



elmhurst  
energy



## SAP Report Submission for Building Regulations Compliance

Client: Adiuvo

Project: 116, High Street  
Billingshurst, RH14 9QX

Contact: Jostec  
01923 518 923  
carlos@jostec.co.uk

Report Issue Date: 17/02/2022

EXCELLENCE  
IN ENERGY  
ASSESSMENT

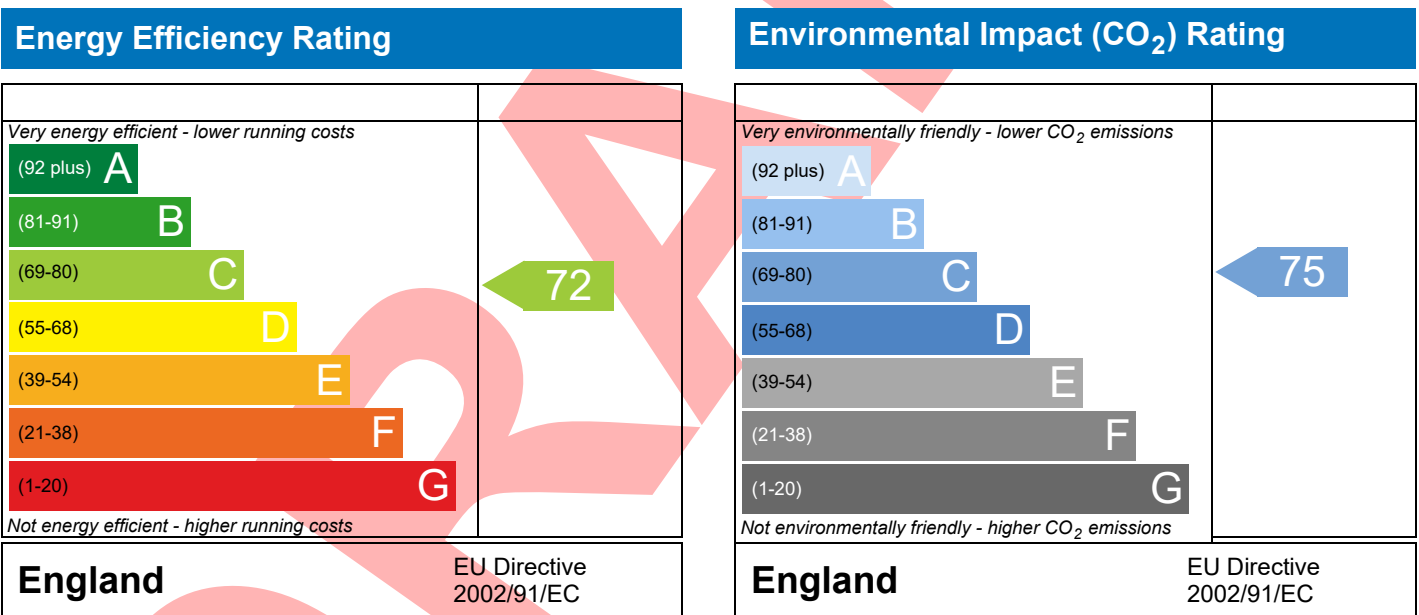
# PREDICTED ENERGY ASSESSMENT

116, High Street,  
Billingshurst,  
RH14 9QX

Dwelling type: House, Detached  
Date of assessment: 17/02/2022  
Produced by: Carlos Val  
Total floor area: 96.57 m<sup>2</sup>

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

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



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

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

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# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

Property Reference	22038		Issued on Date	17/02/2022	
Assessment Reference	As design	Prop Type Ref			
Property	116, High Street, Billingshurst, RH14 9QX				
SAP Rating	72 C	DER	31.63	TER	31.91
Environmental	75 C	% DER<TER	0.89		
CO <sub>2</sub> Emissions (t/year)	2.07	DFEE	68.20	TFEE	74.37
General Requirements Compliance	Pass	% DFEE<TFEE	8.29		
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com			Assessor ID	H664-0001
Client	Adiuvo, 22038				

### 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)	31.91	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	31.63	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-0.28 (-0.9%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	74.37	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	68.20	kWh/m <sup>2</sup> /yr	
	-6.2 (-8.3%)	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	0.20 (max. 0.30)	0.26 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

Air permeability at 50 pascals	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

Main heating system	Boiler system with radiators or underfloor - Electric Direct-acting boiler	
Secondary heating system	None	

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# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

### 5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.42 kWh/day Permitted by DBSCG 2.30	Pass
Primary pipework insulated	No primary pipework	

### 6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass

### 7 Low energy lights

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

### 8 Mechanical ventilation

Not applicable

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

### 9 Summertime temperature

Overheating risk (South East England)	Medium	Pass
Based on:		
Overshading	Average	
Windows facing North	5.73 m <sup>2</sup> , No overhang	
Windows facing East	9.15 m <sup>2</sup> , No overhang	
Windows facing South	8.48 m <sup>2</sup> , No overhang	
Windows facing West	5.55 m <sup>2</sup> , No overhang	
Air change rate	4.00 ach	
Blinds/curtains	None	

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

### 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

Roof U-value	0.00	W/m <sup>2</sup> K
Photovoltaic array	3.00	kW

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# RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£185	C 77	C 79	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
<b>Totals</b>	<b>£4,000 - £6,000</b>	<b>£185</b>	<b>C 77</b>	<b>C 79</b>	

DRAFT

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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Property	116, High Street, Billingshurst, RH14 9QX				
SAP Rating	72 C	DER	31.63	TER	31.91
Environmental	75 C	% DER<TER	0.89		
CO <sub>2</sub> Emissions (t/year)	2.07	DFEE	68.20	TFEE	74.37
General Requirements Compliance	Pass	% DFEE<TFEE	8.29		
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com			Assessor ID	H664-0001
Client	Aduvo, 22038				

# 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

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) 31.91 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 31.63 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 74.4 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 68.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.26 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

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

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Electric  
Direct-acting boiler

Secondary heating system: None

#### 5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.42 kWh/day  
Permitted by DBSCG 2.30 OK  
Primary pipework insulated: No primary pipework

#### 6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

#### 7 Low energy lights

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

#### 8 Mechanical ventilation

Not applicable

#### 9 Summertime temperature

Overheating risk (South East England): Medium OK

Based on:

Overshading: Average  
Windows facing North: 5.73 m<sup>2</sup>, No overhang  
Windows facing East: 9.15 m<sup>2</sup>, No overhang  
Windows facing South: 8.48 m<sup>2</sup>, No overhang  
Windows facing West: 5.55 m<sup>2</sup>, No overhang  
Air change rate: 4.00 ach  
Blinds/curtains: None

#### 10 Key features

Roof U-value 0.00 W/m<sup>2</sup>K  
Photovoltaic array 3.00 kW

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)							
Pressure test				Yes								
Measured/design AP50				4.5000								
Infiltration rate				0.4366 (18)								
Number of sides sheltered				0 (19)								
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (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	0.5567	0.5458	0.5349	0.4803	0.4694	0.4148	0.4148	0.4039	0.4366	0.4694	0.4912	0.5130 (22b)
Effective ac	0.6550	0.6489	0.6430	0.6153	0.6102	0.5860	0.5860	0.5816	0.5953	0.6102	0.6206	0.6316 (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					
Entrance door			2.2000	1.4000	3.0800		(26)					
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)					
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)					
Ground floor			33.7100	0.1300	4.3823		(28a)					
Exposed floor			11.3300	0.1900	2.1527		(28b)					
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)					
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)					
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)					
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)					
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)					
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)					
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)					
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)					
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)					
Total net area of external elements Aum(A, m2)			281.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)					
Total fabric heat loss							(33) + (36) = 115.4553 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.0665	Feb 50.5973	Mar 50.1375	Apr 47.9776	May 47.5735	Jun 45.6922	Jul 45.6922	Aug 45.3439	Sep 46.4169	Oct 47.5735	Nov 48.3910	Dec 49.2457 (38)
Heat transfer coeff	166.5218	166.0527	165.5928	163.4329	163.0288	161.1476	161.1476	160.7992	161.8722	163.0288	163.8463	164.7010 (39)
Average = Sum(39)m / 12 =												163.4310 (39)
HLP	Jan 1.7244	Feb 1.7195	Mar 1.7147	Apr 1.6924	May 1.6882	Jun 1.6687	Jul 1.6687	Aug 1.6651	Sep 1.6762	Oct 1.6882	Nov 1.6967	Dec 1.7055 (40)
HLP (average)												1.6924 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1549.0618 (45)
Water storage loss:	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120 (56)
If cylinder contains dedicated solar storage												
26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (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)
Output from w/h												
187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490	1860.0418 (64)
Heat gains from water heating, kWh/month												
74.5306	65.7897	69.3248	62.4658	61.4467	55.2386	53.3682	58.1238	57.8841	64.7577	68.0715	72.8456	72.8456 (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	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3466	19.8480	16.1415	12.2201	9.1347	7.7119	8.3330	10.8315	14.5381	18.4594	21.5448	22.9676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.6604	253.2615	246.7069	232.7529	215.1385	198.5834	187.5236	184.9225	191.4772	205.4312	223.0456	239.6006 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)	100.1756	97.9013	93.1786	86.7580	82.5896	76.7202	71.7314	78.1234	80.3945	87.0399	94.5438	97.9108 (72)
Total internal gains	439.7639	437.5922	422.6083	398.3124	373.4441	349.5969	334.1694	340.4589	352.9911	377.5118	405.7155	427.0604 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	5.7300	10.6334	0.6300	0.7000	0.7700	18.6208 (74)						
East	9.1500	19.6403	0.6300	0.7000	0.7700	54.9212 (76)						
South	8.4800	46.7521	0.6300	0.7000	0.7700	121.1626 (78)						
West	5.5500	19.6403	0.6300	0.7000	0.7700	33.3129 (80)						
North	4.2000	15.2954	0.6300	0.7000	1.0000	25.4972 (82)						
Solar gains	253.5146	454.0964	681.2372	945.7943	1153.1216	1186.2670	1126.4061	965.2262	771.7434	517.9550	307.6883	214.3541 (83)
Total gains	693.2786	891.6886	1103.8455	1344.1067	1526.5658	1535.8639	1460.5755	1305.6850	1124.7345	895.4668	713.4039	641.4146 (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)												
tau	40.2725	40.3863	40.4984	41.0337	41.1354	41.6156	41.6156	41.7057	41.4293	41.1354	40.9301	40.7177
alpha	3.6848	3.6924	3.6999	3.7356	3.7424	3.7744	3.7744	3.7804	3.7620	3.7424	3.7287	3.7145
util living area	0.9955	0.9884	0.9687	0.9098	0.7864	0.6138	0.4686	0.5358	0.7872	0.9545	0.9909	0.9966 (86)
MIT	19.5461	19.7425	20.0462	20.4267	20.7181	20.8694	20.9120	20.9018	20.7741	20.3693	19.8857	19.5179 (87)
Th 2	19.5234	19.5269	19.5303	19.5463	19.5493	19.5633	19.5633	19.5659	19.5579	19.5493	19.5432	19.5369 (88)
util rest of house	0.9939	0.9842	0.9573	0.8770	0.7147	0.4985	0.3237	0.3831	0.6861	0.9310	0.9870	0.9954 (89)
MIT 2	17.6308	17.9183	18.3568	18.8948	19.2600	19.4251	19.4538	19.4525	19.3437	18.8352	18.1404	17.5992 (90)
Living area fraction												
MIT	18.6528	18.8917	19.2583	19.7122	20.0381	20.1958	20.2319	20.2259	20.1070	19.6538	19.0717	18.6230 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5028	18.7417	19.1083	19.5622	19.8881	20.0458	20.0819	20.0759	19.9570	19.5038	18.9217	18.4730 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	687.9348	874.9496	1052.0373	1179.4191	1119.3933	828.7059	551.6642	574.5326	807.4439	832.8651	702.4319	637.6609 (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	2365.0782	2298.4551	2087.8396	1742.5623	1334.8908	877.5723	561.1017	591.0760	948.0794	1451.5775	1936.9429	2350.7840 (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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Space heating kWh	1247.7947	956.5957	770.6369	405.4631	160.3301	0.0000	0.0000	0.0000	0.0000	460.3220	888.8479	1274.5635 (98)
Space heating												6164.5539 (98)
Space heating per m2												(98) / (4) = 63.8351 (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 %)												100.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6164.5539 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1247.7947	956.5957	770.6369	405.4631	160.3301	0.0000	0.0000	0.0000	0.0000	460.3220	888.8479	1274.5635 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	1247.7947	956.5957	770.6369	405.4631	160.3301	0.0000	0.0000	0.0000	0.0000	460.3220	888.8479	1274.5635 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (219)
Water heating fuel used												1860.0418 (219)
Annual totals kWh/year												
Space heating fuel - main system												6164.5539 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												30.0000 (231)
Electricity for lighting (calculated in Appendix L)												394.6473 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 3.00 * 1068 * 1.00) =										-2563.3692		-2563.3692 (233)
Total delivered energy for all uses												5885.8739 (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	6164.5539	0.5190	3199.4035 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1860.0418	0.5190	965.3617 (264)
Space and water heating			4164.7652 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	394.6473	0.5190	204.8219 (268)
Energy saving/generation technologies			
PV Unit	-2563.3692	0.5190	-1330.3886 (269)
Total CO2, kg/year			3054.7685 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			31.6300 (273)

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

DER			31.6300 ZC1
Total Floor Area		TFA	96.5700
Assumed number of occupants		N	2.7054
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.3812 ZC2
CO2 emissions from cooking, equation (L16)			1.9046 ZC3
Total CO2 emissions			48.9158 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			48.9158 ZC8

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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) =	0.1270 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3770 (18)							
Number of sides sheltered					0 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3770 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4806	0.4712	0.4618	0.4147	0.4052	0.3581	0.3581	0.3487	0.3770	0.4052	0.4241	0.4429 (22b)
	0.6155	0.6110	0.6066	0.5860	0.5821	0.5641	0.5641	0.5608	0.5711	0.5821	0.5899	0.5981 (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			2.2000	1.0000	2.2000		(26)					
TER Opening Type (Uw = 1.40)			19.1600	1.3258	25.4015		(27)					
TER Room Window (Uw = 1.70)			2.7800	1.5918	4.4251		(27a)					
Ground floor			33.7100	0.1300	4.3823		(28a)					
Exposed floor			11.3300	0.1300	1.4729		(28b)					
External Wall 1	17.2600		17.2600	0.1800	3.1068		(29a)					
External Wall 2	60.0300	4.4600	55.5700	0.1800	10.0026		(29a)					
External Wall 3	27.9600		27.9600	0.1800	5.0328		(29a)					
External Wall 4	51.5000	0.6200	50.8800	0.1800	9.1584		(29a)					
External Wall 5	16.7500	5.7300	11.0200	0.1800	1.9836		(29a)					
External Wall 8-9-10	20.8700	10.5500	10.3200	0.1800	1.8576		(29a)					
External Roof 1	39.1000	2.7800	36.3200	0.1300	4.7216		(30)					
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)					
External Roof 3	7.4700		7.4700	0.1300	0.9711		(30)					
Total net area of external elements Aum(A, m2)			316.1100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	78.6332	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6546 (36)					
Total fabric heat loss							(33) + (36) = 98.2878 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.9910	Feb 47.6412	Mar 47.2984	Apr 45.6884	May 45.3871	Jun 43.9848	Jul 43.9848	Aug 43.7251	Sep 44.5249	Oct 45.3871	Nov 45.9965	Dec 46.6336 (38)
Heat transfer coeff	146.2788	145.9290	145.5863	143.9762	143.6749	142.2726	142.2726	142.0129	142.8128	143.6749	144.2843	144.9214 (39)
Average = Sum(39)m / 12 =												143.9747 (39)
HLP	Jan 1.5147	Feb 1.5111	Mar 1.5076	Apr 1.4909	May 1.4878	Jun 1.4733	Jul 1.4733	Aug 1.4706	Sep 1.4789	Oct 1.4878	Nov 1.4941	Dec 1.5007 (40)
HLP (average)												1.4909 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Energy content (annual)	Total = Sum(45)m =										1549.0618 (45)	
Distribution loss (46)m = 0.15 x (45)m												
24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305	(46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage												
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
212.3512	187.2046	196.6947	176.4466	173.0009	154.7106	148.7047	163.0074	162.6670	182.9590	193.3059	207.2835	(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	(63)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h												
212.3512	187.2046	196.6947	176.4466	173.0009	154.7106	148.7047	163.0074	162.6670	182.9590	193.3059	207.2835	(64)
Heat gains from water heating, kWh/month												2158.3362 (64)
94.7983	84.0960	89.5925	82.0797	81.7143	74.8524	73.6358	78.3915	77.4979	85.0254	87.6854	93.1133	(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
135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
22.3466	19.8480	16.1415	12.2201	9.1347	7.7119	8.3330	10.8315	14.5381	18.4594	21.5448	22.9676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
250.6604	253.2615	246.7069	232.7529	215.1385	198.5834	187.5236	184.9225	191.4772	205.4312	223.0456	239.6006	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	(71)
Water heating gains (Table 5)												
127.4171	125.1428	120.4201	113.9995	109.8311	103.9617	98.9729	105.3649	107.6360	114.2814	121.7852	125.1523	(72)
Total internal gains												454.3019 (73)
467.0054	464.8337	449.8498	425.5539	400.6856	376.8384	361.4109	367.7003	380.2326	404.7533	432.9570	454.3019	(73)

#### 6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access			Gains		
			m <sup>2</sup>	Table 6a	Specific data	Specific data	factor			W		
				W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d					
North			3.8000	10.6334	0.6300	0.7000	0.7700			12.3489 (74)		
East			6.0600	19.6403	0.6300	0.7000	0.7700			36.3741 (76)		
South			5.6200	46.7521	0.6300	0.7000	0.7700			80.2988 (78)		
West			3.6800	19.6403	0.6300	0.7000	0.7700			22.0885 (80)		
North			2.7800	15.2954	0.6300	0.7000	1.0000			16.8767 (82)		
Solar gains	167.9869	300.8962	451.3945	626.6687	764.0161	785.9658	746.3093	639.5350	511.3574	343.2079	203.8838	142.0381 (83)
Total gains	634.9924	765.7299	901.2443	1052.2226	1164.7017	1162.8042	1107.7202	1007.2353	891.5900	747.9613	636.8408	596.3401 (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	45.8457	45.9556	46.0638	46.5789	46.6765	47.1366	47.1366	47.2228	46.9583	46.6765	46.4794	46.2751
alpha	4.0564	4.0637	4.0709	4.1053	4.1118	4.1424	4.1424	4.1482	4.1306	4.1118	4.0986	4.0850
util living area	0.9969	0.9929	0.9818	0.9459	0.8554	0.6969	0.5407	0.6062	0.8431	0.9701	0.9938	0.9976 (86)
MIT	19.3495	19.5499	19.8805	20.3162	20.6886	20.9079	20.9752	20.9608	20.7856	20.2958	19.7438	19.3182 (87)
Th 2	19.6765	19.6792	19.6818	19.6943	19.6967	19.7076	19.7076	19.7096	19.7034	19.6967	19.6919	19.6870 (88)
util rest of house	0.9957	0.9904	0.9750	0.9246	0.7988	0.5882	0.3937	0.4559	0.7593	0.9543	0.9911	0.9967 (89)
MIT 2	17.5168	17.8103	18.2905	18.9148	19.4035	19.6502	19.6996	19.6951	19.5378	18.9007	18.1027	17.4778 (90)
Living area fraction												0.5336 (91)
MIT	18.4947	18.7385	19.1389	19.6626	20.0892	20.3213	20.3802	20.3705	20.2036	19.6451	18.9784	18.4599 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4947	18.7385	19.1389	19.6626	20.0892	20.3213	20.3802	20.3705	20.2036	19.6451	18.9784	18.4599 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9943	0.9878	0.9713	0.9239	0.8179	0.6430	0.4727	0.5364	0.7959	0.9534	0.9891	0.9956	(94)
Useful gains	631.3769	756.4231	875.3950	972.1912	952.6205	747.6616	523.6062	540.2993	709.6073	713.1431	629.8763	593.6884 (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												
2076.3875	2019.4441	1840.0553	1549.5523	1205.3195	813.9894	537.8248	563.8554	871.6736	1299.5589	1713.8668	2066.5594	(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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating kWh	1075.0879	848.7501	717.7073	415.7000	188.0081	0.0000	0.0000	0.0000	0.0000	436.2934	780.4731	1095.8160 (98)
Space heating												5557.8359 (98)
Space heating per m2												(98) / (4) = 57.5524 (99)

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 8c. Space cooling requirement  
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Not applicable

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 9a. Energy requirements - Individual heating systems, including micro-CHP  
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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													5944.2095 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1075.0879	848.7501	717.7073	415.7000	188.0081	0.0000	0.0000	0.0000	0.0000	436.2934	780.4731	1095.8160	(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)	1149.8266	907.7541	767.6014	444.5989	201.0782	0.0000	0.0000	0.0000	0.0000	466.6239	834.7306	1171.9957	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	212.3512	187.2046	196.6947	176.4466	173.0009	154.7106	148.7047	163.0074	162.6670	182.9590	193.3059	207.2835	(64)
Efficiency of water heater (217)m	88.5418	88.3590	87.9629	87.0230	85.0360	79.8000	79.8000	79.8000	79.8000	87.0514	88.1536	88.6100	(216)
Fuel for water heating, kWh/month	239.8315	211.8681	223.6110	202.7585	203.4444	193.8729	186.3467	204.2700	203.8433	210.1735	219.2831	233.9278	(219)
Water heating fuel used													2533.2310 (219)
Annual totals kWh/year													
Space heating fuel - main system													5944.2095 (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)													394.6473 (232)
Total delivered energy for all uses													8947.0877 (238)

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5944.2095	0.2160	1283.9492 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2533.2310	0.2160	547.1779 (264)
Space and water heating			1831.1271 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	394.6473	0.5190	204.8219 (268)
Total CO2, kg/m2/year			2074.8741 (272)
Emissions per m2 for space and water heating			18.9617 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.1210 (272b)
Emissions per m2 for pumps and fans			0.4031 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.9617 * 1.55) + 2.1210 + 0.4031, rounded to 2 d.p.			31.9100 (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	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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) =	0.1270 (8)							
Pressure test				Yes								
Measured/design AP50				4.5000								
Infiltration rate				0.3520 (18)								
Number of sides sheltered				0 (19)								
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3520 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136 (22b)
	0.6007	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855 (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					
Entrance door			2.2000	1.4000	3.0800		(26)					
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)					
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)					
Ground floor			33.7100	0.1300	4.3823		(28a)					
Exposed floor			11.3300	0.1900	2.1527		(28b)					
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)					
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)					
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)					
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)					
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)					
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)					
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)					
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)					
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)					
Total net area of external elements Aum(A, m2)			281.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)					
Total fabric heat loss							(33) + (36) = 115.4553 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.8360	Feb 46.5312	Mar 46.2323	Apr 44.8287	May 44.5661	Jun 43.3436	Jul 43.3436	Aug 43.1172	Sep 43.8145	Oct 44.5661	Nov 45.0974	Dec 45.6528 (38)
Heat transfer coeff	162.2914	161.9865	161.6877	160.2841	160.0214	158.7989	158.7989	158.5726	159.2698	160.0214	160.5527	161.1081 (39)
Average = Sum(39)m / 12 =												160.2828 (39)
HLP	Jan 1.6806	Feb 1.6774	Mar 1.6743	Apr 1.6598	May 1.6571	Jun 1.6444	Jul 1.6444	Aug 1.6420	Sep 1.6493	Oct 1.6571	Nov 1.6626	Dec 1.6683 (40)
HLP (average)												1.6598 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1549.0618 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1285	29.8490	30.8015	26.8535	25.7665	22.2346	20.6036	23.6429	23.9253	27.8826	30.4361	33.0516 (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	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.3466	19.8480	16.1415	12.2201	9.1347	7.7119	8.3330	10.8315	14.5381	18.4594	21.5448	22.9676	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	250.6604	253.2615	246.7069	232.7529	215.1385	198.5834	187.5236	184.9225	191.4772	205.4312	223.0456	239.6006	(68)
Pumps, fans	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	(71)
Total internal gains	45.8716	44.4181	41.3998	37.2965	34.6325	30.8813	27.6930	31.7781	33.2296	37.4767	42.2723	44.4242	(72)
	382.4600	381.1090	367.8296	345.8509	322.4870	300.7580	287.1310	291.1136	302.8261	324.9486	350.4441	370.5738	(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 Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.7300	10.6334	0.6300	0.6300	0.7000	0.7700	18.6208	(74)					
East	9.1500	19.6403	0.6300	0.6300	0.7000	0.7700	54.9212	(76)					
South	8.4800	46.7521	0.6300	0.6300	0.7000	0.7700	121.1626	(78)					
West	5.5500	19.6403	0.6300	0.6300	0.7000	0.7700	33.3129	(80)					
North	4.2000	15.2954	0.6300	0.6300	0.7000	1.0000	25.4972	(82)					
Solar gains	253.5146	454.0964	681.2372	945.7943	1153.1216	1186.2670	1126.4061	965.2262	771.7434	517.9550	307.6883	214.3541	(83)
Total gains	635.9746	835.2054	1049.0668	1291.6452	1475.6086	1487.0250	1413.5371	1256.3397	1074.5695	842.9035	658.1324	584.9280	(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	41.3223	41.4001	41.4766	41.8398	41.9084	42.2311	42.2311	42.2914	42.1062	41.9084	41.7698	41.6258	
alpha	3.7548	3.7600	3.7651	3.7893	3.7939	3.8154	3.8154	3.8194	3.8071	3.7939	3.7847	3.7751	
util living area	0.9967	0.9906	0.9727	0.9165	0.7948	0.6232	0.4767	0.5477	0.8008	0.9611	0.9930	0.9976	(86)
MIT	19.1586	19.4200	19.8245	20.3276	20.7191	20.9200	20.9778	20.9631	20.7874	20.2396	19.5963	19.1134	(87)
Th 2	19.5548	19.5571	19.5593	19.5698	19.5718	19.5809	19.5809	19.5826	19.5774	19.5718	19.5678	19.5636	(88)
util rest of house	0.9955	0.9872	0.9625	0.8857	0.7247	0.5084	0.3314	0.3942	0.7027	0.9406	0.9900	0.9967	(89)
MIT 2	17.9207	18.1820	18.5812	19.0660	19.4024	19.5497	19.5766	19.5743	19.4728	18.9995	18.3668	17.8822	(90)
Living area fraction									fLA = Living area / (4) =			0.5336	(91)
MIT	18.5813	18.8426	19.2447	19.7392	20.1050	20.2809	20.3243	20.3153	20.1743	19.6612	19.0229	18.5391	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5813	18.8426	19.2447	19.7392	20.1050	20.2809	20.3243	20.3153	20.1743	19.6612	19.0229	18.5391	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9943	0.9849	0.9597	0.8900	0.7532	0.5677	0.4095	0.4767	0.7485	0.9422	0.9884	0.9958	(94)
Ext temp.	632.3748	822.5969	1006.8362	1149.5257	1111.4998	844.1948	578.8449	598.8564	804.3217	794.2213	650.4925	582.4791	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2317.7258	2258.5160	2060.6545	1737.3443	1344.9836	902.1250	591.4139	620.8662	967.4523	1449.9896	1914.2483	2310.1503	(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	1253.9011	964.9377	784.0408	423.2294	173.7119	0.0000	0.0000	0.0000	0.0000	487.8917	909.9042	1285.3873	(98)
Space heating per m <sup>2</sup>												6283.0042	(98)
												(98) / (4) =	65.0617 (99)

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1492.7101	1175.1122	1205.1514	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9113	0.8777	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1282.8624	1070.9051	1057.7214	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1800.6940	1715.7999	1543.3548	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	372.8388	479.8017	361.3112	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction													1213.9517 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 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	0.0000 (106)
Space cooling													0.0000 (107)
Space cooling per m2													303.4879 (107)
Energy for space heating													3.1427 (108)
Energy for space cooling													65.0617 (99)
Total													3.1427 (108)
Dwelling Fabric Energy Efficiency (DFEE)													68.2043 (109)
													68.2 (109)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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) =	0.1270 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3770 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3770 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4806	0.4712	0.4618	0.4147	0.4052	0.3581	0.3581	0.3487	0.3770	0.4052	0.4241	0.4429 (22b)
	0.6155	0.6110	0.6066	0.5860	0.5821	0.5641	0.5641	0.5608	0.5711	0.5821	0.5899	0.5981 (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			2.2000	1.0000	2.2000		(26)
TER Opening Type (Uw = 1.40)			19.1600	1.3258	25.4015		(27)
TER Room Window (Uw = 1.70)			2.7800	1.5918	4.4251		(27a)
Ground floor			33.7100	0.1300	4.3823		(28a)
Exposed floor			11.3300	0.1300	1.4729		(28b)
External Wall 1	17.2600		17.2600	0.1800	3.1068		(29a)
External Wall 2	60.0300	4.4600	55.5700	0.1800	10.0026		(29a)
External Wall 3	27.9600		27.9600	0.1800	5.0328		(29a)
External Wall 4	51.5000	0.6200	50.8800	0.1800	9.1584		(29a)
External Wall 5	16.7500	5.7300	11.0200	0.1800	1.9836		(29a)
External Wall 8-9-10	20.8700	10.5500	10.3200	0.1800	1.8576		(29a)
External Roof 1	39.1000	2.7800	36.3200	0.1300	4.7216		(30)
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)
External Roof 3	7.4700		7.4700	0.1300	0.9711		(30)
Total net area of external elements Aum(A, m2)			316.1100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	78.6332	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.6546 (36)
Total fabric heat loss							(33) + (36) = 98.2878 (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	47.9910	47.6412	47.2984	45.6884	45.3871	43.9848	43.9848	43.7251	44.5249	45.3871	45.9965	46.6336 (38)
Average = Sum(39)m / 12 =	146.2788	145.9290	145.5863	143.9762	143.6749	142.2726	142.2726	142.0129	142.8128	143.6749	144.2843	144.9214 (39)
												143.9747 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5147	1.5111	1.5076	1.4909	1.4878	1.4733	1.4733	1.4706	1.4789	1.4878	1.4941	1.5007 (40)
HLP (average)												1.4909 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy conte	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Energy content (annual)	Total = Sum(45)m = 1549.0618 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1285	29.8490	30.8015	26.8535	25.7665	22.2346	20.6036	23.6429	23.9253	27.8826	30.4361	33.0516 (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	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712	135.2712 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.3466	19.8480	16.1415	12.2201	9.1347	7.7119	8.3330	10.8315	14.5381	18.4594	21.5448	22.9676	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	250.6604	253.2615	246.7069	232.7529	215.1385	198.5834	187.5236	184.9225	191.4772	205.4312	223.0456	239.6006	(68)
Pumps, fans	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	36.5271	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	(71)
Total internal gains	45.8716	44.4181	41.3998	37.2965	34.6325	30.8813	27.6930	31.7781	33.2296	37.4767	42.2723	44.4242	(72)
	382.4600	381.1090	367.8296	345.8509	322.4870	300.7580	287.1310	291.1136	302.8261	324.9486	350.4441	370.5738	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	g	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
North	3.8000	10.6334	0.6300	0.7000	0.7700	12.3489 (74)							
East	6.0600	19.6403	0.6300	0.7000	0.7700	36.3741 (76)							
South	5.6200	46.7521	0.6300	0.7000	0.7700	80.2988 (78)							
West	3.6800	19.6403	0.6300	0.7000	0.7700	22.0885 (80)							
North	2.7800	15.2954	0.6300	0.7000	1.0000	16.8767 (82)							
Solar gains	167.9869	300.8962	451.3945	626.6687	764.0161	785.9658	746.3093	639.5350	511.3574	343.2079	203.8838	142.0381	(83)
Total gains	550.4469	682.0052	819.2241	972.5196	1086.5031	1086.7238	1033.4403	930.6486	814.1836	668.1565	554.3279	512.6120	(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	45.8457	45.9556	46.0638	46.5789	46.6765	47.1366	47.1366	47.2228	46.9583	46.6765	46.4794	46.2751	
alpha	4.0564	4.0637	4.0709	4.1053	4.1118	4.1424	4.1424	4.1482	4.1306	4.1118	4.0986	4.0850	
util living area	0.9982	0.9953	0.9869	0.9575	0.8777	0.7286	0.5733	0.6444	0.8735	0.9795	0.9963	0.9986	(86)
MIT	19.2733	19.4755	19.8108	20.2575	20.6495	20.8909	20.9693	20.9508	20.7484	20.2306	19.6700	19.2423	(87)
Th 2	19.6765	19.6792	19.6818	19.6943	19.6967	19.7076	19.7076	19.7096	19.7034	19.6967	19.6919	19.6870	(88)
util rest of house	0.9975	0.9936	0.9818	0.9399	0.8262	0.6208	0.4205	0.4899	0.7981	0.9680	0.9946	0.9981	(89)
MIT 2	18.1260	18.3295	18.6640	19.1082	19.4665	19.6598	19.7006	19.6967	19.5653	19.0918	18.5338	18.1030	(90)
Living area fraction	fLA = Living area / (4) = 0.5336 (91)												
MIT	18.7382	18.9411	19.2759	19.7215	20.0977	20.3167	20.3776	20.3659	20.1966	19.6995	19.1401	18.7110	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.7382	18.9411	19.2759	19.7215	20.0977	20.3167	20.3776	20.3659	20.1966	19.6995	19.1401	18.7110	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9968	0.9923	0.9798	0.9403	0.8441	0.6753	0.5028	0.5730	0.8311	0.9680	0.9937	0.9976	(94)
Useful gains	548.7042	676.7786	802.6892	914.4912	917.1045	733.8129	519.6375	533.2658	676.6754	646.7896	550.8213	511.3972	(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	2112.0050	2048.9973	1859.9973	1558.0333	1206.5443	813.3358	537.4445	563.2098	870.6751	1307.3699	1737.1971	2102.9519	(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	1163.0958	922.1310	786.6372	463.3503	215.3432	0.0000	0.0000	0.0000	0.0000	491.4717	854.1906	1184.1167	(98)
Space heating	6080.3366 (98)												
Space heating per m <sup>2</sup>	(98) / (4) = 62.9630 (99)												

#### 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1337.3624	1052.8172	1079.2981	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8083	0.8764	0.8375	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1080.9479	922.6400	903.8743	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1346.4862	1284.1204	1172.0551	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	191.1876	268.9414	199.5265	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling													659.6555 (104)
Cooled fraction													1.0000 (105)
Intermittency factor (Table 10b)													
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	47.7969	67.2354	49.8816	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													164.9139 (107)
Space cooling per m2													1.7077 (108)
Energy for space heating													62.9630 (99)
Energy for space cooling													1.7077 (108)
Total													64.6707 (109)
Target Fabric Energy Efficiency (TFEE)													74.4 (109)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.4366 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.4000	3.4000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.0000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8500	0.8500	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7500	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.4039	0.3711	0.3711	0.3602	0.3602	0.3275	0.3384	0.3165	0.3056	0.3275	0.3165	0.3493 (22b)
	0.5816	0.5689	0.5689	0.5649	0.5649	0.5536	0.5573	0.5501	0.5467	0.5536	0.5501	0.5610 (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
Entrance door			2.2000	1.4000	3.0800		(26)
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)
Ground floor			33.7100	0.1300	4.3823		(28a)
Exposed floor			11.3300	0.1900	2.1527		(28b)
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)
Total net area of external elements Aum(A, m2)			281.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)
Total fabric heat loss							(33) + (36) = 115.4553 (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	45.3439	44.3545	44.3545	44.0433	44.0433	43.1654	43.4487	42.8913	42.6265	43.1654	42.8913	43.7413 (38)
Average = Sum(39)m / 12 =	160.7992	159.8098	159.8098	159.4986	159.4986	158.6207	158.9040	158.3466	158.0819	158.6207	158.3466	159.1967 (39)
												159.1278 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6651	1.6549	1.6549	1.6516	1.6516	1.6425	1.6455	1.6397	1.6370	1.6425	1.6397	1.6485 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1549.0618 (45)
Water storage loss:	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (56)
If cylinder contains dedicated solar storage												
	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												
	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
	74.5306	65.7897	69.3248	62.4658	61.4467	55.2386	53.3682	58.1238	57.8841	64.7577	68.0715	72.8456 (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	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.8664	49.6200	40.3537	30.5504	22.8368	19.2798	20.8325	27.0788	36.3451	46.1485	53.8621	57.4191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	374.1201	378.0023	368.2193	347.3924	321.1022	296.3932	279.8860	276.0038	285.7868	306.6137	332.9038	357.6129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)												
	100.1756	97.9013	93.1786	86.7580	82.5896	76.7202	71.7314	78.1234	80.3945	87.0399	94.5438	97.9108 (72)
Total internal gains	641.2085	636.5701	612.7980	575.7472	537.5750	503.4396	483.4963	492.2525	513.5729	550.8485	592.3561	623.9893 (73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	5.7300	13.0873	0.6300	0.7000	0.7700	22.9180 (74)						
East	9.1500	24.4516	0.6300	0.7000	0.7700	68.3754 (76)						
South	8.4800	55.0866	0.6300	0.7000	0.7700	142.7623 (78)						
West	5.5500	24.4516	0.6300	0.7000	0.7700	41.4736 (80)						
North	4.2000	18.5854	0.6300	0.7000	1.0000	30.9814 (82)						
Solar gains	306.5107	467.2645	708.5668	1010.4549	1197.5892	1340.0099	1249.8917	1080.4787	857.1764	581.2289	364.6537	252.5190 (83)
Total gains	947.7192	1103.8346	1321.3648	1586.2021	1735.1642	1843.4495	1733.3880	1572.7311	1370.7492	1132.0775	957.0099	876.5082 (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	41.7057	41.9639	41.9639	42.0458	42.0458	42.2785	42.2031	42.3517	42.4226	42.2785	42.3517	42.1256	
alpha	3.7804	3.7976	3.7976	3.8031	3.8031	3.8186	3.8135	3.8234	3.8282	3.8186	3.8234	3.8084	
util living area	0.9848	0.9737	0.9361	0.8421	0.6851	0.4660	0.3355	0.3671	0.6522	0.8912	0.9713	0.9886 (86)	
MIT	19.8567	19.9922	20.2926	20.6065	20.8173	20.9097	20.9249	20.9236	20.8611	20.5853	20.1627	19.8053 (87)	
Th 2	19.5659	19.5734	19.5734	19.5757	19.5757	19.5823	19.5802	19.5843	19.5863	19.5823	19.5843	19.5780 (88)	
util rest of house	0.9794	0.9647	0.9143	0.7930	0.5997	0.3552	0.2086	0.2294	0.5343	0.8429	0.9595	0.9846 (89)	
MIT 2	18.1116	18.3106	18.7322	19.1454	19.3855	19.4701	19.4756	19.4798	19.4436	19.1417	18.5668	18.0463 (90)	
Living area fraction													
MIT	19.0428	19.2079	19.5648	19.9250	20.1495	20.2383	20.2490	20.2502	20.2000	19.9120	19.4184	18.9849 (92)	
Temperature adjustment													
adjusted MIT	18.8928	19.0579	19.4148	19.7750	19.9995	20.0883	20.0990	20.1002	20.0500	19.7620	19.2684	18.8349 (93)	

#### 8. Space heating requirement

Utilisation	0.9760	0.9606	0.9114	0.8008	0.6269	0.3958	0.2555	0.2803	0.5758	0.8501	0.9561	0.9818 (94)
Useful gains	925.0190	1060.3110	1204.2883	1270.1630	1087.6972	729.6292	442.9169	440.8859	789.2461	962.4198	914.9843	860.5257 (95)
Ext temp.	5.2000	5.5000	7.3000	9.6000	12.5000	15.4000	17.3000	17.3000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	2201.7942	2166.6859	1936.0671	1622.9057	1196.1587	743.6592	444.7665	443.4071	845.7361	1326.3861	1800.1419	2202.4710 (97)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 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												
Space heating	949.9208	743.4840	544.4434	253.9747	80.6953	0.0000	0.0000	0.0000	0.0000	270.7909	637.3135	998.4073 (98)
RHI space heating demand												4479.0299 (98)
												4479 (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	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)							
Pressure test				Yes								
Measured/design AP50				4.5000								
Infiltration rate				0.4366 (18)								
Number of sides sheltered				0 (19)								
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (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	0.5567	0.5458	0.5349	0.4803	0.4694	0.4148	0.4148	0.4039	0.4366	0.4694	0.4912	0.5130 (22b)
Effective ac	0.6550	0.6489	0.6430	0.6153	0.6102	0.5860	0.5860	0.5816	0.5953	0.6102	0.6206	0.6316 (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					
Entrance door			2.2000	1.4000	3.0800		(26)					
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)					
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)					
Ground floor			33.7100	0.1300	4.3823		(28a)					
Exposed floor			11.3300	0.1900	2.1527		(28b)					
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)					
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)					
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)					
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)					
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)					
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)					
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)					
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)					
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)					
Total net area of external elements Aum(A, m2)			281.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)					
Total fabric heat loss							(33) + (36) = 115.4553 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.0665	Feb 50.5973	Mar 50.1375	Apr 47.9776	May 47.5735	Jun 45.6922	Jul 45.6922	Aug 45.3439	Sep 46.4169	Oct 47.5735	Nov 48.3910	Dec 49.2457 (38)
Heat transfer coeff	166.5218	166.0527	165.5928	163.4329	163.0288	161.1476	161.1476	160.7992	161.8722	163.0288	163.8463	164.7010 (39)
Average = Sum(39)m / 12 =												163.4310 (39)
HLP	Jan 1.7244	Feb 1.7195	Mar 1.7147	Apr 1.6924	May 1.6882	Jun 1.6687	Jul 1.6687	Aug 1.6651	Sep 1.6762	Oct 1.6882	Nov 1.6967	Dec 1.7055 (40)
HLP (average)												1.6924 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (56)
If cylinder contains dedicated solar storage												
	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												
	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (64)
Heat gains from water heating, kWh/month												
	74.5306	65.7897	69.3248	62.4658	61.4467	55.2386	53.3682	58.1238	57.8841	64.7577	68.0715	72.8456 (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	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8664	49.6200	40.3537	30.5504	22.8368	19.2798	20.8325	27.0788	36.3451	46.1485	53.8621	57.4191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1201	378.0023	368.2193	347.3924	321.1022	296.3932	279.8860	276.0038	285.7868	306.6137	332.9038	357.6129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)	100.1756	97.9013	93.1786	86.7580	82.5896	76.7202	71.7314	78.1234	80.3945	87.0399	94.5438	97.9108 (72)
Total internal gains	641.2085	636.5701	612.7980	575.7472	537.5750	503.4396	483.4963	492.2525	513.5729	550.8485	592.3561	623.9893 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.7300	10.6334	0.6300	0.7000	0.7700	18.6208 (74)						
East	9.1500	19.6403	0.6300	0.7000	0.7700	54.9212 (76)						
South	8.4800	46.7521	0.6300	0.7000	0.7700	121.1626 (78)						
West	5.5500	19.6403	0.6300	0.7000	0.7700	33.3129 (80)						
North	4.2000	15.2954	0.6300	0.7000	1.0000	25.4972 (82)						
Solar gains	253.5146	454.0964	681.2372	945.7943	1153.1216	1186.2670	1126.4061	965.2262	771.7434	517.9550	307.6883	214.3541 (83)
Total gains	894.7231	1090.6665	1294.0352	1521.5415	1690.6966	1689.7066	1609.9024	1457.4787	1285.3163	1068.8035	900.0445	838.3434 (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)												
tau	40.2725	40.3863	40.4984	41.0337	41.1354	41.6156	41.6156	41.7057	41.4293	41.1354	40.9301	40.7177
alpha	3.6848	3.6924	3.6999	3.7356	3.7424	3.7744	3.7744	3.7804	3.7620	3.7424	3.7287	3.7145
util living area	0.9896	0.9781	0.9505	0.8782	0.7442	0.5696	0.4290	0.4875	0.7313	0.9260	0.9808	0.9917 (86)
MIT	19.6751	19.8651	20.1524	20.5019	20.7564	20.8825	20.9162	20.9091	20.8104	20.4589	20.0024	19.6452 (87)
Th 2	19.5234	19.5269	19.5303	19.5463	19.5493	19.5633	19.5633	19.5659	19.5579	19.5493	19.5432	19.5369 (88)
util rest of house	0.9860	0.9707	0.9336	0.8382	0.6684	0.4581	0.2945	0.3450	0.6243	0.8918	0.9730	0.9888 (89)
MIT 2	17.8175	18.0936	18.5035	18.9887	19.2980	19.4333	19.4551	19.4551	19.3738	18.9514	18.3071	17.7840 (90)
Living area fraction	18.8087	19.0388	19.3834	19.7962	20.0762	20.2066	20.2348	20.2310	20.1404	19.7559	19.2117	18.7772 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6587	18.8888	19.2334	19.6462	19.9262	20.0566	20.0848	20.0810	19.9904	19.6059	19.0617	18.6272 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	879.6069	1054.1332	1202.7331	1280.2288	1166.2960	841.8217	554.6486	580.0811	848.0006	954.9284	872.6158	826.9406 (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	2391.0383	2322.8845	2108.5584	1756.2796	1341.1096	879.3207	561.5596	591.8940	953.4849	1468.2132	1959.8810	2376.1664 (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)

# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	1124.5050	852.6008	673.9340	342.7566	130.0613	0.0000	0.0000	0.0000	0.0000	381.8839	782.8310	1152.6240 (98)
Space heating												5441.1966 (98)
Space heating per m2												(98) / (4) = 56.3446 (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 %)												100.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5441.1966 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1124.5050	852.6008	673.9340	342.7566	130.0613	0.0000	0.0000	0.0000	0.0000	381.8839	782.8310	1152.6240	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1124.5050	852.6008	673.9340	342.7566	130.0613	0.0000	0.0000	0.0000	0.0000	381.8839	782.8310	1152.6240	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490	(219)
Water heating fuel used												1860.0418 (219)	
Annual totals kWh/year												5441.1966 (211)	
Space heating fuel - main system												0.0000 (215)	
Space heating fuel - secondary													

Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
Total electricity for the above, kWh/year												30.0000 (231)
Electricity for lighting (calculated in Appendix L)												394.6473 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 3.00 * 1068 * 1.00) =												-2563.3692 (233)
Total delivered energy for all uses												5162.5165 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5441.1966	13.1900	717.6938	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1860.0418	13.1900	245.3395	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Energy for lighting	394.6473	13.1900	52.0540	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-2563.3692	13.1900	-338.1084	(252)
Total energy cost			680.9359	(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] =		2.0202 (257)
SAP value			71.8189
SAP rating (Section 12)			72 (258)
SAP band			C

#### 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	5441.1966	0.5190	2823.9810	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1860.0418	0.5190	965.3617	(264)
Space and water heating			3789.3427	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	394.6473	0.5190	204.8219	(268)
Energy saving/generation technologies				
PV Unit	-2563.3692	0.5190	-1330.3886	(269)
Total kg/year			2679.3461	(272)
CO2 emissions per m2			27.7500	(273)
EI value			74.6392	

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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating  
EI band

75 (274)  
C

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

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 1.0000 = 14.146$ , stars = 1
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 1.0000 = 0.5566$ , stars = 1
Water heating energy efficiency	$13.19 / 1.0000 = 13.190$ , stars = 1
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$ , stars = 2

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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	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate					0.4366 (18)
Number of sides sheltered				0	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.4000	3.4000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.0000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8500	0.8500	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7500	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.4039	0.3711	0.3711	0.3602	0.3602	0.3275	0.3384	0.3165	0.3056	0.3275	0.3165	0.3493 (22b)
	0.5816	0.5689	0.5689	0.5649	0.5649	0.5536	0.5573	0.5501	0.5467	0.5536	0.5501	0.5610 (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
Entrance door			2.2000	1.4000	3.0800		(26)
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)
Ground floor			33.7100	0.1300	4.3823		(28a)
Exposed floor			11.3300	0.1900	2.1527		(28b)
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)
Total net area of external elements Aum(A, m2)			281.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)
Total fabric heat loss							(33) + (36) = 115.4553 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.3439	44.3545	44.3545	44.0433	44.0433	43.1654	43.4487	42.8913	42.6265	43.1654	42.8913	43.7413 (38)
Average = Sum(39)m / 12 =	160.7992	159.8098	159.8098	159.4986	159.4986	158.6207	158.9040	158.3466	158.0819	158.6207	158.3466	159.1967 (39)
												159.1278 (39)
HLP	1.6651	1.6549	1.6549	1.6516	1.6516	1.6425	1.6455	1.6397	1.6370	1.6425	1.6397	1.6485 (40)
HLP (average)												1.6478 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy conte	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1549.0618 (45)
Water storage loss:	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
If cylinder contains dedicated solar storage	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (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 (59)
Total heat required for water heating calculated for each month												
Solar input	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (62)
Output from w/h	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490 (64)
Heat gains from water heating, kWh/month	74.5306	65.7897	69.3248	62.4658	61.4467	55.2386	53.3682	58.1238	57.8841	64.7577	68.0715	72.8456 (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	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8664	49.6200	40.3537	30.5504	22.8368	19.2798	20.8325	27.0788	36.3451	46.1485	53.8621	57.4191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1201	378.0023	368.2193	347.3924	321.1022	296.3932	279.8860	276.0038	285.7868	306.6137	332.9038	357.6129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)	100.1756	97.9013	93.1786	86.7580	82.5896	76.7202	71.7314	78.1234	80.3945	87.0399	94.5438	97.9108 (72)
Total internal gains	641.2085	636.5701	612.7980	575.7472	537.5750	503.4396	483.4963	492.2525	513.5729	550.8485	592.3561	623.9893 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.7300	13.0873	0.6300	0.7000	0.7700	22.9180 (74)						
East	9.1500	24.4516	0.6300	0.7000	0.7700	68.3754 (76)						
South	8.4800	55.0866	0.6300	0.7000	0.7700	142.7623 (78)						
West	5.5500	24.4516	0.6300	0.7000	0.7700	41.4736 (80)						
North	4.2000	18.5854	0.6300	0.7000	1.0000	30.9814 (82)						
Solar gains	306.5107	467.2645	708.5668	1010.4549	1197.5892	1340.0099	1249.8917	1080.4787	857.1764	581.2289	364.6537	252.5190 (83)
Total gains	947.7192	1103.8346	1321.3648	1586.2021	1735.1642	1843.4495	1733.3880	1572.7311	1370.7492	1132.0775	957.0099	876.5082 (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)												
tau	41.7057	41.9639	41.9639	42.0458	42.0458	42.2785	42.2031	42.3517	42.4226	42.2785	42.3517	42.1256
alpha	3.7804	3.7976	3.7976	3.8031	3.8031	3.8186	3.8135	3.8234	3.8282	3.8186	3.8234	3.8084
util living area	0.9848	0.9737	0.9361	0.8421	0.6851	0.4660	0.3355	0.3671	0.6522	0.8912	0.9713	0.9886 (86)
MIT	19.8567	19.9922	20.2926	20.6065	20.8173	20.9097	20.9249	20.9236	20.8611	20.5853	20.1627	19.8053 (87)
Th 2	19.5659	19.5734	19.5734	19.5757	19.5757	19.5823	19.5802	19.5843	19.5863	19.5823	19.5843	19.5780 (88)
util rest of house	0.9794	0.9647	0.9143	0.7930	0.5997	0.3552	0.2086	0.2294	0.5343	0.8429	0.9595	0.9846 (89)
MIT 2	18.1116	18.3106	18.7322	19.1454	19.3855	19.4701	19.4756	19.4798	19.4436	19.1417	18.5668	18.0463 (90)
Living area fraction									fLA = Living area / (4) =			0.5336 (91)
MIT	19.0428	19.2079	19.5648	19.9250	20.1495	20.2383	20.2490	20.2502	20.2000	19.9120	19.4184	18.9849 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8928	19.0579	19.4148	19.7750	19.9995	20.0883	20.0990	20.1002	20.0500	19.7620	19.2684	18.8349 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9760	0.9606	0.9114	0.8008	0.6269	0.3958	0.2555	0.2803	0.5758	0.8501	0.9561	0.9818 (94)
Ext temp.	925.0190	1060.3110	1204.2883	1270.1630	1087.6972	729.6292	442.9169	440.8859	789.2461	962.4198	914.9843	860.5257 (95)
Heat loss rate W	5.2000	5.5000	7.3000	9.6000	12.5000	15.4000	17.3000	17.3000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	2201.7942	2166.6859	1936.0671	1622.9057	1196.1587	743.6592	444.7665	443.4071	845.7361	1326.3861	1800.1419	2202.4710 (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)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Space heating kWh	949.9208	743.4840	544.4434	253.9747	80.6953	0.0000	0.0000	0.0000	0.0000	270.7909	637.3135	998.4073 (98)
Space heating												4479.0299 (98)
Space heating per m2												(98) / (4) = 46.3812 (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 %)												100.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4479.0299 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	949.9208	743.4840	544.4434	253.9747	80.6953	0.0000	0.0000	0.0000	0.0000	270.7909	637.3135	998.4073	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	949.9208	743.4840	544.4434	253.9747	80.6953	0.0000	0.0000	0.0000	0.0000	270.7909	637.3135	998.4073	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating requirement	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	187.0166	164.3218	171.3601	151.9293	147.6663	130.1933	123.3701	137.6728	138.1496	157.6244	168.7886	181.9490	(219)
Water heating fuel used													(219)
Annual totals kWh/year													1860.0418
Space heating fuel - main system													4479.0299 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.6473 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.00 * 1160 * 1.00) =										-2784.8406			-2784.8406 (233)
Total delivered energy for all uses													3978.8784 (238)

#### 10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4479.0299	19.4400	870.7234	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1860.0418	19.4400	361.5921	(247)
Pumps and fans for heating	30.0000	19.4400	5.8320	(249)
Energy for lighting	394.6473	19.4400	76.7194	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-2784.8406	19.4400	-541.3730	(252)
Total energy cost			773.4940	(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	4479.0299	0.5190	2324.6165	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1860.0418	0.5190	965.3617	(264)
Space and water heating			3289.9782	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	394.6473	0.5190	204.8219	(268)
Energy saving/generation technologies				
PV Unit	-2784.8406	0.5190	-1445.3323	(269)
Total kg/year			2065.0379	(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	4479.0299	3.0700	13750.6219	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1860.0418	3.0700	5710.3285	(264)
Space and water heating			19460.9503	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy for lighting	394.6473	3.0700	1211.5671 (268)
Energy saving/generation technologies			
PV Unit	-2784.8406	3.0700	-8549.4607 (269)
Primary energy kWh/year			12215.1568 (272)
Primary energy kWh/m <sup>2</sup> /year			126.4902 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 72  
 Current environmental impact rating: C 75

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 5.1	-£ 185	-494 kg (23.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£185	5.11 kg/m <sup>2</sup>	C 77 C 79
<b>Total Savings</b>	<b>£185</b>	<b>5.11 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: C 77  
 Potential environmental impact rating: C 79

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 2022)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£1315	£1130	£185
Space heating	£877	£883	-£7
Water heating	£362	£170	£192
Lighting	£77	£77	£0
Generated (PV)	-£541	-£541	£0
<b>Total cost of fuels</b>	<b>£774</b>	<b>£589</b>	<b>£185</b>
<b>Total cost of uses</b>	<b>£775</b>	<b>£589</b>	<b>£185</b>
Delivered energy	41 kWh/m <sup>2</sup>	31 kWh/m <sup>2</sup>	10 kWh/m <sup>2</sup>
Carbon dioxide emissions	2.1 tonnes	1.6 tonnes	0.5 tonnes
CO2 emissions per m <sup>2</sup>	21 kg/m <sup>2</sup>	16 kg/m <sup>2</sup>	5 kg/m <sup>2</sup>
Primary energy	126 kWh/m <sup>2</sup>	96 kWh/m <sup>2</sup>	30 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	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)							
Pressure test				Yes								
Measured/design AP50				4.5000								
Infiltration rate				0.4366 (18)								
Number of sides sheltered				0 (19)								
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (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	0.5567	0.5458	0.5349	0.4803	0.4694	0.4148	0.4148	0.4039	0.4366	0.4694	0.4912	0.5130 (22b)
Effective ac	0.6550	0.6489	0.6430	0.6153	0.6102	0.5860	0.5860	0.5816	0.5953	0.6102	0.6206	0.6316 (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					
Entrance door			2.2000	1.4000	3.0800		(26)					
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)					
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)					
Ground floor			33.7100	0.1300	4.3823		(28a)					
Exposed floor			11.3300	0.1900	2.1527		(28b)					
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)					
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)					
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)					
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)					
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)					
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)					
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)					
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)					
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)					
Total net area of external elements Aum(A, m2)			281.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)					
Total fabric heat loss							(33) + (36) = 115.4553 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.0665	Feb 50.5973	Mar 50.1375	Apr 47.9776	May 47.5735	Jun 45.6922	Jul 45.6922	Aug 45.3439	Sep 46.4169	Oct 47.5735	Nov 48.3910	Dec 49.2457 (38)
Heat transfer coeff	166.5218	166.0527	165.5928	163.4329	163.0288	161.1476	161.1476	160.7992	161.8722	163.0288	163.8463	164.7010 (39)
Average = Sum(39)m / 12 =												163.4310 (39)
HLP	Jan 1.7244	Feb 1.7195	Mar 1.7147	Apr 1.6924	May 1.6882	Jun 1.6687	Jul 1.6687	Aug 1.6651	Sep 1.6762	Oct 1.6882	Nov 1.6967	Dec 1.7055 (40)
HLP (average)												1.6924 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
	26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120 (56)
If cylinder contains dedicated solar storage												
	16.9791	15.3360	16.9791	16.4314	16.9791	16.4314	16.9791	16.9791	16.4314	16.9791	16.4314	16.9791 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	177.5837	155.8018	161.9273	142.8007	138.2335	121.0647	113.9372	128.2400	129.0211	148.1915	159.6600	172.5161 (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												1.1708 (H8)
Utilisation factor												0.5743 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												98.4538 (H14)
Volume ratio Veff/V												1.1731 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-915.9075 (H17)
Solar input	-26.5595	-44.3202	-75.4823	-101.1612	-124.9761	-122.8714	-121.2476	-105.9346	-82.9681	-56.6574	-31.5034	-22.2258 (63)
Solar input (sum of months) = Sum(63)m =												-915.9075 (63)
Output from w/h	151.0242	111.4816	86.4450	41.6395	13.2574	0.0000	0.0000	22.3053	46.0530	91.5341	128.1566	150.2903 (64)
Total per year (kWh/year) = Sum(64)m =												842.1871 (64)
Heat gains from water heating, kWh/month	66.9843	58.9737	61.7786	55.1629	53.9004	47.9357	45.8219	50.5775	50.5812	57.2114	60.7686	65.2994 (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	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8664	49.6200	40.3537	30.5504	22.8368	19.2798	20.8325	27.0788	36.3451	46.1485	53.8621	57.4191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1201	378.0023	368.2193	347.3924	321.1022	296.3932	279.8860	276.0038	285.7868	306.6137	332.9038	357.6129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)	90.0327	87.7584	83.0357	76.6152	72.4467	66.5774	61.5886	67.9806	70.2517	76.8971	84.4009	87.7679 (72)
Total internal gains	631.0656	626.4272	602.6551	565.6044	527.4322	493.2967	473.3534	482.1096	503.4300	540.7057	582.2133	613.8464 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
North	5.7300	10.6334	0.6300	0.7000	0.7700	18.6208 (74)
East	9.1500	19.6403	0.6300	0.7000	0.7700	54.9212 (76)
South	8.4800	46.7521	0.6300	0.7000	0.7700	121.1626 (78)
West	5.5500	19.6403	0.6300	0.7000	0.7700	33.3129 (80)
North	4.2000	15.2954	0.6300	0.7000	1.0000	25.4972 (82)

Solar gains	253.5146	454.0964	681.2372	945.7943	1153.1216	1186.2670	1126.4061	965.2262	771.7434	517.9550	307.6883	214.3541 (83)
Total gains	884.5803	1080.5236	1283.8923	1511.3987	1680.5538	1679.5637	1599.7595	1447.3358	1275.1734	1058.6606	889.9016	828.2005 (84)

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

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	40.2725	40.3863	40.4984	41.0337	41.1354	41.6156	41.6156	41.7057	41.4293	41.1354	40.9301	40.7177
alpha	3.6848	3.6924	3.6999	3.7356	3.7424	3.7744	3.7744	3.7804	3.7620	3.7424	3.7287	3.7145
util living area	0.9899	0.9787	0.9515	0.8801	0.7468	0.5724	0.4315	0.4905	0.7348	0.9278	0.9815	0.9920 (86)
MIT	19.6686	19.8590	20.1470	20.4979	20.7543	20.8818	20.9159	20.9086	20.8084	20.4540	19.9962	19.6387 (87)
Th 2	19.5234	19.5269	19.5303	19.5463	19.5493	19.5633	19.5633	19.5659	19.5579	19.5493	19.5432	19.5369 (88)
util rest of house	0.9865	0.9715	0.9350	0.8405	0.6711	0.4606	0.2963	0.3473	0.6280	0.8943	0.9739	0.9893 (89)

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## Calculation Type: New Build (As Designed)

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

MIT 2	17.8083	18.0849	18.4961	18.9838	19.2959	19.4329	19.4551	19.4550	19.3722	18.9452	18.2983	17.7746 (90)
Living area fraction									fLA = Living area / (4) =			0.5336 (91)
MIT	18.8010	19.0315	19.3770	19.7917	20.0741	20.2060	20.2346	20.2307	20.1385	19.7503	19.2043	18.7693 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6510	18.8815	19.2270	19.6417	19.9241	20.0560	20.0846	20.0807	19.9885	19.6003	19.0543	18.6193 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9674	0.9308	0.8435	0.6924	0.5008	0.3466	0.4006	0.6633	0.8957	0.9705	0.9869	(94)
Useful gains	870.1363	1045.2600	1195.0527	1274.8730	1163.6938	841.0771	554.4797	579.7762	845.7983	948.2799	863.6418	817.3483	(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													
	2389.7511	2321.6705	2107.5006	1755.5527	1340.7660	879.2213	561.5336	591.8487	953.1921	1467.3070	1958.6667	2374.8759	(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													
	1130.5934	857.7479	678.8612	346.0894	131.7417	0.0000	0.0000	0.0000	0.0000	386.1561	788.4180	1158.8006	(98)
Space heating													
												5478.4082	(98)
Space heating per m2													(98) / (4) =
													56.7299 (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 %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5478.4082 (211)
Space heating requirement	1130.5934	857.7479	678.8612	346.0894	131.7417	0.0000	0.0000	0.0000	0.0000	386.1561	788.4180	1158.8006	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1130.5934	857.7479	678.8612	346.0894	131.7417	0.0000	0.0000	0.0000	0.0000	386.1561	788.4180	1158.8006	(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	151.0242	111.4816	86.4450	41.6395	13.2574	0.0000	0.0000	22.3053	46.0530	91.5341	128.1566	150.2903	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	151.0242	111.4816	86.4450	41.6395	13.2574	0.0000	0.0000	22.3053	46.0530	91.5341	128.1566	150.2903	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													5478.4082 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													80.0000 (231)
Electricity for lighting (calculated in Appendix L)													394.6473 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.00 * 1068 * 1.00) =										-2563.3692			-2563.3692 (233)
Total delivered energy for all uses													4231.8735 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5478.4082	13.1900	722.6020	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	842.1871	13.1900	111.0845	(247)
Pumps and fans for heating	30.0000	13.1900	3.9570	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	394.6473	13.1900	52.0540	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-2563.3692	13.1900	-338.1084	(252)
Total energy cost			558.1841	(255)

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

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			1.6560 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	76.8991
SAP rating (Section 12)			77 (258)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

SAP band

C

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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	5478.4082	0.5190	2843.2939 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	842.1871	0.5190	437.0951 (264)
Space and water heating			3280.3890 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	394.6473	0.5190	204.8219 (268)
Energy saving/generation technologies			
PV Unit	-2563.3692	0.5190	-1330.3886 (269)
Total kg/year			2196.3423 (272)
CO2 emissions per m2			22.7400 (273)
EI value			79.2110
EI rating			79 (274)
EI band			C

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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	45.0400 (1b)	2.5000 (2b)	112.6000 (1b) - (3b)
First floor	51.5300 (1c)	2.4000 (2c)	123.6720 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.5700		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.2720 (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				5 * 10 =	50.0000 (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) =				50.0000 / (5) =	0.2116 (8)
Pressure test				Yes	
Measured/design AP50					4.5000
Infiltration rate					0.4366 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4366 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.7000	3.4000	3.4000	3.3000	3.3000	3.0000	3.1000	2.9000	2.8000	3.0000	2.9000	3.2000 (22)
Wind factor	0.9250	0.8500	0.8500	0.8250	0.8250	0.7500	0.7750	0.7250	0.7000	0.7500	0.7250	0.8000 (22a)
Adj infilt rate												
Effective ac	0.4039	0.3711	0.3711	0.3602	0.3602	0.3275	0.3384	0.3165	0.3056	0.3275	0.3165	0.3493 (22b)
	0.5816	0.5689	0.5689	0.5649	0.5649	0.5536	0.5573	0.5501	0.5467	0.5536	0.5501	0.5610 (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
Entrance door			2.2000	1.4000	3.0800		(26)
Windows (Uw = 1.40)			28.9100	1.3258	38.3277		(27)
Rooflights (Uw = 1.40)			4.2000	1.3258	5.5682		(27a)
Ground floor			33.7100	0.1300	4.3823		(28a)
Exposed floor			11.3300	0.1900	2.1527		(28b)
External Wall 1	17.2600		17.2600	0.2200	3.7972		(29a)
External Wall 2	60.0300	6.7300	53.3000	0.2100	11.1930		(29a)
External Wall 3	27.9600		27.9600	0.2100	5.8716		(29a)
External Wall 4	51.5000	0.9300	50.5700	0.1700	8.5969		(29a)
External Wall 5	16.7500	7.5300	9.2200	0.1700	1.5674		(29a)
External Wall 8-9-10	20.8700	15.9200	4.9500	0.2600	1.2870		(29a)
External Roof 1	39.1000	4.2000	34.9000	0.0000	0.0000		(30)
External Roof 2	30.1300		30.1300	0.1300	3.9169		(30)
External Roof 3	7.4700		7.4700	0.1600	1.1952		(30)
Total net area of external elements Aum(A, m2)			281.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.9360	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							24.5193 (36)
Total fabric heat loss						(33) + (36) =	115.4553 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	45.3439	44.3545	44.3545	44.0433	44.0433	43.1654	43.4487	42.8913	42.6265	43.1654	42.8913	43.7413 (38)
Average = Sum(39)m / 12 =	160.7992	159.8098	159.8098	159.4986	159.4986	158.6207	158.9040	158.3466	158.0819	158.6207	158.3466	159.1967 (39)
												159.1278 (39)
HLP	1.6651	1.6549	1.6549	1.6516	1.6516	1.6425	1.6455	1.6397	1.6370	1.6425	1.6397	1.6485 (40)
HLP (average)												1.6478 (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												2.7054 (42)
Average daily hot water use (litres/day)												98.4538 (43)
Daily hot water use												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content	108.2992	104.3610	100.4229	96.4847	92.5466	88.6084	88.6084	92.5466	96.4847	100.4229	104.3610	108.2992 (44)
Energy content (annual)	160.6046	140.4658	144.9481	126.3693	121.2543	104.6333	96.9581	111.2608	112.5896	131.2124	143.2286	155.5370 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0907	21.0699	21.7422	18.9554	18.1881	15.6950	14.5437	16.6891	16.8884	19.6819	21.4843	23.3305 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.8520 (55)
Total storage loss												
26.4120	23.8560	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120	25.5600	26.4120	25.5600	26.4120	26.4120 (56)
If cylinder contains dedicated solar storage												
16.9791	15.3360	16.9791	16.4314	16.9791	16.4314	16.9791	16.9791	16.4314	16.9791	16.4314	16.9791	16.9791 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
177.5837	155.8018	161.9273	142.8007	138.2335	121.0647	113.9372	128.2400	129.0211	148.1915	159.6600	172.5161	172.5161 (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												1182.1574 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1986.0244 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2821 (H8)
Utilisation factor												0.5416 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												98.4538 (H14)
Volume ratio Veff/V												1.1731 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-945.7696 (H17)
Solar input	-30.6043	-43.3415	-74.1816	-101.4847	-121.5204	-129.8766	-125.9151	-111.1773	-86.8376	-60.3034	-35.5591	-24.9679 (63)
Solar input (sum of months) = Sum(63)m =												-945.7696 (63)
Output from w/h												
146.9794	112.4602	87.7457	41.3160	16.7131	0.0000	0.0000		17.0627	42.1834	87.8881	124.1009	147.5482 (64)
Total per year (kWh/year) = Sum(64)m =												823.9977 (64)
Heat gains from water heating, kWh/month												
66.9843	58.9737	61.7786	55.1629	53.9004	47.9357	45.8219		50.5775	50.5812	57.2114	60.7686	65.2994 (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	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254	162.3254 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8664	49.6200	40.3537	30.5504	22.8368	19.2798	20.8325	27.0788	36.3451	46.1485	53.8621	57.4191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	374.1201	378.0023	368.2193	347.3924	321.1022	296.3932	279.8860	276.0038	285.7868	306.6137	332.9038	357.6129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380	53.9380 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169	-108.2169 (71)
Water heating gains (Table 5)	90.0327	87.7584	83.0357	76.6152	72.4467	66.5774	61.5886	67.9806	70.2517	76.8971	84.4009	87.7679 (72)
Total internal gains	631.0656	626.4272	602.6551	565.6044	527.4322	493.2967	473.3534	482.1096	503.4300	540.7057	582.2133	613.8464 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
North	5.7300	13.0873	0.6300	0.7000	0.7700	22.9180 (74)						
East	9.1500	24.4516	0.6300	0.7000	0.7700	68.3754 (76)						
South	8.4800	55.0866	0.6300	0.7000	0.7700	142.7623 (78)						
West	5.5500	24.4516	0.6300	0.7000	0.7700	41.4736 (80)						
North	4.2000	18.5854	0.6300	0.7000	1.0000	30.9814 (82)						
Solar gains	306.5107	467.2645	708.5668	1010.4549	1197.5892	1340.0099	1249.8917	1080.4787	857.1764	581.2289	364.6537	252.5190 (83)
Total gains	937.5763	1093.6917	1311.2220	1576.0592	1725.0213	1833.3067	1723.2452	1562.5883	1360.6064	1121.9346	946.8670	866.3654 (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)												
tau	41.7057	41.9639	41.9639	42.0458	42.0458	42.2785	42.2031	42.3517	42.4226	42.2785	42.3517	42.1256
alpha	3.7804	3.7976	3.7976	3.8031	3.8031	3.8186	3.8135	3.8234	3.8282	3.8186	3.8234	3.8084
util living area	0.9853	0.9745	0.9374	0.8443	0.6877	0.4683	0.3374	0.3694	0.6556	0.8936	0.9723	0.9891 (86)
MIT	19.8504	19.9861	20.2874	20.6030	20.8157	20.9093	20.9248	20.9235	20.8598	20.5810	20.1567	19.7988 (87)
Th 2	19.5659	19.5734	19.5734	19.5757	19.5757	19.5823	19.5802	19.5843	19.5863	19.5823	19.5843	19.5780 (88)
util rest of house	0.9801	0.9657	0.9160	0.7955	0.6024	0.3571	0.2098	0.2308	0.5377	0.8459	0.9608	0.9852 (89)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

MIT 2	18.1026	18.3021	18.7253	19.1415	19.3841	19.4700	19.4756	19.4798	19.4428	19.1366	18.5584	18.0370 (90)
Living area fraction									fLA = Living area / (4) =			0.5336 (91)
MIT	19.0352	19.2007	19.5588	19.9214	20.1480	20.2380	20.2489	20.2502	20.1989	19.9074	19.4112	18.9771 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8852	19.0507	19.4088	19.7714	19.9980	20.0880	20.0989	20.1002	20.0489	19.7574	19.2612	18.8271 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9768	0.9616	0.9130	0.8031	0.6295	0.3978	0.2570	0.2821	0.5791	0.8529	0.9574	0.9824 (94)
Useful gains	915.8218	1051.6644	1197.1755	1265.7241	1085.9105	729.3429	442.8708	440.8175	787.9622	956.9025	906.4929	851.1196 (95)
Ext temp.	5.2000	5.5000	7.3000	9.6000	12.5000	15.4000	17.3000	17.3000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
2200.5702	2165.5330	1935.1118	1622.3183	1195.9277	743.6198	444.7583	443.3951	845.5670	1325.6517	1799.0157	2201.2324 (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	955.8528	748.5197	549.0247	256.7478	81.8527	0.0000	0.0000	0.0000	0.0000	274.3494	642.6164	1004.4839 (98)
Space heating												4513.4475 (98)
Space heating per m2												(98) / (4) = 46.7376 (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 %)												100.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4513.4475 (211)
Space heating requirement	955.8528	748.5197	549.0247	256.7478	81.8527	0.0000	0.0000	0.0000	0.0000	274.3494	642.6164	1004.4839 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	955.8528	748.5197	549.0247	256.7478	81.8527	0.0000	0.0000	0.0000	0.0000	274.3494	642.6164	1004.4839 (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	146.9794	112.4602	87.7457	41.3160	16.7131	0.0000	0.0000	17.0627	42.1834	87.8881	124.1009	147.5482 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	146.9794	112.4602	87.7457	41.3160	16.7131	0.0000	0.0000	17.0627	42.1834	87.8881	124.1009	147.5482 (219)
Water heating fuel used												823.9977 (219)
Annual totals kWh/year												
Space heating fuel - main system												4513.4475 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												394.6473 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 3.00 * 1160 * 1.00) =									-2784.8406			-2784.8406 (233)
Total delivered energy for all uses												3027.2519 (238)

#### 10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4513.4475	19.4400	877.4142 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	823.9977	19.4400	160.1852 (247)
Pumps and fans for heating	30.0000	19.4400	5.8320 (249)
Pump for solar water heating	50.0000	19.4400	9.7200 (249)
Energy for lighting	394.6473	19.4400	76.7194 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-2784.8406	19.4400	-541.3730 (252)
Total energy cost			588.4978 (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	4513.4475	0.5190	2342.4793 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

# FULL SAP CALCULATION PRINTOUT

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

Water heating (other fuel)	823.9977	0.5190	427.6548 (264)
Space and water heating			2770.1341 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	394.6473	0.5190	204.8219 (268)
Energy saving/generation technologies			
PV Unit	-2784.8406	0.5190	-1445.3323 (269)
Total kg/year			1571.1437 (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	4513.4475	3.0700	13856.2839 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	823.9977	3.0700	2529.6731 (264)
Space and water heating			16385.9569 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	394.6473	3.0700	1211.5671 (268)
Energy saving/generation technologies			
PV Unit	-2784.8406	3.0700	-8549.4607 (269)
Primary energy kWh/year			9293.6634 (272)
Primary energy kWh/m2/year			96.2376 (273)

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

##### Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	South East England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

##### Overheating Calculation

Summer ventilation heat loss coefficient	311.88 (P1)
Transmission heat loss coefficient	115.46 (37)
Summer heat loss coefficient	427.33 (P2)

##### Overhangs

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

##### Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
North	1.000	0.90	1.000	0.900 (P8)
North	1.000	1.00	1.000	1.000 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.7300	86.6589	0.6300	0.7000	0.9000	177.3745
East	9.1500	124.7972	0.6300	0.7000	0.9000	407.8962
South	8.4800	118.3991	0.6300	0.7000	0.9000	358.6474
West	5.5500	124.7972	0.6300	0.7000	0.9000	247.4124
North	4.2000	156.2874	0.6300	0.7000	1.0000	260.5279
total:						1451.8585

	Jun	Jul	Aug
Solar gains	1546	1452	1259 (P3)
Internal gains	500	480	489
Total summer gains	2046	1932	1748 (P5)
Summer gain/loss ratio	4.79	4.52	4.09 (P6)
Summer external temperature	15.40	17.40	17.50
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25
Threshold temperature	20.44	22.17	21.84 (P7)
Likelihood of high internal temperature	Not significant	Medium	Slight
Assessment of likelihood of high internal temperature:	Medium		

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Property Reference	22038		Issued on Date	17/02/2022	
Assessment Reference	As design	Prop Type Ref			
Property	116, High Street, Billingshurst, RH14 9QX				
SAP Rating	72 C	DER	31.63	TER	31.91
Environmental	75 C	% DER<TER	0.89		
CO <sub>2</sub> Emissions (t/year)	2.07	DFEE	68.20	TREE	74.37
General Requirements Compliance	Pass	% DFEE<TFEE	8.29		
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com			Assessor ID	H664-0001
Client	Adiuvo, 22038				

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

#### 6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	33.04 m	45.04 m <sup>2</sup>	2.50 m
1st Storey:	43.29 m	51.53 m <sup>2</sup>	2.40 m

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

8.0 Thermal Mass Parameter   
 Thermal Mass  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> )
External Wall 1	Solid Wall	0.22	17.26	17.26
External Wall 2	Cavity Wall	0.21	60.03	53.30
External Wall 3	Cavity Wall	0.21	27.96	27.96
External Wall 4	Timber Frame	0.17	51.50	50.57
External Wall 5	Timber Frame	0.17	16.75	9.22
External Wall 8-9-10	Timber Frame	0.26	20.87	4.95

#### 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> )
External Roof 1	External Slope Roof	0.00	39.10	34.90
External Roof 2	External Slope Roof	0.13	30.13	30.13
External Roof 3	External Flat Roof	0.16	7.47	7.47

#### 11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Area (m <sup>2</sup> )
Ground floor	Ground Floor - Solid		0.13	33.71
Exposed floor	Exposed Floor - Timber		0.19	11.33

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

### 12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
Entrance door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Rooflights	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40

### 13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m <sup>2</sup> )	Curtain Closed
Entrance	Solid Door	[5] External Wall 5	East							2.20	
East windows	Window	[5] External Wall 5	East	None	0.00					5.33	
East window	Window	[6] External Wall 8-9-10	East	None	0.00					3.82	
Rear door	Window	[2] External Wall 2	West	None	0.00					1.93	
West window	Window	[6] External Wall 8-9-10	West	None	0.00					3.62	
South window	Window	[6] External Wall 8-9-10	South	None	0.00					8.48	
North windows	Window	[2] External Wall 2	North	None	0.00					4.80	
Opening 8	Window	[4] External Wall 4	North	None	0.00					0.93	
Rooflights	Roof Window	[1] External Roof 1	North	None						4.20	

### 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)	18.68	0.050	No	Catnic
Table K1 - Approved	E3 Sill	7.10	0.040	No	
Table K1 - Approved	E4 Jamb	39.15	0.050	No	
Table K1 - Approved	E5 Ground floor (normal)	33.04	0.160	No	
Table K1 - Default	E20 Exposed floor (normal)	13.52	0.320	No	
Table K1 - Approved	E6 Intermediate floor within a dwelling	33.25	0.070	No	
Table K1 - Approved	E11 Eaves (insulation at rafter level)	28.48	0.040	No	
Table K1 - Approved	E12 Gable (insulation at ceiling level)	14.49	0.240	No	
Table K1 - Default	E14 Flat roof	3.75	0.080	No	
Table K1 - Approved	E16 Corner (normal)	24.60	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	11.17	-0.090	No	
Table K1 - Default	R1 Head of roof window	3.50	0.080	No	
Table K1 - Default	R2 Sill of roof window	3.50	0.060	No	
Table K1 - Default	R3 Jamb of roof window	18.80	0.080	No	
Table K1 - Default	R4 Ridge (vaulted ceiling)	16.05	0.080	No	

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

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Cross ventilation possible

Night Ventilation

Air change rate

### Mechanical Ventilation

Mechanical Ventilation System Present

### 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				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

### 22.0 Lighting

#### Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings  %

#### External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat  %

Main Heating

SAP Code

Efficiency (SAP Table)  %

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Is MHS Pumped

Heat Emitter

Underfloor Heating

25.0 Main Heating 2

Community Heating

### 28.0 Water Heating

HWP From main heating 1

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Water use <= 125 litres/person/day	Yes			
SAP Code	901			
Immersion Heater	Dual			
<b>29.0 Hot Water Cylinder</b>	Hot Water Cylinder			
Cylinder In Heated Space	Yes			
Insulation Type	Measured Loss			
Cylinder Volume	210.00			L
Loss	1.42			kWh/day
<b>31.0 Thermal Store</b>	None			
<b>32.0 Photovoltaic Unit</b>	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.00	South	45°	None Or Little	Yes

### Recommendations

#### Lower cost measures

None

#### Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£185	C 77	