4813 (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	5.5500	10.6334	0.6300	0.7000	0.7700	18.0359 (74)						
South	8.6300	46.7521	0.6300	0.7000	0.7700	123.3058 (78)						
Solar gains	141.3416	236.4105	315.8083	384.8129	429.6948	427.2306	411.5378	377.1439	339.1356	258.8435	168.4089	121.5831 (83)
Total gains	614.5346	707.2697	771.3968	815.7703	835.4936	809.0062	777.8733	749.9376	724.7443	669.3086	607.3734	582.0644 (84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
63.6769	63.8316	63.9840	64.7096	64.8472	65.4956	65.4956	65.6170	65.2443	64.8472	64.5695	64.2816	64.2816 (86)
alpha	5.2451	5.2554	5.2656	5.3140	5.3231	5.3664	5.3664	5.3745	5.3496	5.3231	5.3046	5.2854
util living area												
0.9975	0.9942	0.9863	0.9629	0.8968	0.7461	0.5691	0.6103	0.8361	0.9690	0.9943	0.9981	0.9981 (86)
MIT	19.8696	20.0234	20.2483	20.5329	20.7855	20.9450	20.9894	20.9847	20.8941	20.5745	20.1682	19.8421 (87)
Th 2	20.0085	20.0107	20.0128	20.0228	20.0247	20.0334	20.0334	20.0350	20.0300	20.0247	20.0209	20.0169 (88)
util rest of house												
0.9966	0.9923	0.9815	0.9488	0.8568	0.6594	0.4512	0.4926	0.7649	0.9544	0.9920	0.9975 (89)	
MIT 2	18.5025	18.7281	19.0557	19.4684	19.8083	19.9953	20.0293	20.0285	19.9450	19.5333	18.9475	18.4685 (90)
Living area fraction												
18.7810	18.9919	19.2986	19.6853	20.0074	20.1888	20.2249	20.2233	20.1383	19.7454	19.1962	18.7483 (92)	
Temperature adjustment												
18.7810	18.9919	19.2986	19.6853	20.0074	20.1888	20.2249	20.2233	20.1383	19.7454	19.1962	18.7483 (93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9951	0.9894	0.9768	0.9427	0.8560	0.6745	0.4753	0.5165	0.7739	0.9490	0.9893	0.9962 (94)	
Useful gains	611.4968	699.8010	753.5128	768.9871	715.1481	545.7014	369.7546	387.3783	560.9114	635.1574	600.8553	579.8627 (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												
1535.0388	1490.1778	1350.1908	1125.0341	864.7219	575.9801	373.5825	393.3024	624.7096	951.9529	1264.5151	1527.6684 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
687.1153	531.1332	443.9284	256.3539	111.2829	0.0000	0.0000	0.0000	0.0000	235.6959	477.8351	705.1674 (98)	
Space heating per m <sup>2</sup>												
											(98) / (4) =	35.4785 (99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3688.2482 (211)
Space heating requirement	687.1153	531.1332	443.9284	256.3539	111.2829	0.0000	0.0000	0.0000	0.0000	235.6959	477.8351	705.1674	(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)	734.8826	568.0569	474.7897	274.1753	119.0191	0.0000	0.0000	0.0000	0.0000	252.0812	511.0536	754.1898	(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	215.7681	190.2835	200.0866	179.7069	176.3549	157.9361	152.0199	166.3455	165.9052	186.3289	196.5931	210.6923	(64)
Efficiency of water heater (217)m	87.6901	87.4086	86.8807	85.7610	83.6252	79.8000	79.8000	79.8000	79.8000	85.4418	87.0958	87.7920	(216)
Fuel for water heating, kWh/month	246.0574	217.6942	230.3004	209.5438	210.8873	197.9149	190.5011	208.4530	207.9013	218.0769	225.7204	239.9905	(219)
Water heating fuel used													2603.0412 (219)
Annual totals kWh/year													
Space heating fuel - main system													3688.2482 (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)													421.4162 (232)
Total delivered energy for all uses													6787.7056 (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	3688.2482	0.2160	796.6616 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2603.0412	0.2160	562.2569 (264)
Space and water heating			1358.9185 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Total CO2, kg/m2/year			1616.5585 (272)
Emissions per m2 for space and water heating			13.9806 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2502 (272b)
Emissions per m2 for pumps and fans			0.4005 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9806 * 1.55) + 2.2502 + 0.4005, rounded to 2 d.p.			24.3200 (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	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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) =	0.1208 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3458 (18)	
Number of sides sheltered				2 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2939 (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	0.3748	0.3674	0.3601	0.3233	0.3160	0.2792	0.2792	0.2719	0.2939	0.3160	0.3307	0.3454 (22b)
Effective ac	0.5702	0.5675	0.5648	0.5523	0.5499	0.5390	0.5390	0.5370	0.5432	0.5499	0.5547	0.5596 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.1802		(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)							11.7489 (36)
Total fabric heat loss						(33) + (36) =	66.9291 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	46.7321	46.5086	46.2896	45.2607	45.0682	44.1721	44.1721	44.0062	44.5173	45.0682	45.4576	45.8648 (38)
Heat transfer coeff	113.6612	113.4377	113.2187	112.1898	111.9973	111.1012	111.1012	110.9353	111.4464	111.9973	112.3867	112.7939 (39)
Average = Sum(39)m / 12 =												112.1889 (39)
HLP	1.1694	1.1671	1.1648	1.1542	1.1522	1.1430	1.1430	1.1413	1.1466	1.1522	1.1562	1.1604 (40)
HLP (average)												1.1542 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)										Total = Sum(45)m =		1551.5378 (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												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	34.1830	29.8967	30.8507	26.8964	25.8077	22.2701	20.6365	23.6807	23.9635	27.9272	30.4847	33.1044	33.1044	33.1044	(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	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8623	21.1943	17.2364	13.0490	9.7543	8.2350	8.8982	11.5662	15.5242	19.7115	23.0062	24.5255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(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)	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)	45.9449	44.4891	41.4660	37.3561	34.6878	30.9307	27.7373	31.8289	33.2827	37.5366	42.3399	44.4952	(72)
Total internal gains	385.2081	383.6963	370.1329	347.8227	324.1708	302.2693	288.6326	292.7802	304.7742	327.2284	353.0153	373.3150	(73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
North	5.5500	10.6334	0.7200	0.7000	0.7700	20.6124 (74)							
South	5.3000	46.7521	0.7200	0.7000	0.7700	86.5447 (78)							
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)							
Solar gains	161.5333	270.1835	360.9237	439.7861	491.0798	488.2635	470.3289	431.0216	387.5836	295.8212	192.4674	138.9521	(83)
Total gains	546.7413	653.8798	731.0567	787.6088	815.2506	790.5328	758.9615	723.8017	692.3578	623.0496	545.4827	512.2671	(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	23.7548	23.8016	23.8477	24.0664	24.1077	24.3022	24.3022	24.3385	24.2269	24.1077	24.0242	23.9375	
alpha	2.5837	2.5868	2.5898	2.6044	2.6072	2.6201	2.6201	2.6226	2.6151	2.6072	2.6016	2.5958	
util living area	0.9711	0.9538	0.9278	0.8817	0.8045	0.6844	0.5532	0.5892	0.7602	0.8983	0.9569	0.9753	
MIT	18.5038	18.8024	19.2383	19.7830	20.2916	20.6868	20.8729	20.8455	20.5535	19.8887	19.0922	18.4446	
Th 2	19.9446	19.9464	19.9483	19.9568	19.9584	19.9659	19.9659	19.9672	19.9630	19.9584	19.9552	19.9518	
util rest of house	0.9666	0.9467	0.9162	0.8612	0.7667	0.6158	0.4503	0.4894	0.7021	0.8766	0.9491	0.9715	
MIT 2	17.6629	17.9588	18.3888	18.9249	19.4077	19.7644	19.9066	19.8908	19.6551	19.0365	18.2549	17.6093	
Living area fraction	FLA = Living area / (4) =												
MIT	17.8342	18.1306	18.5619	19.0997	19.5877	19.9523	20.1034	20.0853	19.8381	19.2101	18.4255	17.7795	
Temperature adjustment													
adjusted MIT	17.8342	18.1306	18.5619	19.0997	19.5877	19.9523	20.1034	20.0853	19.8381	19.2101	18.4255	17.7795	

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9544	0.9307	0.8970	0.8407	0.7511	0.6148	0.4652	0.5019	0.6941	0.8571	0.9338	0.9605	
Useful gains	521.7888	608.5637	655.7241	662.1756	612.3563	486.0203	353.0470	363.3043	480.5543	534.0286	509.3901	492.0156	
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	1538.3134	1500.8549	1365.6284	1144.3070	883.4031	594.6462	389.2349	408.8247	639.4945	964.3093	1272.8324	1531.6798	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
Space heating kWh	756.2943	599.6197	528.1688	347.1346	201.6588	0.0000	0.0000	0.0000	0.0000	320.1288	549.6785	773.5102	
Space heating													
Space heating per m2	(98) / (4) =												

#### 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	1044.3514	822.1490	843.1081	0.0000	0.0000	0.0000	0.0000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7181	0.7868	0.7656	0.0000	0.0000	0.0000	0.0000	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.9112	646.9063	645.4960	0.0000	0.0000	0.0000	0.0000	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1028.0872	989.0124	949.9318	0.0000	0.0000	0.0000	0.0000	
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	
Space cooling kWh													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	200.2868	254.5269	226.5002	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												681.3139 (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	50.0717	63.6317	56.6251	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												170.3285 (107)
Energy for space heating												1.7524 (108)
Energy for space cooling												41.9361 (99)
Total												1.7524 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.6885 (109)
												43.7 (109)

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## 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	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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) =	0.1208 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3708 (18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3152 (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	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2915	0.3152	0.3388	0.3546	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (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)			14.1800	1.3258	18.7992		(27)					
Heat Loss Floor 1			42.3000	0.1300	5.4990		(28a)					
BRICK TF	104.2400	16.3400	87.9000	0.1800	15.8220		(29a)					
CEILING	48.6000		48.6000	0.1300	6.3180		(30)					
Total net area of external elements Aum(A, m2)			195.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 48.5982		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8114 (36)					
Total fabric heat loss							(33) + (36) = 58.4096 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	47.5943	47.3374	47.0855	45.9025	45.6812	44.6508	44.6508	44.4600	45.0477	45.6812	46.1289	46.5970 (38)
Heat transfer coeff	106.0040	105.7470	105.4952	104.3121	104.0908	103.0604	103.0604	102.8696	103.4573	104.0908	104.5386	105.0067 (39)
Average = Sum(39)m / 12 =												104.3111 (39)
HLP	1.0906	1.0879	1.0853	1.0732	1.0709	1.0603	1.0603	1.0583	1.0644	1.0709	1.0755	1.0803 (40)
HLP (average)												1.0732 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)										Total = Sum(45)m =		1551.5378 (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												

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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	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	(59)
	34.1830	29.8967	30.8507	26.8964	25.8077	22.2701	20.6365	23.6807	23.9635	27.9272	30.4847	33.1044	(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	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.8623	21.1943	17.2364	13.0490	9.7543	8.2350	8.8982	11.5662	15.5242	19.7115	23.0062	24.5255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(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)	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)	45.9449	44.4891	41.4660	37.3561	34.6878	30.9307	27.7373	31.8289	33.2827	37.5366	42.3399	44.4952	(72)
Total internal gains	385.2081	383.6963	370.1329	347.8227	324.1708	302.2693	288.6326	292.7802	304.7742	327.2284	353.0153	373.3150	(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	5.5500	10.6334	0.6300	0.7000	0.7700	18.0359 (74)							
South	8.6300	46.7521	0.6300	0.7000	0.7700	123.3058 (78)							
Solar gains	141.3416	236.4105	315.8083	384.8129	429.6948	427.2306	411.5378	377.1439	339.1356	258.8435	168.4089	121.5831	(83)
Total gains	526.5497	620.1068	685.9412	732.6356	753.8656	729.4999	700.1704	669.9240	643.9098	586.0719	521.4243	494.8981	(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	63.6769	63.8316	63.9840	64.7096	64.8472	65.4956	65.4956	65.6170	65.2443	64.8472	64.5695	64.2816	(85)
alpha	5.2451	5.2554	5.2656	5.3140	5.3231	5.3664	5.3664	5.3745	5.3496	5.3231	5.3046	5.2854	
util living area	0.9988	0.9968	0.9919	0.9759	0.9264	0.7976	0.6240	0.6704	0.8825	0.9821	0.9972	0.9991	(86)
MIT	19.7845	19.9403	20.1696	20.4638	20.7356	20.9236	20.9837	20.9763	20.8571	20.5030	20.0860	19.7575	(87)
Th 2	20.0085	20.0107	20.0128	20.0228	20.0247	20.0334	20.0334	20.0350	20.0300	20.0247	20.0209	20.0169	(88)
util rest of house	0.9984	0.9958	0.9889	0.9661	0.8942	0.7146	0.4989	0.5472	0.8214	0.9730	0.9961	0.9988	(89)
MIT 2	18.8955	19.0526	19.2822	19.5795	19.8360	19.9954	20.0289	20.0278	19.9470	19.6220	19.2066	18.8753	(90)
Living area fraction	fLA = Living area / (4) =												0.2037 (91)
MIT	19.0766	19.2334	19.4630	19.7596	20.0193	20.1845	20.2234	20.2210	20.1324	19.8015	19.3857	19.0550	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0766	19.2334	19.4630	19.7596	20.0193	20.1845	20.2234	20.2210	20.1324	19.8015	19.3857	19.0550	(93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9946	0.9866	0.9628	0.8940	0.7290	0.5247	0.5724	0.8291	0.9703	0.9950	0.9984	(94)
Useful gains	525.3998	616.7519	676.7826	705.3531	673.9462	531.8380	367.3463	383.4935	533.8351	568.6431	518.8194	494.1149	(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	1566.3791	1515.7134	1367.5327	1132.7878	865.9621	575.5411	373.4310	393.0640	624.0971	957.7874	1284.3304	1559.8746	(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	774.4886	604.1022	513.9181	307.7530	142.8598	0.0000	0.0000	0.0000	0.0000	289.5234	551.1679	792.9253	(98)
Space heating													3976.7382 (98)
Space heating per m2													(98) / (4) = 40.9129 (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	968.7681	762.6472	781.8091	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8376	0.9104	0.8911	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	811.4557	694.3315	696.6889	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	956.7500	920.2955	886.9579	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.6119	168.1172	141.5601	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													414.2892 (104)
Cooled fraction													fC = cooled area / (4) = 1.0000 (105)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Intermittency factor (Table 10b)	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	0.0000	0.0000	0.0000	0.0000	26.1530	42.0293	35.3900	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												103.5723 (107)
Space cooling per m2												1.0656 (108)
Energy for space heating												40.9129 (99)
Energy for space cooling												1.0656 (108)
Total												41.9785 (109)
Target Fabric Energy Efficiency (TFEE)												48.3 (109)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1913 (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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.1802		(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) 11.7489 (36)  
 Total fabric heat loss (33) + (36) = 66.9291 (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	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771 (38)
Average = Sum(39)m / 12 =	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7120 (42)  
 Average daily hot water use (litres/day) 98.6112 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy content (annual)	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1551.5378 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (64)
Total per year (kWh/year) = Sum(64)m =												2223.5758 (64)
RHI water heating demand												2224 (64)
Heat gains from water heating, kWh/month	99.1481	86.0224	93.9340	86.2737	86.0433	79.0350	77.9519	82.7151	81.6847	89.3596	91.8884	97.4605 (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	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6558	52.9858	43.0909	32.6226	24.3858	20.5875	22.2455	28.9156	38.8104	49.2787	57.5156	61.3138 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.7016	379.6002	369.7758	348.8609	322.4596	297.6461	281.0692	277.1705	286.9949	307.9098	334.3111	359.1246 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843 (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)	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)	133.2636	130.9857	126.2554	119.8246	115.6495	109.7708	104.7740	111.1762	113.4510	120.1070	127.6228	130.9952 (72)
Total internal gains	676.8464	671.7970	647.3475	609.5335	570.7203	536.2297	516.3140	525.4877	547.4816	585.5209	627.6748	659.6591 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	5.5500	11.3201	0.7200	0.7200	0.7000	0.7700	21.9436 (74)					
South	5.3000	49.0238	0.7200	0.7200	0.7000	0.7700	90.7500 (78)					
South	3.3300	49.0238	0.7200	0.7200	0.7000	0.7700	57.0184 (78)					
Solar gains	169.7120	288.0896	386.2861	481.8335	508.6188	547.1730	507.8648	473.8776	429.5875	323.9067	227.5936	161.3976 (83)
Total gains	846.5584	959.8866	1033.6336	1091.3670	1079.3391	1083.4027	1024.1788	999.3653	977.0692	909.4276	855.2685	821.0567 (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)	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217 (85)
alpha	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
util living area	0.9246	0.8975	0.8546	0.7862	0.6963	0.5388	0.4296	0.4467	0.6286	0.8017	0.8900	0.9301 (86)
Tweekday	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
Tweekend	20.4980	20.5379	20.6030	20.6734	20.7323	20.7793	20.7945	20.7932	20.7625	20.6833	20.5825	20.4889
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	20.2252	20.2853	20.3873	20.4900	20.5869	20.6610	20.6828	20.6808	20.6291	20.5112	20.3480	20.2113 (87)
Th 2	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house	0.9146	0.8844	0.8354	0.7569	0.6514	0.4700	0.3423	0.3592	0.5664	0.7691	0.8736	0.9207 (89)
Tweekday	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
Tweekend	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
MIT 2	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036 (90)
Living area fraction												fLA = Living area / (4) =
MIT	19.1887	19.2708	19.4051	19.5464	19.6635	19.7491	19.7729	19.7712	19.7197	19.5698	19.3631	19.1700 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1887	19.2708	19.4051	19.5464	19.6635	19.7491	19.7729	19.7712	19.7197	19.5698	19.3631	19.1700 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9054	0.8736	0.8228	0.7424	0.6352	0.4520	0.3221	0.3387	0.5478	0.7535	0.8617	0.9118 (94)
Ext temp.	766.4436	838.5609	850.4230	810.2540	685.6433	489.7137	329.9050	338.4523	535.2680	685.2535	737.0163	748.6407 (95)
Heat loss rate W	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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1606.5811	1561.4881	1381.7448	1138.0202	848.5188	534.0390	342.3784	352.9821	617.1950	978.6907	1323.2694	1615.3574	(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	625.0623	485.8071	395.3034	235.9917	121.1794	0.0000	0.0000	0.0000	0.0000	218.3173	422.1023	644.8372	(98)
RHI space heating demand												3148.6006	(98)
												3149	(98)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1913 (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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.1802		(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) 11.7489 (36)  
 Total fabric heat loss (33) + (36) = 66.9291 (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	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771 (38)
Average = Sum(39)m / 12 =	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7120 (42)  
 Average daily hot water use (litres/day) 98.6112 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy content (annual)	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1551.5378 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (46)
Water storage loss:												
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												
Enter (49) or (54) in (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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (64)
Heat gains from water heating, kWh/month	99.1481	88.0224	93.9340	86.2737	86.0433	79.0350	77.9519	82.7151	81.6847	89.3596	91.8884	97.4605 (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	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6558	52.9858	43.0909	32.6226	24.3858	20.5875	22.2455	28.9156	38.8104	49.2787	57.5156	61.3138 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.7016	379.6002	369.7758	348.8609	322.4596	297.6461	281.0692	277.1705	286.9949	307.9098	334.3111	359.1246 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843 (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)	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)	133.2636	130.9857	126.2554	119.8246	115.6495	109.7708	104.7740	111.1762	113.4510	120.1070	127.6228	130.9952 (72)
Total internal gains	676.8464	671.7970	647.3475	609.5335	570.7203	536.2297	516.3140	525.4877	547.4816	585.5209	627.6748	659.6591 (73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.5500	10.6334	0.7200	0.7000	0.7700	20.6124 (74)						
South	5.3000	46.7521	0.7200	0.7000	0.7700	86.5447 (78)						
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)						
Solar gains	161.5333	270.1835	360.9237	439.7861	491.0798	488.2635	470.3289	431.0216	387.5836	295.8212	192.4674	138.9521 (83)
Total gains	838.3797	941.9805	1008.2713	1049.3196	1061.8001	1024.4932	986.6429	956.5092	935.0652	881.3421	820.1422	798.6112 (84)

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

Temperature during heating periods in the living area from Table 9, T <sub>h1</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)	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217 (85)
tau	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
alpha	0.9261	0.9000	0.8625	0.8013	0.7065	0.5738	0.4432	0.4713	0.6403	0.8084	0.8984	0.9339 (86)
util living area	18.9194	19.0095	19.1380	19.2876	19.4202	19.5073	19.5393	19.5360	19.4852	19.3258	19.0955	18.8919
Tweekday	20.4961	20.5370	20.5956	20.6650	20.7287	20.7740	20.7937	20.7912	20.7611	20.6815	20.5751	20.4836
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	20.2222	20.2839	20.3759	20.4768	20.5813	20.6529	20.6816	20.6778	20.6269	20.5085	20.3366	20.2030 (87)
Th 2	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house	0.9163	0.8870	0.8441	0.7733	0.6626	0.5059	0.3540	0.3828	0.5773	0.7760	0.8829	0.9250 (89)
Tweekday	18.9194	19.0095	19.1380	19.2876	19.4202	19.5073	19.5393	19.5360	19.4852	19.3258	19.0955	18.8919
Tweekend	18.9194	19.0095	19.1380	19.2876	19.4202	19.5073	19.5393	19.5360	19.4852	19.3258	19.0955	18.8919
MIT 2	18.9194	19.0095	19.1380	19.2876	19.4202	19.5073	19.5393	19.5360	19.4852	19.3258	19.0955	18.8919 (90)
Living area fraction	19.1848	19.2691	19.3901	19.5299	19.6567	19.7407	19.7720	19.7686	19.7177	19.5667	19.3483	19.1590 (92)
MIT	19.1848	19.2691	19.3901	19.5299	19.6567	19.7407	19.7720	19.7686	19.7177	19.5667	19.3483	19.1590 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	19.1848	19.2691	19.3901	19.5299	19.6567	19.7407	19.7720	19.7686	19.7177	19.5667	19.3483	19.1590 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	760.4827	825.4397	838.5697	796.3343	686.3379	499.3899	328.7334	345.9400	521.9270	670.1570	714.7011	731.8372 (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	1606.1578	1550.5147	1390.9259	1147.0311	858.5788	554.7136	342.2733	363.4962	606.1890	967.5650	1321.6674	1614.1660 (97)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	629.1823	487.2504	410.9530	252.5017	128.1473	0.0000	0.0000	0.0000	0.0000	221.2716	437.0157	656.4527 (98)
Space heating												3222.7746 (98)
Space heating per m2												(98) / (4) = 33.1561 (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 %)												324.7350 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												992.4321 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	629.1823	487.2504	410.9530	252.5017	128.1473	0.0000	0.0000	0.0000	0.0000	221.2716	437.0157	656.4527 (98)
Space heating efficiency (main heating system 1)	324.7350	324.7350	324.7350	324.7350	324.7350	0.0000	0.0000	0.0000	0.0000	324.7350	324.7350	324.7350 (210)
Space heating fuel (main heating system)	193.7525	150.0456	126.5503	77.7562	39.4621	0.0000	0.0000	0.0000	0.0000	68.1391	134.5761	202.1503 (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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (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)
Fuel for water heating, kWh/month	109.2752	96.3918	101.4124	91.1589	89.5133	80.2429	77.3116	84.4945	84.2387	94.5143	99.6257	106.7302 (219)
Water heating fuel used												1114.9096 (219)
Annual totals kWh/year												
Space heating fuel - main system												992.4321 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.8875, total flow = 29.0000, SFP = 0.1685)												51.0629 (230a)
mechanical ventilation fans (SFP = 0.1685)												51.0629 (231)
Total electricity for the above, kWh/year												421.4162 (232)
Electricity for lighting (calculated in Appendix L)												2579.8209 (238)
Total delivered energy for all uses												

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	992.4321	13.1900	130.9018 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1114.9096	13.1900	147.0566 (247)
Mechanical ventilation fans	51.0629	13.1900	6.7352 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	421.4162	13.1900	55.5848 (250)
Additional standing charges			0.0000 (251)
Total energy cost			340.2784 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0050 (257)
SAP value		85.9797
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	992.4321	0.5190	515.0723 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1114.9096	0.5190	578.6381 (264)
Space and water heating			1093.7104 (265)
Pumps and fans	51.0629	0.5190	26.5017 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Total kg/year			1338.9270 (272)
CO2 emissions per m2			13.7700 (273)
EI value			87.3828
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  $13.19 \times (1 + 0.29 \times 0.75) / 3.2474 = 4.945$ , stars = 4  
Main heating environmental impact  $0.519 \times (1 + 0.29 \times 0.75) / 3.2474 = 0.1946$ , 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  
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1913 (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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.1802		(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)							11.7489 (36)
Total fabric heat loss							(33) + (36) = 66.9291 (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	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771 (38)
Average = Sum(39)m / 12 =	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)
HLP	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101 (40)
HLP (average)												1.1101 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)												Total = Sum(45)m = 1551.5378 (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:	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (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												
	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (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												
	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628 (64)
Heat gains from water heating, kWh/month												
	99.1481	88.0224	93.9340	86.2737	86.0433	79.0350	77.9519	82.7151	81.6847	89.3596	91.8884	97.4605 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.6558	52.9858	43.0909	32.6226	24.3858	20.5875	22.2455	28.9156	38.8104	49.2787	57.5156	61.3138 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	375.7016	379.6002	369.7758	348.8609	322.4596	297.6461	281.0692	277.1705	286.9949	307.9098	334.3111	359.1246 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843 (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)												
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)												
	133.2636	130.9857	126.2554	119.8246	115.6495	109.7708	104.7740	111.1762	113.4510	120.1070	127.6228	130.9952 (72)
Total internal gains	676.8464	671.7970	647.3475	609.5335	570.7203	536.2297	516.3140	525.4877	547.4816	585.5209	627.6748	659.6591 (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			5.5500	11.3201	0.7200		0.7000	0.7700	21.9436 (74)			
South			5.3000	49.0238	0.7200		0.7000	0.7700	90.7500 (78)			
South			3.3300	49.0238	0.7200		0.7000	0.7700	57.0184 (78)			
Solar gains	169.7120	288.0896	386.2861	481.8335	508.6188	547.1730	507.8648	473.8776	429.5875	323.9067	227.5936	161.3976 (83)
Total gains	846.5584	959.8866	1033.6336	1091.3670	1079.3391	1083.4027	1024.1788	999.3653	977.0692	909.4276	855.2685	821.0567 (84)

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

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217
alpha	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
util living area	0.9246	0.8975	0.8546	0.7862	0.6963	0.5388	0.4296	0.4467	0.6286	0.8017	0.8900	0.9301 (86)
Tweekday	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
Tweekend	20.4980	20.5379	20.6030	20.6734	20.7323	20.7793	20.7945	20.7932	20.7625	20.6833	20.5825	20.4889
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	20.2252	20.2853	20.3873	20.4900	20.5869	20.6610	20.6828	20.6808	20.6291	20.5112	20.3480	20.2113 (87)
Th 2	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house	0.9146	0.8844	0.8354	0.7569	0.6514	0.4700	0.3423	0.3592	0.5664	0.7691	0.8736	0.9207 (89)
Tweekday	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
Tweekend	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036
MIT 2	18.9235	19.0113	19.1538	19.3050	19.4273	19.5158	19.5402	19.5385	19.4871	19.3290	19.1112	18.9036 (90)
Living area fraction									fLA = Living area / (4) =			0.2037 (91)
MIT	19.1887	19.2708	19.4051	19.5464	19.6635	19.7491	19.7729	19.7712	19.7197	19.5698	19.3631	19.1700 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1887	19.2708	19.4051	19.5464	19.6635	19.7491	19.7729	19.7712	19.7197	19.5698	19.3631	19.1700 (93)

#### 8. Space heating requirement

Utilisation	0.9054	0.8736	0.8228	0.7424	0.6352	0.4520	0.3221	0.3387	0.5478	0.7535	0.8617	0.9118 (94)
Useful gains	766.4436	838.5609	850.4230	810.2540	685.6433	489.7137	329.9050	338.4523	535.2680	685.2535	737.0163	748.6407 (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	1606.5811	1561.4881	1381.7448	1138.0202	848.5188	534.0390	342.3784	352.9821	617.1950	978.6907	1323.2694	1615.3574 (97)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	625.0623	485.8071	395.3034	235.9917	121.1794	0.0000	0.0000	0.0000	0.0000	218.3173	422.1023	644.8372	(98)
Space heating													3148.6006 (98)
Space heating per m2													(98) / (4) = 32.3930 (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 %)													324.7350 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													969.5908 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	625.0623	485.8071	395.3034	235.9917	121.1794	0.0000	0.0000	0.0000	0.0000	218.3173	422.1023	644.8372	(98)
Space heating efficiency (main heating system 1)	324.7350	324.7350	324.7350	324.7350	324.7350	0.0000	0.0000	0.0000	0.0000	324.7350	324.7350	324.7350	(210)
Space heating fuel (main heating system)	192.4838	149.6011	121.7311	72.6721	37.3164	0.0000	0.0000	0.0000	0.0000	67.2294	129.9836	198.5734	(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	217.9385	192.2439	202.2570	181.8073	178.5253	160.0365	154.1903	168.5159	168.0056	188.4993	198.6935	212.8628	(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	109.2752	96.3918	101.4124	91.1589	89.5133	80.2429	77.3116	84.4945	84.2387	94.5143	99.6257	106.7302	(219)
Water heating fuel used													1114.9096 (219)
Annual totals kWh/year													
Space heating fuel - main system													969.5908 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.8875, total flow = 29.0000, SFP = 0.1685) mechanical ventilation fans (SFP = 0.1685)													51.0629 (230a)
Total electricity for the above, kWh/year													51.0629 (231)
Electricity for lighting (calculated in Appendix L)													421.4162 (232)
Total delivered energy for all uses													2556.9795 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	969.5908	20.4300	198.0874 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1114.9096	20.4300	227.7760 (247)
Mechanical ventilation fans	51.0629	20.4300	10.4322 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	421.4162	20.4300	86.0953 (250)
Additional standing charges			0.0000 (251)
Total energy cost			522.3909 (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	969.5908	0.5190	503.2176 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1114.9096	0.5190	578.6381 (264)
Space and water heating			1081.8557 (265)
Pumps and fans	51.0629	0.5190	26.5017 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Total kg/year			1327.0724 (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	969.5908	3.0700	2976.6436 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1114.9096	3.0700	3422.7726 (264)
Space and water heating			6399.4162 (265)
Pumps and fans	51.0629	3.0700	156.7632 (267)
Energy for lighting	421.4162	3.0700	1293.7477 (268)
Primary energy kWh/year			7849.9271 (272)
Primary energy kWh/m2/year			80.7606 (273)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86  
 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	+ 2.3	-£ 88	-223 kg (16.8%)
U Solar photovoltaic panels	+ 9.4	-£ 388	-985 kg (89.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£88	2.30 kg/m <sup>2</sup>	B 88 B 89
Solar photovoltaic panels	£388	10.13 kg/m <sup>2</sup>	A 98 A 98
<b>Total Savings</b>	<b>£475</b>	<b>12.43 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	£522	£434	£88
Space heating	£209	£209	-£0
Water heating	£228	£140	£88
Lighting	£86	£86	£0
Generated (PV)	-£0	-£388	£388
<b>Total cost of fuels</b>	<b>£522</b>	<b>£46</b>	<b>£476</b>
<b>Total cost of uses</b>	<b>£523</b>	<b>£47</b>	<b>£476</b>
Delivered energy	26 kWh/m <sup>2</sup>	2 kWh/m <sup>2</sup>	24 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.3 tonnes	0.1 tonnes	1.2 tonnes
CO2 emissions per m <sup>2</sup>	14 kg/m <sup>2</sup>	1 kg/m <sup>2</sup>	12 kg/m <sup>2</sup>
Primary energy	81 kWh/m <sup>2</sup>	7 kWh/m <sup>2</sup>	74 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	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1913 (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	0.2438	0.2391	0.2343	0.2104	0.2056	0.1817	0.1817	0.1769	0.1913	0.2056	0.2152	0.2247 (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)			10.8500	1.3258	14.3845		(27)
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
external door			2.1600	1.2000	2.5920		(26)
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)
CEILING	48.6000		48.6000	0.1400	6.8040		(30)
Total net area of external elements Aum(A, m2)			195.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.1802		(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) 11.7489 (36)  
 Total fabric heat loss (33) + (36) = 66.9291 (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	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771	40.9771 (38)
Average = Sum(39)m / 12 =	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101	1.1101 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7120 (42)  
 Average daily hot water use (litres/day) 98.6112 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy content (annual)	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1551.5378 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Water storage loss:	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (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	217.9385	192.2439	200.8612	175.0537	165.7310	147.4298	141.1633	156.4194	162.6027	187.1036	198.6935	212.8628 (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												1.1689 (H8)
Utilisation factor												0.5749 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6112 (H14)
Volume ratio Veff/V												0.7606 (H15)
Solar storage volume factor												0.9453 (H16)
Solar input												-866.6467 (H17)
Solar input	-25.1310	-41.9365	-71.4226	-95.7204	-118.2544	-116.2629	-114.7265	-100.2371	-78.5058	-53.6102	-29.8090	-21.0304 (63)
Solar input (sum of months) = Sum(63)m =												-866.6467 (63)
Output from w/h	192.8074	150.3074	129.4386	79.3333	47.4766	31.1668	26.4369	56.1823	84.0970	133.4934	168.8845	191.8324 (64)
Total per year (kWh/year) = Sum(64)m =												1291.4566 (64)
Heat gains from water heating, kWh/month	99.1481	88.0224	92.8174	80.8709	75.8078	68.9496	67.5303	73.0380	77.3624	88.2430	91.8884	97.4605 (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	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6558	52.9858	43.0909	32.6226	24.3858	20.5875	22.2455	28.9156	38.8104	49.2787	57.5156	61.3138 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.7016	379.6002	369.7758	348.8609	322.4596	297.6461	281.0692	277.1705	286.9949	307.9098	334.3111	359.1246 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843 (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)	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)	133.2636	130.9857	124.7546	112.3206	101.8922	95.7633	90.7665	98.1693	107.4478	118.6062	127.6228	130.9952 (72)
Total internal gains	676.8464	671.7970	645.8467	602.0295	556.9629	522.2223	502.3065	512.4808	541.4784	584.0201	627.6748	659.6591 (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	5.5500	10.6334	0.7200	0.7000	0.7700	20.6124 (74)						
South	5.3000	46.7521	0.7200	0.7000	0.7700	86.5447 (78)						
South	3.3300	46.7521	0.7200	0.7000	0.7700	54.3762 (78)						
Solar gains	161.5333	270.1835	360.9237	439.7861	491.0798	488.2635	470.3289	431.0216	387.5836	295.8212	192.4674	138.9521 (83)
Total gains	838.3797	941.9805	1006.7705	1041.8156	1048.0427	1010.4858	972.6355	943.5023	929.0620	879.8413	820.1422	798.6112 (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, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217
alpha	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
util living area	0.9261	0.9000	0.8628	0.8035	0.7114	0.5793	0.4484	0.4765	0.6429	0.8089	0.8984	0.9339 (86)
Tweekday	18.9194	19.0095	19.1374	19.2854	19.4176	19.5062	19.5389	19.5356	19.4844	19.3253	19.0955	18.8919
Tweekend	20.4961	20.5370	20.5953	20.6638	20.7273	20.7733	20.7933	20.7909	20.7606	20.6813	20.5751	20.4836
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	20.2222	20.2839	20.3755	20.4751	20.5791	20.6518	20.6811	20.6772	20.6262	20.5082	20.3366	20.2030 (87)
Th 2	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house	0.9163	0.8870	0.8445	0.7757	0.6677	0.5113	0.3586	0.3874	0.5799	0.7766	0.8829	0.9250 (89)
Tweekday	18.9194	19.0095	19.1374	19.2854	19.4176	19.5062	19.5389	19.5356	19.4844	19.3253	19.0955	18.8919

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Tweekend	18.9194	19.0095	19.1374	19.2854	19.4176	19.5062	19.5389	19.5356	19.4844	19.3253	19.0955	18.8919
MIT 2	18.9194	19.0095	19.1374	19.2854	19.4176	19.5062	19.5389	19.5356	19.4844	19.3253	19.0955	18.8919 (90)
Living area fraction									fLA = Living area / (4) =			0.2037 (91)
MIT	19.1848	19.2691	19.3896	19.5277	19.6542	19.7396	19.7716	19.7682	19.7170	19.5663	19.3483	19.1590 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1848	19.2691	19.3896	19.5277	19.6542	19.7396	19.7716	19.7682	19.7170	19.5663	19.3483	19.1590 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9071	0.8763	0.8321	0.7613	0.6514	0.4927	0.3375	0.3661	0.5607	0.7609	0.8714	0.9164 (94)
Useful gains	760.4827	825.4397	837.7279	793.1318	682.7014	497.8270	328.2620	345.3711	520.9177	669.5150	714.7011	731.8372 (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	1606.1578	1550.5147	1390.8654	1146.7982	858.3095	554.5911	342.2310	363.4465	606.1111	967.5181	1321.6674	1614.1660 (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	629.1823	487.2504	411.5343	254.6398	130.6524	0.0000	0.0000	0.0000	0.0000	221.7143	437.0157	656.4527 (98)
Space heating per m2												328.4420 (98)
												(98) / (4) = 33.2144 (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 %)												324.7350 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												994.1774 (211)
Space heating requirement	629.1823	487.2504	411.5343	254.6398	130.6524	0.0000	0.0000	0.0000	0.0000	221.7143	437.0157	656.4527 (98)
Space heating efficiency (main heating system 1)	324.7350	324.7350	324.7350	324.7350	324.7350	0.0000	0.0000	0.0000	0.0000	324.7350	324.7350	324.7350 (210)
Space heating fuel (main heating system)	193.7525	150.0456	126.7293	78.4147	40.2336	0.0000	0.0000	0.0000	0.0000	68.2755	134.5761	202.1503 (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	192.8074	150.3074	129.4386	79.3333	47.4766	31.1668	26.4369	56.1823	84.0970	133.4934	168.8845	191.8324 (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	96.6744	75.3647	64.9010	39.7780	23.8049	15.6272	13.2555	28.1700	42.1666	66.9341	84.6793	96.1855 (219)
Water heating fuel used												647.5414 (219)
Annual totals kWh/year												
Space heating fuel - main system												994.1774 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.8875, total flow = 29.0000, SFP = 0.1685)												
mechanical ventilation fans (SFP = 0.1685)												51.0629 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												101.0629 (231)
Electricity for lighting (calculated in Appendix L)												421.4162 (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												436.9585 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	994.1774	13.1900	131.1320 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	647.5414	13.1900	85.4107 (247)
Mechanical ventilation fans	51.0629	13.1900	6.7352 (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	421.4162	13.1900	55.5848 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit		-1727.2394	-227.8229 (252)
Total energy cost			57.6348 (255)

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

Energy cost deflator (Table 12):	0.4200 (256)
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# FULL SAP CALCULATION PRINTOUT

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

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.1702 (257)  
 SAP value 97.6253  
 SAP rating (Section 12) 98 (258)  
 SAP band A

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	994.1774	0.5190	515.9781 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	647.5414	0.5190	336.0740 (264)
Space and water heating			852.0521 (265)
Pumps and fans	101.0629	0.5190	52.4517 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			226.7815 (272)
CO2 emissions per m2			2.3300 (273)
EI value			97.8630
EI rating			98 (274)
EI band			A

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	48.6000 (1b)	2.4600 (2b)	119.5560 (1b) - (3b)
First floor	48.6000 (1c)	2.6500 (2c)	128.7900 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 248.3460 (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					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1913 (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	0.2152	0.2152	0.2104	0.1865	0.1817	0.1626	0.1578	0.1578	0.1673	0.1817	0.1865	0.1960 (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)			10.8500	1.3258	14.3845		(27)					
FRENCH DOOR (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
external door			2.1600	1.2000	2.5920		(26)					
Heat Loss Floor 1			42.3000	0.1600	6.7680		(28a)					
BRICK TF	104.2400	16.3400	87.9000	0.2300	20.2170		(29a)					
CEILING	48.6000		48.6000	0.1400	6.8040		(30)					
Total net area of external elements Aum(A, m2)			195.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 55.1802		(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)							11.7489 (36)					
Total fabric heat loss							(33) + (36) = 66.9291 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.9771	Feb 40.9771	Mar 40.9771	Apr 40.9771	May 40.9771	Jun 40.9771	Jul 40.9771	Aug 40.9771	Sep 40.9771	Oct 40.9771	Nov 40.9771	Dec 40.9771 (38)
Heat transfer coeff	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062	107.9062 (39)
Average = Sum(39)m / 12 =												107.9062 (39)
HLP	Jan 1.1101	Feb 1.1101	Mar 1.1101	Apr 1.1101	May 1.1101	Jun 1.1101	Jul 1.1101	Aug 1.1101	Sep 1.1101	Oct 1.1101	Nov 1.1101	Dec 1.1101 (40)
HLP (average)												1.1101 (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												2.7120 (42)
Average daily hot water use (litres/day)												98.6112 (43)
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723 (44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856 (45)
Energy content (annual)												Total = Sum(45)m = 1551.5378 (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

	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678 (46)
Water storage loss:												
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												
217.9385	192.2439	200.8612	175.0537	165.7310	147.4298	141.1633	156.4194	162.6027	187.1036	198.6935	212.8628 (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												1.2838 (H8)
Utilisation factor												0.5411 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6112 (H14)
Volume ratio Veff/V												0.7606 (H15)
Solar storage volume factor												0.9453 (H16)
Solar input												-895.8389 (H17)
Solar input	-25.1244	-42.5774	-72.7447	-99.5164	-115.8599	-123.0731	-117.0927	-104.4369	-82.7315	-55.8942	-33.5504	-23.2373 (63)
Solar input (sum of months) = Sum(63)m =												-895.8389 (63)
Output from w/h												
192.8140	149.6665	128.1166	75.5372	49.8711	24.3567	24.0707		51.9825	79.8713	131.2093	165.1431	189.6255 (64)
Total per year (kWh/year) = Sum(64)m =												1262.2645 (64)
Heat gains from water heating, kWh/month												
99.1481	88.0224	92.8174	80.8709	75.8078	68.9496	67.5303	73.0380	77.3624	88.2430	91.8884	97.4605 (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	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230	162.7230 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	59.6558	52.9858	43.0909	32.6226	24.3858	20.5875	22.2455	28.9156	38.8104	49.2787	57.5156	61.3138 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	375.7016	379.6002	369.7758	348.8609	322.4596	297.6461	281.0692	277.1705	286.9949	307.9098	334.3111	359.1246 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843	53.9843 (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)												
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820 (71)
Water heating gains (Table 5)												
	133.2636	130.9857	124.7546	112.3206	101.8922	95.7633	90.7665	98.1693	107.4478	118.6062	127.6228	130.9952 (72)
Total internal gains	676.8464	671.7970	645.8467	602.0295	556.9629	522.2223	502.3065	512.4808	541.4784	584.0201	627.6748	659.6591 (73)

#### 6. Solar gains

[Jan]		Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		5.5500	11.3201	0.7200	0.7000	0.7700	21.9436 (74)					
South		5.3000	49.0238	0.7200	0.7000	0.7700	90.7500 (78)					
South		3.3300	49.0238	0.7200	0.7000	0.7700	57.0184 (78)					
Solar gains	169.7120	288.0896	386.2861	481.8335	508.6188	547.1730	507.8648	473.8776	429.5875	323.9067	227.5936	161.3976 (83)
Total gains	846.5584	959.8866	1032.1328	1083.8630	1065.5818	1069.3952	1010.1714	986.3583	971.0660	907.9268	855.2685	821.0567 (84)

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

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217	25.0217
alpha	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681	2.6681
util living area	0.9246	0.8975	0.8549	0.7885	0.7011	0.5440	0.4346	0.4515	0.6310	0.8022	0.8900	0.9301 (86)
Tweekday	18.9235	19.0113	19.1532	19.3029	19.4248	19.5149	19.5398	19.5381	19.4864	19.3286	19.1112	18.9036
Tweekend	20.4980	20.5379	20.6027	20.6724	20.7310	20.7787	20.7942	20.7929	20.7620	20.6831	20.5825	20.4889
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	20.2252	20.2853	20.3869	20.4884	20.5848	20.6601	20.6824	20.6803	20.6284	20.5109	20.3480	20.2113 (87)
Th 2	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926	19.9926 (88)
util rest of house												
	0.9146	0.8844	0.8358	0.7593	0.6565	0.4749	0.3466	0.3634	0.5689	0.7696	0.8736	0.9207 (89)
Tweekday	18.9235	19.0113	19.1532	19.3029	19.4248	19.5149	19.5398	19.5381	19.4864	19.3286	19.1112	18.9036

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Tweekend	18.9235	19.0113	19.1532	19.3029	19.4248	19.5149	19.5398	19.5381	19.4864	19.3286	19.1112	18.9036
MIT 2	18.9235	19.0113	19.1532	19.3029	19.4248	19.5149	19.5398	19.5381	19.4864	19.3286	19.1112	18.9036 (90)
Living area fraction									fLA = Living area / (4) =			0.2037 (91)
MIT	19.1887	19.2708	19.4045	19.5444	19.6611	19.7482	19.7726	19.7708	19.7191	19.5694	19.3631	19.1700 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1887	19.2708	19.4045	19.5444	19.6611	19.7482	19.7726	19.7708	19.7191	19.5694	19.3631	19.1700 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9054	0.8736	0.8232	0.7448	0.6402	0.4568	0.3262	0.3427	0.5502	0.7541	0.8617	0.9118 (94)
Useful gains	766.4436	838.5609	849.6084	807.2570	682.1941	488.4797	329.4827	337.9919	534.3155	684.6289	737.0163	748.6407 (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	1606.5811	1561.4881	1381.6862	1137.8021	848.2630	533.9414	342.3405	352.9413	617.1216	978.6451	1323.2694	1615.3574 (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	625.0623	485.8071	395.8658	237.9924	123.5553	0.0000	0.0000	0.0000	0.0000	218.7480	422.1023	644.8372 (98)
Space heating per m2												3153.9705 (98)
												(98) / (4) = 32.4483 (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 %)												324.7350 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												971.2444 (211)
Space heating requirement	625.0623	485.8071	395.8658	237.9924	123.5553	0.0000	0.0000	0.0000	0.0000	218.7480	422.1023	644.8372 (98)
Space heating efficiency (main heating system 1)	324.7350	324.7350	324.7350	324.7350	324.7350	0.0000	0.0000	0.0000	0.0000	324.7350	324.7350	324.7350 (210)
Space heating fuel (main heating system)	192.4838	149.6011	121.9043	73.2882	38.0480	0.0000	0.0000	0.0000	0.0000	67.3620	129.9836	198.5734 (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	192.8140	149.6665	128.1166	75.5372	49.8711	24.3567	24.0707	51.9825	79.8713	131.2093	165.1431	189.6255 (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	96.6777	75.0434	64.2382	37.8747	25.0055	12.2125	12.0691	26.0642	40.0478	65.7889	82.8034	95.0790 (219)
Water heating fuel used												632.9044 (219)
Annual totals kWh/year												
Space heating fuel - main system												971.2444 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.8875, total flow = 29.0000, SFP = 0.1685)												
mechanical ventilation fans (SFP = 0.1685)												51.0629 (230a)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												101.0629 (231)
Electricity for lighting (calculated in Appendix L)												421.4162 (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												229.5904 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	971.2444	20.4300	198.4252 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	632.9044	20.4300	129.3024 (247)
Mechanical ventilation fans	51.0629	20.4300	10.4322 (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	421.4162	20.4300	86.0953 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1897.0374	20.4300	-387.5647 (252)
Total energy cost			46.9053 (255)

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

Energy Emission factor Emissions

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	971.2444	0.5190	504.0758 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	632.9044	0.5190	328.4774 (264)
Space and water heating			832.5532 (265)
Pumps and fans	101.0629	0.5190	52.4517 (267)
Energy for lighting	421.4162	0.5190	218.7150 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	0.5190	-984.5624 (269)
Total kg/year			119.1574 (272)

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 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	971.2444	3.0700	2981.7202 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	632.9044	3.0700	1943.0164 (264)
Space and water heating			4924.7367 (265)
Pumps and fans	101.0629	3.0700	310.2632 (267)
Energy for lighting	421.4162	3.0700	1293.7477 (268)
Energy saving/generation technologies			
PV Unit	-1897.0374	3.0700	-5823.9049 (269)
Primary energy kWh/year			704.8427 (272)
Primary energy kWh/m2/year			7.2515 (273)

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	HOUSE TYPE B1	<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>	86 B	<b>DER</b>	14.82	<b>TER</b>	24.32
<b>Environmental</b>	87 B	<b>% DER&lt;TER</b>	39.06		
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.33	<b>DFEE</b>	43.69	<b>TFEE</b>	48.28
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	9.50		

<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
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<b>Client</b>	
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### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

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

##### 1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	24.32	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	14.82	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-9.50 (-39.1%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.28	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.69	kWh/m <sup>2</sup> /yr	
	-4.6 (-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	1.37 (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	
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	5.55 m <sup>2</sup> , No overhang	
Windows facing South	8.63 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
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This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Property Reference	HOUSE TYPE B1	Issued on Date	09/11/2022
Assessment Reference	GRANT ASHP	Prop Type Ref	
Property			

SAP Rating	86 B	DER	14.82	TER	24.32
Environmental	87 B	% DER<TER	39.06		
CO <sub>2</sub> Emissions (t/year)	1.33	DFEE	43.69	TFEE	48.28
General Requirements Compliance	Pass	% DFEE<TFEE	9.50		

Assessor Details	Mr. Neil Jones, S J Roberts Construction Limited, Tel: 01743 891858, neil.jones@sjroberts.com	Assessor ID	K559-0001
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Client	
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### 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	2
5.0 Sunlight/Shade	Average or unknown

#### 6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.40 m	48.60 m <sup>2</sup>	2.46 m
1st Storey:	20.40 m	48.60 m <sup>2</sup>	2.65 m

7.0 Living Area	19.80	m <sup>2</sup>
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m <sup>2</sup> K

#### 9.0 External Walls

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	104.24	87.90

#### 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	48.60	48.60

#### 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	Manufacture	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
FRENCH DOOR	Manufacture	Window	Double Low-E Hard	0.15		0.72		0.70	1.40
external door	Manufacture	Solid Door							1.20
REAR DOOR	Manufacture	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 WINDOW	Window	[1] BRICK TF	North	None	0.00					5.55	
REAR WINDOW	Window	[1] BRICK TF	South	None	0.00					5.30	
FRONT DOOR	Solid Door	[1] BRICK TF	North							2.16	
FRENCH DOOR	Window	[1] BRICK TF	South	None	0.00					3.33	

### 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)	12.02	0.141	Yes	TRADA
Independently assessed	E3 Sill	8.38	0.027	No	TRADA
Independently assessed	E4 Jamb	24.32	0.038	Yes	TRADA
Independently assessed	E5 Ground floor (normal)	20.40	0.131	Yes	TRADA
Independently assessed	E6 Intermediate floor within a dwelling	20.40	0.094	Yes	TRADA
Independently assessed	E10 Eaves (insulation at ceiling level)	8.33	0.060	No	TRADA
Independently assessed	E12 Gable (insulation at ceiling level)	10.21	0.062	No	TRADA
Independently assessed	E16 Corner (normal)	15.33	0.058	No	TRADA
Independently assessed	E18 Party wall between dwellings	10.22	0.034	Yes	TRADA
Independently assessed	P1 Party wall - Ground floor	8.33	0.119	No	TRADA
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.33	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.33	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

Air change rate

#### Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation



# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500275
Duct Type	Rigid

### 19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.13	Through Wall Fan Kitchen	1
0.16	Through Wall Fan Other Wet Room	2

### 20.0 Fans, Open Fireplaces, Flues

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

### 21.0 Fixed Cooling System

No

### 22.0 Lighting

#### Internal

Total number of light fittings	25	
Total number of L.E.L. fittings	25	
Percentage of L.E.L. fittings	100.00	%

#### External

External lights fitted	Yes
Light and motion sensor	Yes

### 23.0 Electricity Tariff

Standard

### 24.0 Main Heating 1

Description	Database	
ASHP		
Percentage of Heat	100	%
Database Ref. No.	103763	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	341.8	
In Summer	332.4	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in Concrete	
Flow Temperature	36° - 45°C	

### 25.0 Main Heating 2

None

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

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	L
Loss	2.02	kWh/day
Pipes insulation	Fully insulated primary pipework	
<b>31.0 Thermal Store</b>	None	

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