

# PREDICTED ENERGY ASSESSMENT

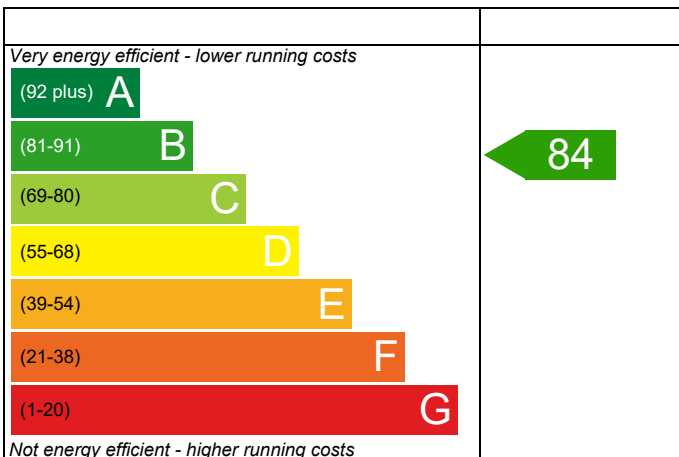
7, Woodcroft Lane,  
WATERLOOVILLE,  
Hampshire,  
PO8 9PY

Dwelling type: House, Detached  
Date of assessment: 31/03/2020  
Produced by: SRE Limited  
Total floor area: 94 m<sup>2</sup>  
DRRN: 1409-2607-7600

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

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

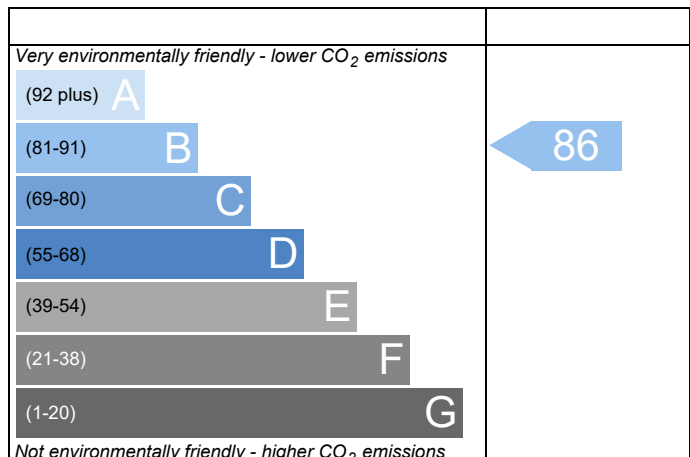
## Energy Efficiency Rating



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

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

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



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

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

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

Property Reference	EXBU-WOOD-2166-D-07		Issued on Date	31/03/2020	
Assessment Reference	DF Detached	Prop Type Ref			
Property	7, Woodcroft Lane, WATERLOOVILLE, Hampshire, PO8 9PY				
SAP Rating	84 B	DER	17.12	TER	18.02
Environmental	86 B	% DER<TER	4.99		
CO <sub>2</sub> Emissions (t/year)	1.33	DFEE	52.87	TFEE	54.04
General Requirements Compliance	Pass	% DFEE<TFEE	2.16		
Assessor Details	Mr. Malcolm Maclean, SRE Limited, Tel: 01730 710044, malcolm@sre.co.uk		Assessor ID	V497-0002	
Client					

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

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

##### 1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.02	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	17.12	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-0.90 (-5.0%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.04	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	52.87	kWh/m <sup>2</sup> /yr	
	-1.1 (-2.0%)	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	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	1.50 (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

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# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas  
Data from database  
Vaillant ecoTEC exclusive 835 VUW 356/5-7 (H-GB)  
Combi boiler  
Efficiency: 89.7% SEDBUK2009  
Minimum: 88.0%

Pass

Secondary heating system

None

### 5 Cylinder insulation

Hot water storage

No cylinder

### 6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

### 7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

### 8 Mechanical ventilation

Not applicable

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

### 9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

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

Windows facing East

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

Windows facing South

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

Air change rate

4.00 ach

Blinds/curtains

Light-coloured curtain or roller blind, closed 100% of daylight hours

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

### Party Walls

Type

U-value

W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

4.50 (design value) m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Maximum

10.0 m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Pass

### 10 Key features

Party wall U-value

0.00 W/m<sup>2</sup>K

Roof U-value

0.11 W/m<sup>2</sup>K

Floor U-value

0.12 W/m<sup>2</sup>K

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Property Reference	EXBU-WOOD-2166-D-07			Issued on Date	31/03/2020
Assessment Reference	DF Detached	Prop Type Ref			
Property	7, Woodcroft Lane, WATERLOOVILLE, Hampshire, PO8 9PY				
SAP Rating	84 B	DER	17.12	TER	18.02
Environmental	86 B	% DER<TER	4.99		
CO <sub>2</sub> Emissions (t/year)	1.33	DFEE	52.87	TFEE	54.04
General Requirements Compliance	Pass	% DFEE<TFEE	2.16		
Assessor Details	Mr. Malcolm Maclean, SRE Limited, Tel: 01730 710044, malcolm@sre.co.uk			Assessor ID	V497-0002
Client					

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 94 m<sup>2</sup>

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

1a TER and DER

Fuel for main heating:Mains gas  
Fuel factor:1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 18.02 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 17.12 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.0 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)52.9 kWh/m<sup>2</sup>/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (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 - Mains gas

Data from database

Vaillant ecoTEC exclusive 835 VUW 356/5-7 (H-GB)

Combi boiler

Efficiency: 89.7% SEDBUK2009

Minimum: 88.0%

OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:

Average

Windows facing North: 8.06 m<sup>2</sup>, No overhang

Windows facing East: 3.00 m<sup>2</sup>, No overhang

Windows facing South: 5.63 m<sup>2</sup>, No overhang

Air change rate: 4.00 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

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

Roof U-value 0.11 W/m<sup>2</sup>K

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	47.0000 (1b)	2.4500 (2b)	115.1500 (1b) - (3b)
First floor	47.0000 (1c)	2.7000 (2c)	126.9000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.0500 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1239 (8)
Pressure test				Yes	
Measured/design AP50					4.5000
Infiltration rate					0.3489 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3228 (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	0.4115	0.4035	0.3954	0.3550	0.3470	0.3066	0.3066	0.2986	0.3228	0.3470	0.3631	0.3793 (22b)
	0.5847	0.5814	0.5782	0.5630	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5659	0.5719 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows Normal (Uw = 1.40)			14.1300	1.3258	18.7330		(27)
Front Door			2.2700	1.5000	3.4050		(26a)
Semi Transparent (Uw = 1.40)			1.2900	1.3258	1.7102		(27)
'Spandrel' (Uw = 1.40)			1.2700	1.3258	1.6837		(27)
Ground Floor			47.0000	0.1200	5.6400	75.0000	3525.0000 (28a)
Ext Wall	99.9100	18.9600	80.9500	0.2100	16.9995	110.0000	8904.5000 (29a)
Ceiling Roof	47.0000		47.0000	0.1100	5.1700	9.0000	423.0000 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			193.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.3414		(33)
Internal Wall 1			25.0000			9.0000	225.0000 (32c)
Internal Wall 2			14.0000			75.0000	1050.0000 (32c)
Internal Floor 1			47.0000			18.0000	846.0000 (32d)
Internal Ceiling 1			47.0000			18.0000	846.0000 (32e)
Internal Ceiling 2			47.0000			18.0000	846.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16665.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							177.2926 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.5987 (36)
Total fabric heat loss						(33) + (36) =	72.9401 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	46.7022	46.4395	46.1821	44.9728	44.7466	43.6934	43.6934	43.4983	44.0991	44.7466	45.2043	45.6828 (38)
Heat transfer coeff	119.6423	119.3796	119.1222	117.9129	117.6867	116.6335	116.6335	116.4384	117.0391	117.6867	118.1444	118.6229 (39)
Average = Sum(39)m / 12 =												117.9118 (39)
HLP	1.2728	1.2700	1.2673	1.2544	1.2520	1.2408	1.2408	1.2387	1.2451	1.2520	1.2569	1.2619 (40)
HLP (average)												1.2544 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy content (annual)	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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)
Combi loss	4.2507	3.8394	4.2507	4.1136	4.2507	4.1136	4.2507	4.2507	4.1136	4.2507	4.1136	4.2507 (61)
Total heat required for water heating calculated for each month	163.7390	143.3288	148.1914	129.6045	124.6623	108.0196	100.5349	114.7382	115.9207	134.5511	146.3467	158.7066 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
FGHRS	-50.9350	-43.3083	-42.0546	-33.8554	-28.9745	-15.4924	-14.4301	-16.3821	-16.5577	-34.1037	-42.1700	-50.4737 eq. (G2)
Output from w/h	112.8040	100.0205	106.1368	95.7492	95.6877	92.5272	86.1048	98.3561	99.3629	100.4474	104.1767	108.2329 (64)
Heat gains from water heating, kWh/month	54.0925	47.3401	48.9229	42.7541	41.0995	35.5771	33.0772	37.7998	38.2043	44.3876	48.3209	52.4193 (65)
Total per year (kWh/year) = Sum(64)m = 1199.6062 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4719	19.9593	16.2320	12.2887	9.1859	7.7551	8.3797	10.8923	14.6196	18.5629	21.6657	23.0964 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831 (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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644 (71)
Water heating gains (Table 5)	72.7050	70.4466	65.7566	59.3807	55.2413	49.4127	44.4586	50.8062	53.0615	59.6607	67.1123	70.4560 (72)
Total internal gains	407.5734	405.3577	390.5013	366.4737	341.9272	318.4042	303.2096	309.5144	321.9363	346.1871	374.0458	395.0839 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W						
North	8.0600	10.6334	0.6300	0.7000	0.7700	26.1926 (74)						
East	2.3800	19.6403	0.6300	0.7000	0.7700	14.2855 (76)						
South	3.6900	46.7521	0.6300	0.7000	0.7700	52.7229 (78)						
East	0.6200	19.6403	0.4000	0.7000	0.7700	2.3628 (76)						
South	0.6700	46.7521	0.4000	0.7000	0.7700	6.0781 (78)						
South	1.2700	46.7521	0.0000	0.7000	0.7700	0.0000 (78)						
Solar gains	101.6419	178.9239	261.3608	353.4887	424.3829	434.1958	413.2230	358.1191	292.7877	202.0982	122.7697	86.3357 (83)
Total gains	509.2153	584.2816	651.8621	719.9624	766.3101	752.6000	716.4326	667.6335	614.7240	548.2853	496.8155	481.4196 (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)	38.6929	38.7780	38.8618	39.2604	39.3359	39.6911	39.6911	39.7575	39.5535	39.3359	39.1835	39.0254
alpha	3.5795	3.5852	3.5908	3.6174	3.6224	3.6461	3.6461	3.6505	3.6369	3.6224	3.6122	3.6017
util living area	0.9944	0.9902	0.9810	0.9564	0.8979	0.7815	0.6399	0.6915	0.8767	0.9691	0.9907	0.9954 (86)
MIT	19.1193	19.3051	19.6268	20.0654	20.4851	20.7990	20.9305	20.9061	20.6591	20.1226	19.5447	19.0869 (87)
Th 2	19.8622	19.8644	19.8666	19.8767	19.8786	19.8875	19.8875	19.8892	19.8841	19.8786	19.8748	19.8708 (88)
util rest of house	0.9930	0.9877	0.9757	0.9430	0.8630	0.7008	0.5083	0.5654	0.8205	0.9572	0.9878	0.9943 (89)
MIT 2	17.3577	17.6298	18.0985	18.7356	19.3197	19.7215	19.8516	19.8356	19.5633	18.8263	17.9871	17.3156 (90)
Living area fraction	FLA = Living area / (4) = 0.2638 (91)											
MIT	17.8225	18.0718	18.5017	19.0864	19.6272	20.0057	20.1362	20.1180	19.8524	19.1683	18.3981	17.7829 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8225	18.0718	18.5017	19.0864	19.6272	20.0057	20.1362	20.1180	19.8524	19.1683	18.3981	17.7829 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	503.6194	573.6139	630.1346	669.9714	653.9476	534.8109	387.1263	396.7925	503.1515	519.0117	487.9410	477.0497 (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	1617.8634	1572.4428	1429.6713	1201.1126	932.9260	630.4910	412.4441	432.9166	673.2581	1008.3741	1334.8011	1611.2478 (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	828.9976	671.2130	594.8553	382.4216	207.5599	0.0000	0.0000	0.0000	0.0000	364.0856	609.7393	843.8434 (98)
Space heating	4502.7157 (98)											

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Space heating per m2

(98) / (4) = 47.9012 (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 %)	90.6000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4969.8849 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	828.9976	671.2130	594.8553	382.4216	207.5599	0.0000	0.0000	0.0000	0.0000	364.0856	609.7393	843.8434	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	915.0083	740.8532	656.5732	422.0989	229.0948	0.0000	0.0000	0.0000	0.0000	401.8605	673.0014	931.3945	(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	112.8040	100.0205	106.1368	95.7492	95.6877	92.5272	86.1048	98.3561	99.3629	100.4474	104.1767	108.2329	(64)
Efficiency of water heater (217)m	90.1660	90.1303	90.0521	89.8768	89.4656	87.1000	87.1000	87.1000	87.1000	89.8196	90.0718	87.1000	(216)
Fuel for water heating, kWh/month	125.1070	110.9732	117.8615	106.5338	106.9548	106.2310	98.8574	112.9232	114.0792	111.8325	115.6595	120.0081	(219)
Water heating fuel used												1347.0211	(219)
Annual totals kWh/year													
Space heating fuel - main system												4969.8849	(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)	396.8603 (232)
Total delivered energy for all uses	6788.7663 (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	4969.8849	0.2160	1073.4951	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1347.0211	0.2160	290.9566	(264)
Space and water heating			1364.4517	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8603	0.5190	205.9705	(268)
Total CO2, kg/year			1609.3472	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1200	(273)

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

DER		17.1200	ZC1
Total Floor Area	TFA	94.0000	
Assumed number of occupants	N	2.6766	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5235	ZC2
CO2 emissions from cooking, equation (L16)		1.9493	ZC3
Total CO2 emissions		34.5929	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.5929	ZC8



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	47.0000 (1b)	2.4500 (2b)	115.1500 (1b) - (3b)
First floor	47.0000 (1c)	2.7000 (2c)	126.9000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 242.0500 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1239 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3739 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3459 (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	0.4410	0.4324	0.4237	0.3805	0.3718	0.3286	0.3286	0.3200	0.3459	0.3718	0.3891	0.4064 (22b)
Effective ac	0.5972	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
TER Semi-glazed door			2.2700	1.2000	2.7240		(26a)					
TER Opening Type (Uw = 1.40)			16.6900	1.3258	22.1269		(27)					
Ground Floor			47.0000	0.1300	6.1100		(28a)					
Ext Wall	99.9100	18.9600	80.9500	0.1800	14.5710		(29a)					
Ceiling Roof	47.0000		47.0000	0.1300	6.1100		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			193.9100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		51.6419 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1526 (36)					
Total fabric heat loss						(33) + (36) =	62.7945 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 47.7061	Feb 47.4044	Mar 47.1088	Apr 45.7201	May 45.4602	Jun 44.2507	Jul 44.2507	Aug 44.0267	Sep 44.7166	Oct 45.4602	Nov 45.9859	Dec 46.5354 (38)
Heat transfer coeff	110.5006	110.1989	109.9033	108.5146	108.2547	107.0452	107.0452	106.8212	107.5111	108.2547	108.7804	109.3299 (39)
Average = Sum(39)m / 12 =												108.5133 (39)
HLP	Jan 1.1755	Feb 1.1723	Mar 1.1692	Apr 1.1544	May 1.1516	Jun 1.1388	Jul 1.1388	Aug 1.1364	Sep 1.1437	Oct 1.1516	Nov 1.1572	Dec 1.1631 (40)
HLP (average)												1.1544 (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												2.6766 (42)
Average daily hot water use (litres/day)												97.7695 (43)
Daily hot water use	107.5465	103.6357	99.7249	95.8141	91.9033	87.9926	87.9926	91.9033	95.8141	99.7249	103.6357	107.5465 (44)
Energy conte	159.4883	139.4895	143.9406	125.4909	120.4115	103.9060	96.2842	110.4875	111.8071	130.3004	142.2331	154.4559 (45)
Energy content (annual)												Total = Sum(45)m = 1538.2950 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.9232	20.9234	21.5911	18.8236	18.0617	15.5859	14.4426	16.5731	16.7711	19.5451	21.3350	23.1684 (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												

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.8187	47.2508	46.8329	43.3936	44.8400	46.8329	47.2508	50.8187	49.3151	50.9589	61								
Solar input	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148	(62)								
Output from w/h	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)								
Heat gains from water heating, kWh/month	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148	(64)								
	65.7696	57.8871	60.5649	53.5384	51.7451	45.3971	43.2245	48.4453	48.9886	56.0296	59.6213	64.0963	(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)
(66)m	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	133.8305	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4719	19.9593	16.2320	12.2887	9.1859	7.7551	8.3797	10.8923	14.6196	18.5629	21.6657	23.0964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.2474	248.8027	242.3634	228.6551	211.3508	195.0872	184.2221	181.6668	188.1061	201.8144	219.1187	235.3823	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	36.3831	(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)	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	-107.0644	(71)
Water heating gains (Table 5)	88.4000	86.1415	81.4045	74.3589	69.5498	63.0516	58.0975	65.1147	68.0397	75.3085	82.8073	86.1510	(72)
Total internal gains	423.2684	421.0526	406.1491	381.4519	356.2357	332.0431	316.8484	323.8230	336.9144	361.8350	389.7408	410.7788	(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	(74)					
North	8.0600	10.6334	0.6300	0.7000	0.7700	26.1926	(74)						
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(76)						
South	5.6300	46.7521	0.6300	0.7000	0.7700	80.4417	(78)						
Solar gains	124.6412	217.0236	310.8845	410.8978	485.3779	493.3748	470.8442	413.2222	345.0393	243.4792	150.1153	106.1525	(83)
Total gains	547.9096	638.0762	717.0336	792.3497	841.6136	825.4179	787.6927	737.0451	681.9538	605.3142	539.8561	516.9313	(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	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	59.0746	59.2363	59.3957	60.1558	60.3002	60.9815	60.9815	61.1094	60.7172	60.3002	60.0088	59.7072	(85)
tau	4.9383	4.9491	4.9597	5.0104	5.0200	5.0654	5.0654	5.0740	5.0478	5.0200	5.0006	4.9805	(86)
util living area	0.9983	0.9959	0.9894	0.9668	0.8989	0.7489	0.5794	0.6356	0.8677	0.9790	0.9963	0.9987	(86)
MIT	19.7088	19.8669	20.1197	20.4540	20.7500	20.9330	20.9853	20.9771	20.8499	20.4674	20.0279	19.6838	(87)
Th 2	19.9396	19.9422	19.9447	19.9566	19.9589	19.9693	19.9693	19.9712	19.9653	19.9589	19.9544	19.9496	(88)
util rest of house	0.9976	0.9945	0.9855	0.9537	0.8580	0.6583	0.4531	0.5086	0.8003	0.9682	0.9947	0.9983	(89)
MIT 2	18.2186	18.4512	18.8205	19.3072	19.7074	19.9232	19.9638	19.9615	19.8411	19.3341	18.6957	18.1892	(90)
Living area fraction	18.6117	18.8247	19.1633	19.6098	19.9825	20.1896	20.2333	20.2294	20.1072	19.6331	19.0472	18.5836	(92)
Temperature adjustment	18.6117	18.8247	19.1633	19.6098	19.9825	20.1896	20.2333	20.2294	20.1072	19.6331	19.0472	18.5836	(93)
adjusted MIT													

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Useful gains	545.9978	633.2041	703.8195	751.2418	723.0491	560.7403	383.3308	399.6231	553.1615	583.3302	535.9345	515.5684	(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	1581.4560	1534.4872	1391.7353	1162.1672	896.6152	598.3449	388.9255	409.0648	645.8414	977.8784	1299.6154	1572.5521	(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	770.3809	605.6623	511.8093	295.8663	129.1331	0.0000	0.0000	0.0000	0.0000	293.5439	549.8503	786.3958	(98)
Space heating												3942.6420	(98)
Space heating per m2												41.9430	(99)

#### 8c. Space cooling requirement

Not applicable

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4221.2441 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	770.3809	605.6623	511.8093	295.8663	129.1331	0.0000	0.0000	0.0000	0.0000	293.5439	549.8503	786.3958 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	824.8190	648.4607	547.9757	316.7734	138.2582	0.0000	0.0000	0.0000	0.0000	314.2868	588.7048	841.9656 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	210.4472	185.5169	194.7594	172.7417	167.2445	147.2996	141.1242	157.3204	159.0579	181.1191	191.5481	205.4148 (64)
Efficiency of water heater (217)m	88.0245	87.8102	87.3709	86.3943	84.4090	80.3000	80.3000	80.3000	80.3000	86.2601	87.5548	80.3000 (216)
Fuel for water heating, kWh/month	239.0780	211.2702	222.9111	199.9458	198.1359	183.4366	175.7462	195.9159	198.0796	209.9687	218.7751	233.1481 (219)
Water heating fuel used												2486.4111 (219)
Annual totals kWh/year												
Space heating fuel - main system												4221.2441 (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)												396.8603 (232)
Total delivered energy for all uses												7179.5155 (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	4221.2441	0.2160	911.7887 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2486.4111	0.2160	537.0648 (264)
Space and water heating			1448.8535 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.8603	0.5190	205.9705 (268)
Total CO2, kg/m2/year			1693.7490 (272)
Emissions per m2 for space and water heating			15.4133 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1912 (272b)
Emissions per m2 for pumps and fans			0.4141 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4133 * 1.00) + 2.1912 + 0.4141, rounded to 2 d.p.			18.0200 (273)