



CANAL MEWS

ENERGY STATEMENT

FEBRUARY 2021

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DOCUMENT CONTROL SHEET

Report Reference	MW086/ES/CM/202102-EC
Revision	
Issue Purpose	Planning Condition 16
Report Prepared For	Seaward Properties Ltd
Author	Edward Coate
Approved By	Neil Rothern
Date of Initial Issue	09/07/2020

DISCLAIMER

The information contained within this Report is based on Drawings and Specifications provided by the Design Team along with information assumed by NRG Consulting for the purposes of compliance where no other information was available. Any budget costs or plant sizing contained within this document are based upon available information and are to be taken as an estimation and guideline only.

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1. EXECUTIVE SUMMARY

- 1.1 NRG Consulting have been appointed to undertake an Energy Statement on a proposed development at the land off Canal Mews, Barnham, PO22 0DP
- 1.2 The proposed scheme is for 2 dwellings.
- 1.3 This document has been produced in adherence to the planning condition (16) associated with this development within Arun District Council. This planning condition states:

- 16) At least 10% of the energy supply of the development shall be secured from decentralised or low carbon energy sources (as described in glossary at Annex 2 of the NPPF) unless it can be demonstrated that a fabric-first approach would be achieved an equivalent energy saving. Details and a timetable of how this it to be achieved, including details of physical works on site, shall be submitted to and approved by the Local Planning Authority before any development above damp proof course (DPC) level begins. The development shall be implemented in accordance with the approved details and timetable and retained as operational thereafter, unless otherwise agreed in writing by the Local Planning Authority.

Reason: In order to secure on site renewable energy in accordance with national planning policy, and in accordance with Policy ECC SP2 of the Arun Local Plan.

- 1.4 This document illustrates a reduction 16.18% in CO₂ emissions over that of the baseline of Part L SAP 2012, where <10% of the energy is from low carbon sources in the form of PV. Overall via:

“Energy Efficiency Measures”

- U-Values are at least 50% better than the Part L limiting parameters.
- Air Permeability 50% better than the Part L limiting parameter.
- Natural Ventilation
- 100% low energy lighting

therefore the site will be proposing on-site heating comprising of individual Gas Boilers.

“Renewable Energy”

- Provision of PV Array at the development of 1.30 kWp over 4 panels, 2 for each dwelling.
- 1.5 Overall, the scheme achieves a 16.18% reduction in CO₂ over that of the Part L baseline under SAP

FINAL CARBON EMISSIONS – SAP 2012		
	CO ₂ Emissions (Tonnes per Annum)	
	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	3.53	Renewable Energy Contribution 13.82%
DER: Pre-PV	3.45	
DER: PV	2.96	
Overall Reduction	16.18%	

2. POLICY FRAMEWORK

- 2.1 The proposed development falls within the Government's "minor" category of planning applications.

KEY POLICIES AND REFERENCE DOCUMENT SUMMARY

This document has been produced to satisfy and written in adherence too:

NATIONAL PLANNING POLICY FRAMEWORK (2019)

14. Meeting the challenge of climate change, flooding and coastal change
 "151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including landscape and visual impacts);
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

153. In determining planning applications, local planning authorities should expect new development to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

154. When determining planning applications for renewable and low carbon development, local planning authorities should:

- a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
- b) approve the application if its impacts are (or can be made) acceptable."



Figure 1: Proposed Site Plan

3. ENERGY CALCULATIONS – SAP 2012

3.1 In order to estimate the predicted energy demand and regulated CO₂ emissions for the site, sample SAP Calculations have been carried out by a licensed OCDEA (SAP) Assessor using Elmhurst Design SAP 2012.

3.2 The baseline CO₂ emissions covered by Part L 2013 of the Building Regulations will be expressed as the Target Emissions Rate (TER), obtained from the SAP calculations. SAP Calculations cover regulated energy use that comprises of:

- Heating
- Hot Water
- Lighting
- Pumps and Fans

PASSIVE AND ACTIVE DESIGN

The design of the development prioritises passive measures to minimise heat loss. The U-values and the air permeability rate have been selected to exceed the minimum requirements of the Building Regulation and the development will incorporate efficient building services to limit carbon emissions, including a low-NO_x heating system and low energy lighting. The proposed building services are compliant with the recommendations of the Domestic Building Services Compliance Guide (2013).

	CO ₂ Emissions (Tonnes per Annum)
	Regulated
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	3.53
Be Lean: Energy Demand Reduction	3.45
Regulated CO₂ Savings at 'Be Lean' over Part L 2013	2.36%

ELEMENT	PART L1A LIMITING FABRIC PARAMETERS	PROPOSED U-VALUES (W/m ² K)
<i>Walls</i>		
External Wall	0.3 W/m ² K	0.20 W/m²K
<i>Floors</i>		
Ground Floor	0.25 W/m ² K	0.14 W/m²K
<i>Roof</i>		
Main Roof	0.2 W/m ² K	0.12 W/m²K
<i>Openings</i>		
Windows	2.2 W/m ² K	1.4 W/m²K
<i>Thermal Bridging</i>		
A mix of Kingspan K108 TB Details and ACDs.		

Table 1: Proposed Fabric Specification

ELEMENT	PROPOSED DETAILS
Air Permeability	5 m³/(hm²) @50Pa
Ventilation	System 1 – Intermittent fans and trickle vents
Heating	Mains Gas Combi Boiler. 89.5% Efficient.
Hot Water	From Boiler
Heating Controls	Room Thermostats and TRVs.
Heat Emitters	Radiators
Lighting	100% Low Energy

Table 2: Proposed Mechanical and Electrical Specification

4. RENEWABLE ENERGY (“Be Green”)

- 4.1 In order to achieve the required CO₂ reduction, the implementation of low carbon or renewable technology will be required.
- 4.2 Based on this development’s location and objectives, and based on recent legislation such as the Clean Air Act, the following technologies have been automatically discounted:
- Wind Turbines
 - Biomass
 - Hydropower / Wave Technology
 - Biogas / Biofuel
- 4.3 The feasibility of remaining renewable and low carbon technologies is highlighted below. Following this review, a PV Array has been chosen as the most suited technology for the scheme.

FEASIBILITY

Technology	Feasibility					Overall Feasibility
	Cost	Noise	Land Use	Tariffs	CO ₂ Offset	
Photovoltaic Panels (PV)	✓	✓	✓	✗	✓	
Air Source Heat Pumps	✓	✗	✗	✓	✓	
Ground Source Heat Pumps	✗	✓	✗	✓	✓	
Solar Thermal	✓	✓	✗	✓	✗	

- 4.4 In terms of Photovoltaic Panels, for the needs of this development, both in cost and carbon reduction targets, on-site installation of PV is appropriate. The details and requirements of this can be found below in Table 3.

Residential Properties - PV System Details – Part L 2013	
CO ₂ Reduction Required	0.353 tonnes CO₂/year
CO ₂ Offset via 1kWp	0.422 tonnes CO₂/year
PV Required for Target	0.84 kWp
PV Proposed	1.30 kWp
Total CO ₂ offset via PV	0.489 tonnes CO₂/year
Module Output	325 Watts (Datasheet in Appendices)
Number of Panels	4
Panel Orientation	South-West
Tilt of Collectors	45°

Table 3: Proposed PV Specification



Figure 2: Proposed PV Drawing (for illustration only – not for Construction)

Appendix 1



Canal Mews

RESIDENTIAL UNITS

All Plots	AREA	TER <i>Part L 2013 Baseline</i>	Total TER	DER 'Be Lean'	Total DER 'Be Lean'	DER 'Be Green'	Total DER 'Be Green'
	m ²	kg CO2/m ² /yr	kg CO2/yr	kg CO2/m ² /yr	kg CO2/yr	kg CO2/m ² /yr	kg CO2/yr
Bungalow 1	84.1	20.0	1685.4	19.5	1641.6	16.9	1424.7
Bungalow 2	94.3	19.6	1848.7	19.2	1809.1	16.3	1537.4
Total Site Area (m ²):	178	TOTAL TER CO2:	3,534	TOTAL DER CO2:	3,451		2,962

Total Site TER	3,534	kg CO2/yr
Total Site DER	3,451	kg CO2/yr
CO2 Savings at 'Be Lean'	2.36%	%

CO2 Offset Required for 35% Reduction	353	kg CO2/yr
CO2 Offset via 1kWp PV	422	kg CO2/yr
PV Required for 35% CO2 Reduction	0.84	kWp
PV Proposed	1.30	kWp
Total CO2 Offset via Proposed PV	549	kg CO2/yr

Final CO2 Emissions at 'Be Green'	2,962	kg CO2/yr
CO2 Savings at 'Be Green'	16.18	%

OVERALL RESULTS		
CO2 Reduction at 'Be Lean'	83	kg CO2/yr
CO2 Reduction at 'Be Green'	489	kg CO2/yr

Total CO2 Reduction	572	kg CO2/yr
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Appendix 2



SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	Bungalow 1	Issued on Date	09/02/2021
Assessment Reference	001	Prop Type Ref	
Property	Canal Mews , Bognor Regis, Barnham		
SAP Rating	85 B	DER	16.94
Environmental	87 B	TER	20.04
CO ₂ Emissions (t/year)	1.11	% DER<TER	15.49
General Requirements Compliance	Pass	DFEE	50.70
		TFEE	62.43
		% DFEE<TFEE	18.79
Assessor Details	Mr. Neil Rotheron, Neil Rotheron, Tel: 02037358169, neil@nrgconsulting.org		Assessor ID
Client			L759-0001

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

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Bungalow, Detached
2.0 Number of Storeys	1
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
		38.00 m	84.10 m ²	2.45 m

7.0 Living Area	24.19	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	0.20	93.10	73.77

10.0 External Roofs

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Flat Roof	0.12	84.10	84.10

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Heat Loss Floor 1	Ground Floor - Solid		0.14	84.10

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.40
Opening Type 2	Manufacturer	Solid Door							1.40

13.0 Openings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					2.43	100
Opening 2	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					0.66	100
Opening 3	Solid Door	[1] External Wall 1	North East							2.10	
Opening 4	Window	[1] External Wall 1	South East	Dark-coloured curtain or roller blind	0.00					1.56	100
Opening 5	Window	[1] External Wall 1	North West	Dark-coloured curtain or roller blind	0.00					1.56	100
Opening 6	Window	[1] External Wall 1	North West	Dark-coloured curtain or roller blind	0.00					3.57	100
Opening 7	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					3.13	100
Opening 8	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					1.44	100
Opening 9	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					0.63	100
Opening 10	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					2.25	100

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
Independently assessed	E2 Other lintels (including other steel lintels)	13.70	0.161	Yes
Independently assessed	E3 Sill	12.70	0.002	Yes
Independently assessed	E4 Jamb	30.30	0.001	Yes
Independently assessed	E5 Ground floor (normal)	38.00	0.074	Yes
Independently assessed	E10 Eaves (insulation at ceiling level)	38.00	0.026	No
Independently assessed	E16 Corner (normal)	9.80	0.040	Yes

Y-value

W/m²K

18.0 Pressure Testing

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	6.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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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				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	1	
Total number of L.E.L. fittings	1	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Manufacturer	
Description	DEF	
Percentage of Heat	100	%
Main Heating	BGW	
SAP Code	104	
Efficiency (Manufacturer)	89.5	%
Model Name	DEFAULT	
Manufacturer	DEFAULT	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2106	
Burner Control	On/Off	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

HWP From main heating 1

Water Heating

Main Heating 1

Flue Gas Heat Recovery System

No

Waste Water Heat Recovery
Instantaneous System 1

No

Waste Water Heat Recovery
Instantaneous System 2

No

Waste Water Heat Recovery
Storage System

No

Solar Panel

No

Water use <= 125 litres/person/day

Yes

SAP Code

901

29.0 Hot Water Cylinder

None

32.0 Photovoltaic Unit

One Dwelling

PV Cells kWp

Orientation

Elevation

Overshading

Connected to Dwelling

0.65

South West

45°

Modest

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	£29	B 87	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	Bungalow 2	Issued on Date	09/02/2021
Assessment Reference	001	Prop Type Ref	
Property	Canal Mews , Bognor Regis, Barnham		
SAP Rating	86 B	DER	16.30
Environmental	87 B	TER	19.60
CO ₂ Emissions (t/year)	1.19	% DER<TER	16.83
General Requirements Compliance	Pass	DFEE	51.46
		TFEE	63.05
		% DFEE<TFEE	18.39
Assessor Details	Mr. Neil Rothern, Neil Rothern, Tel: 02037358169, neil@nrgconsulting.org		Assessor ID
Client			L759-0001

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

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Bungalow, Detached
2.0 Number of Storeys	1
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
		39.75 m	94.32 m ²	2.45 m

7.0 Living Area	27.05	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls				
Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall 1	Cavity Wall	0.20	97.39	75.61

10.0 External Roofs				
Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Flat Roof	0.12	94.32	94.32

11.0 Heat Loss Floors			
Description	Type	Construction	U-Value (W/m ² K)
Heat Loss Floor 1	Ground Floor - Solid		0.14

12.0 Opening Types									
Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.40
Opening Type 2	Manufacturer	Solid Door							1.40

13.0 Openings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Opening 1	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					0.66	100
Opening 2	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					2.52	100
Opening 3	Solid Door	[1] External Wall 1	South West							2.10	
Opening 4	Window	[1] External Wall 1	South West	Dark-coloured curtain or roller blind	0.00					2.43	100
Opening 5	Window	[1] External Wall 1	North West	Dark-coloured curtain or roller blind	0.00					3.12	100
Opening 6	Window	[1] External Wall 1	South East	Dark-coloured curtain or roller blind	0.00					1.56	100
Opening 7	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
Opening 8	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					0.63	100
Opening 9	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					1.56	100
Opening 10	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					1.38	100
Opening 11	Window	[1] External Wall 1	North East	Dark-coloured curtain or roller blind	0.00					3.57	100
14.0 Conservatory		None									
15.0 Draught Proofing		100									
16.0 Draught Lobby		No									
17.0 Thermal Bridging		Calculate Bridges									
17.1 List of Bridges											

%

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	15.40	0.161	No
Independently assessed	E3 Sill	14.40	0.002	No
Independently assessed	E4 Jamb	33.20	0.001	No
Independently assessed	E5 Ground floor (normal)	39.75	0.074	No
Independently assessed	E10 Eaves (insulation at ceiling level)	39.75	0.026	No
Independently assessed	E16 Corner (normal)	9.80	0.040	Yes

Y-value W/m²K

18.0 Pressure Testing

Yes
 Designed AP₅₀ m³/(h.m²) @ 50 Pa
 Property Tested ?
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather
 Cross ventilation possible
 Night Ventilation
 Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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				3
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

Manufacturer
 Description
 Percentage of Heat %
 Main Heating
 SAP Code
 Efficiency (Manufacturer) %
 Model Name
 Manufacturer
 Controls
 PCDF Controls
 Delayed Start Stat

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Sap Code	2106
Burner Control	On/Off
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit	One Dwelling			
	Orientation	Elevation	Overshading	Connected to Dwelling
	PV Cells kWp			
0.65	South West	45°	None Or Little	Yes

Recommendations

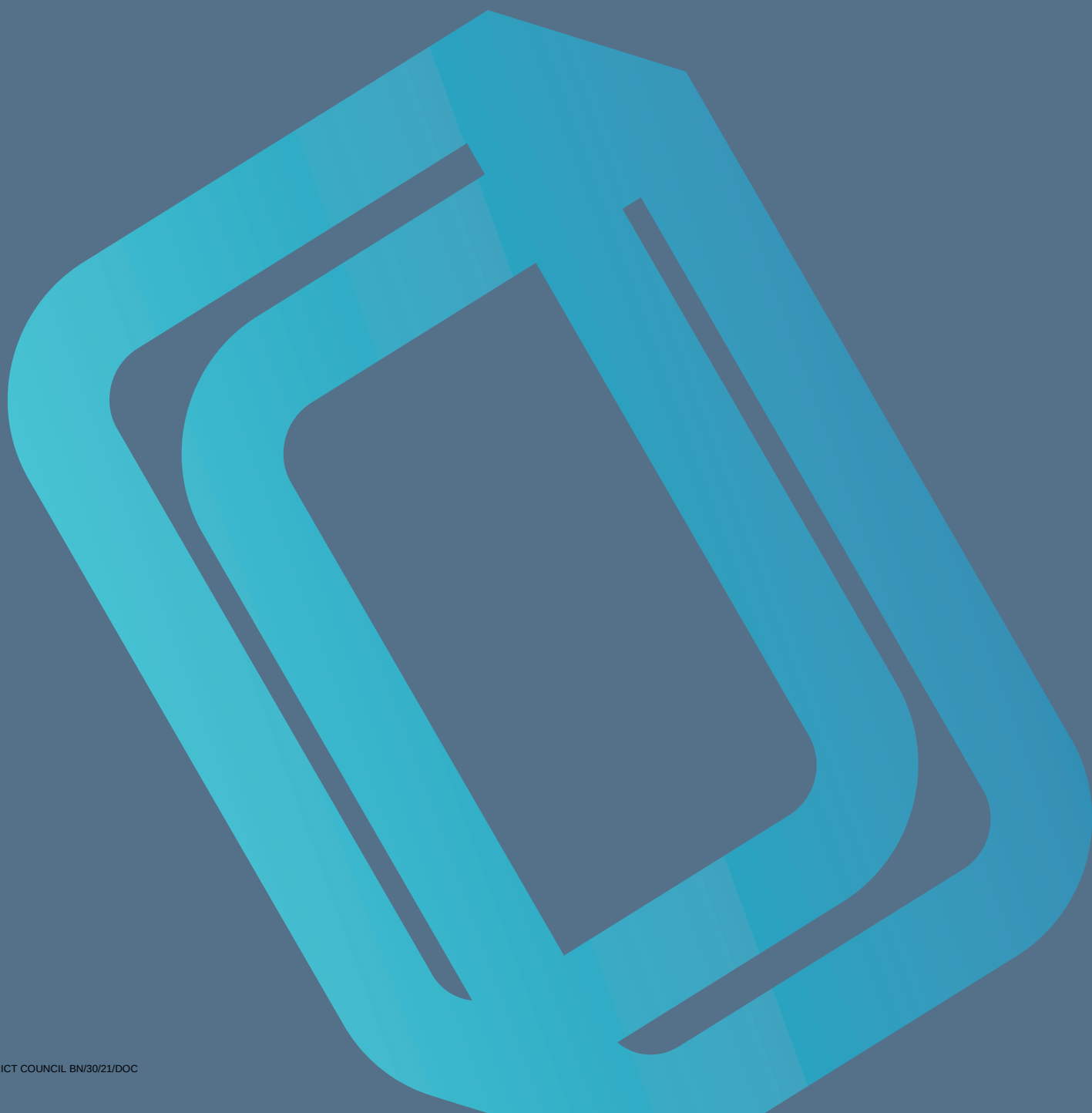
Lower cost measures

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	£30	B 87	

Appendix 3



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Bungalow 1				Issued on Date	09/02/2021
Assessment Reference	001	Prop Type Ref				
Property	Canal Mews , Bognor Regis, Barnham					
SAP Rating	85 B	DER	16.94	TER	20.04	
Environmental	87 B	% DER<TER	15.49			
CO ₂ Emissions (t/year)	1.11	DFEE	50.70	TFEE	62.43	
General Requirements Compliance	Pass	% DFEE<TFEE	18.79			
Assessor Details	Mr. Neil Rothern, Neil Rothern, Tel: 02037358169, neil@nrgconsulting.org				Assessor ID	L759-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 84 m²

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) 20.04 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.94 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 50.7 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
DEFAULT DEFAULT
Combi boiler
Efficiency: 90%
Minimum: 88% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage: No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading: Average

Windows facing North East: 3.09 m², No overhang

Windows facing South East: 1.56 m², No overhang

Windows facing South West: 7.45 m², No overhang

Windows facing North West: 5.13 m², No overhang

Air change rate: 6.00 ach

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

10 Key features

Roof U-value 0.12 W/m²K

Thermal bridging ψ -value 0.025 W/m²K

Photovoltaic array 0.65 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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.1000 (1b)	x 2.4500 (2b)	= 206.0450 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.0450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) = 0.1456 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3956 (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) = 0.3659 (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	0.4666	0.4574	0.4483	0.4025	0.3934	0.3476	0.3476	0.3385	0.3659	0.3934	0.4117	0.4300 (22b)
Effective ac	0.6088	0.6046	0.6005	0.5810	0.5774	0.5604	0.5604	0.5573	0.5670	0.5774	0.5847	0.5924 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			17.2300	1.3258	22.8428		(27)
Opening Type 2			2.1000	1.4000	2.9400		(26)
Heat Loss Floor 1			84.1000	0.1400	11.7740		(28a)
External Wall 1	93.1000	19.3300	73.7700	0.2000	14.7540		(29a)
External Roof 1	84.1000		84.1000	0.1200	10.0920		(30)
Total net area of external elements Aum(A, m ²)			261.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.4028		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4534 (36)
Total fabric heat loss							(33) + (36) = 68.8562 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.3979	41.1106	40.8289	39.5058	39.2583	38.1060	38.1060	37.8926	38.5498	39.2583	39.7591	40.2826 (38)
Heat transfer coeff	110.2541	109.9668	109.6851	108.3620	108.1145	106.9622	106.9622	106.7488	107.4060	108.1145	108.6153	109.1388 (39)
Average = Sum(39)m / 12 =												108.3608 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3110	1.3076	1.3042	1.2885	1.2855	1.2718	1.2718	1.2693	1.2771	1.2855	1.2915	1.2977 (40)
HLP (average)												1.2885 (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												2.5361 (42)
Average daily hot water use (litres/day)												94.4316 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.8748	100.0975	96.3202	92.5430	88.7657	84.9884	84.9884	88.7657	92.5430	96.3202	100.0975	103.8748 (44)
Energy conte	154.0433	134.7272	139.0264	121.2066	116.3006	100.3586	92.9970	106.7154	107.9899	125.8519	137.3771	149.1827 (45)
Energy content (annual)										Total = Sum(45)m =		1485.7769 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1065	20.2091	20.8540	18.1810	17.4451	15.0538	13.9496	16.0073	16.1985	18.8778	20.6066	22.3774 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi loss	50.9589	46.0274	49.0837	45.6376	45.2340	41.9121	43.3092	45.2340	45.6376	49.0837	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.0022	180.7546	188.1102	166.8442	161.5347	142.2707	136.3062	151.9495	153.6276	174.9356	186.6922	200.1416 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.0022	180.7546	188.1102	166.8442	161.5347	142.2707	136.3062	151.9495	153.6276	174.9356	186.6922	200.1416 (64)
Heat gains from water heating, kWh/month	63.9591	56.3037	58.4972	51.7106	49.9785	43.8473	41.7488	46.7914	47.3161	54.1167	58.0067	62.3430 (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	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4038	18.1225	14.7382	11.1578	8.3406	7.0414	7.6085	9.8899	13.2741	16.8546	19.6718	20.9709	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.7958	230.1596	224.2029	211.5217	195.5141	180.4691	170.4182	168.0544	174.0111	186.6922	202.6999	217.7448	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	(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)	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	(71)
Water heating gains (Table 5)	85.9666	83.7852	78.6253	71.8203	67.1754	60.8990	56.1140	62.8916	65.7168	72.7375	80.5648	83.7943	(72)
Total internal gains	398.2072	396.1083	381.6074	358.5408	335.0710	312.4506	298.1817	304.8769	317.0430	340.3253	366.9775	386.5511	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access factor Table 6d		Gains W
Northeast				3.0900	11.2829	0.7200		0.7000		0.7700		12.1771 (75)
Southeast				1.5600	36.7938	0.7200		0.7000		0.7700		20.0476 (77)
Southwest				7.4500	36.7938	0.7200		0.7000		0.7700		95.7404 (79)
Northwest				5.1300	11.2829	0.7200		0.7000		0.7700		20.2164 (81)
Solar gains	148.1815	263.1677	388.6576	529.4700	636.7755	651.4038	620.0188	537.0237	436.9582	298.5623	179.4468	125.5446 (83)
Total gains	546.3887	659.2760	770.2650	888.0108	971.8465	963.8543	918.2005	841.9006	754.0012	638.8876	546.4243	512.0956 (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	52.9711	53.1095	53.2459	53.8960	54.0194	54.6013	54.6013	54.7105	54.3757	54.0194	53.7703	53.5124	
alpha	4.5314	4.5406	4.5497	4.5931	4.6013	4.6401	4.6401	4.6474	4.6250	4.6013	4.5847	4.5675	
util living area	0.9971	0.9929	0.9806	0.9392	0.8351	0.6610	0.5011	0.5624	0.8151	0.9665	0.9939	0.9979	(86)
MIT	19.5935	19.7887	20.0929	20.4803	20.7888	20.9482	20.9885	20.9808	20.8619	20.4476	19.9477	19.5618	(87)
Th 2	19.8322	19.8349	19.8375	19.8499	19.8522	19.8630	19.8630	19.8650	19.8588	19.8522	19.8475	19.8426	(88)
util rest of house	0.9961	0.9905	0.9737	0.9172	0.7791	0.5630	0.3774	0.4339	0.7325	0.9500	0.9914	0.9971	(89)
MIT 2	18.5648	18.7609	19.0631	19.4445	19.7169	19.8408	19.8603	19.8599	19.7866	19.4235	18.9299	18.5414	(90)
Living area fraction	18.8607	19.0565	19.3593	19.7425	20.0252	20.1593	20.1848	20.1824	20.0959	19.7181	19.2227	18.8349	(91)
MIT	18.8607	19.0565	19.3593	19.7425	20.0252	20.1593	20.1848	20.1824	20.0959	19.7181	19.2227	18.8349	(92)
Temperature adjustment	18.7107	18.9065	19.2093	19.5925	19.8752	20.0093	20.0348	20.0324	19.9459	19.5681	19.0727	18.6849	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	543.5377	651.2024	746.1830	809.0583	758.4457	555.6397	364.2312	381.9793	557.8144	603.4999	540.4280	510.0811	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1588.8411	1540.2504	1394.0234	1158.6571	883.8547	578.5919	367.3922	387.7490	627.8798	969.5789	1300.4144	1580.8629	(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	777.7057	597.4403	481.9933	251.7111	93.3043	0.0000	0.0000	0.0000	0.0000	272.3627	547.1902	796.6617	(98)
Space heating												3818.3693	(98)
Space heating per m2												45.4027	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													89.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4266.3344 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	777.7057	597.4403	481.9933	251.7111	93.3043	0.0000	0.0000	0.0000	0.0000	272.3627	547.1902	796.6617	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	868.9450	667.5310	538.5399	281.2414	104.2506	0.0000	0.0000	0.0000	0.0000	304.3159	611.3857	890.1248	(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													
Water heating requirement	205.0022	180.7546	188.1102	166.8442	161.5347	142.2707	136.3062	151.9495	153.6276	174.9356	186.6922	200.1416	(64)
Efficiency of water heater	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	229.0527	201.9605	210.1790	186.4182	180.4857	158.9617	152.2974	169.7759	171.6509	195.4588	208.5947	223.6219	(219)
Water heating fuel used												2288.4573	(219)
Annual totals kWh/year													
Space heating fuel - main system												4266.3344	(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)												360.3375	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1004 * 0.80) =												-417.6624	(233)
Total delivered energy for all uses												6572.4667	(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	4266.3344	0.2160	921.5282 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2288.4573	0.2160	494.3068 (264)
Space and water heating			1415.8350 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	360.3375	0.5190	187.0152 (268)
Energy saving/generation technologies			
PV Unit	-417.6624	0.5190	-216.7668 (269)
Total CO2, kg/year			1425.0084 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9400 (273)

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

DER		16.9400	ZC1
Total Floor Area	TFA	84.1000	
Assumed number of occupants	N	2.5361	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0508	ZC2
CO2 emissions from cooking, equation (L16)		2.1387	ZC3
Total CO2 emissions		35.1295	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.1295	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 ²)	Storey height (m)	Volume (m ³)
Ground floor	84.1000 (1b)	x 2.4500 (2b)	= 206.0450 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 206.0450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1456 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3956 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3659 (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	0.4666	0.4574	0.4483	0.4025	0.3934	0.3476	0.3476	0.3385	0.3659	0.3934	0.4117	0.4300 (22b)
Effective ac	0.6088	0.6046	0.6005	0.5810	0.5774	0.5604	0.5604	0.5573	0.5670	0.5774	0.5847	0.5924 (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			2.1000	1.0000	2.1000		(26)					
TER Opening Type (Uw = 1.40)			17.2300	1.3258	22.8428		(27)					
Heat Loss Floor 1			84.1000	0.1300	10.9330		(28a)					
External Wall 1	93.1000	19.3300	73.7700	0.1800	13.2786		(29a)					
External Roof 1	84.1000		84.1000	0.1300	10.9330		(30)					
Total net area of external elements Aum(A, m2)			261.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.0874		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0770 (36)					
Total fabric heat loss						(33) + (36) =	72.1644 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.3979	Feb 41.1106	Mar 40.8289	Apr 39.5058	May 39.2583	Jun 38.1060	Jul 38.1060	Aug 37.8926	Sep 38.5498	Oct 39.2583	Nov 39.7591	Dec 40.2826 (38)
Heat transfer coeff	113.5623	113.2750	112.9933	111.6702	111.4227	110.2704	110.2704	110.0570	110.7142	111.4227	111.9235	112.4470 (39)
Average = Sum(39)m / 12 =												111.6690 (39)
HLP	Jan 1.3503	Feb 1.3469	Mar 1.3436	Apr 1.3278	May 1.3249	Jun 1.3112	Jul 1.3112	Aug 1.3086	Sep 1.3165	Oct 1.3249	Nov 1.3308	Dec 1.3371 (40)
HLP (average)												1.3278 (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												2.5361 (42)
Average daily hot water use (litres/day)												94.4316 (43)
Daily hot water use	Jan 103.8748	Feb 100.0975	Mar 96.3202	Apr 92.5430	May 88.7657	Jun 84.9884	Jul 84.9884	Aug 88.7657	Sep 92.5430	Oct 96.3202	Nov 100.0975	Dec 103.8748 (44)
Energy conte	154.0433	134.7272	139.0264	121.2066	116.3006	100.3586	92.9970	106.7154	107.9899	125.8519	137.3771	149.1827 (45)
Energy content (annual)										Total = Sum(45)m =		1485.7769 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1065	20.2091	20.8540	18.1810	17.4451	15.0538	13.9496	16.0073	16.1985	18.8778	20.6066	22.3774 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	46.0274	49.0837	45.6376	45.2340	41.9121	43.3092	45.2340	45.6376	49.0837	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.0022	180.7546	188.1102	166.8442	161.5347	142.2707	136.3062	151.9495	153.6276	174.9356	186.6922	200.1416 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.0022	180.7546	188.1102	166.8442	161.5347	142.2707	136.3062	151.9495	153.6276	174.9356	186.6922	200.1416 (64)
Heat gains from water heating, kWh/month	63.9591	56.3037	58.4972	51.7106	49.9785	43.8473	41.7488	46.7914	47.3161	54.1167	58.0067	62.3430 (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	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034	126.8034 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.4038	18.1225	14.7382	11.1578	8.3406	7.0414	7.6085	9.8899	13.2741	16.8546	19.6718	20.9709 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.7958	230.1596	224.2029	211.5217	195.5141	180.4691	170.4182	168.0544	174.0111	186.6922	202.6999	217.7448 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803	35.6803 (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)	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427	-101.4427 (71)
Water heating gains (Table 5)	85.9666	83.7852	78.6253	71.8203	67.1754	60.8990	56.1140	62.8916	65.7168	72.7375	80.5648	83.7943 (72)
Total internal gains	398.2072	396.1083	381.6074	358.5408	335.0710	312.4506	298.1817	304.8769	317.0430	340.3253	366.9775	386.5511 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				3.0900	11.2829		0.6300		0.7000		0.7700		10.6550 (75)
Southeast				1.5600	36.7938		0.6300		0.7000		0.7700		17.5417 (77)
Southwest				7.4500	36.7938		0.6300		0.7000		0.7700		83.7728 (79)
Northwest				5.1300	11.2829		0.6300		0.7000		0.7700		17.6893 (81)
Solar gains	129.6588	230.2718	340.0754	463.2863	557.1785	569.9783	542.5165	469.8958	382.3385	261.2420	157.0159	109.8515	(83)
Total gains	527.8660	626.3801	721.6828	821.8271	892.2495	882.4289	840.6981	774.7726	699.3814	601.5673	523.9934	496.4026	(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	51.4280	51.5584	51.6870	52.2993	52.4155	52.9633	52.9633	53.0659	52.7509	52.4155	52.1810	51.9381
alpha	4.4285	4.4372	4.4458	4.4866	4.4944	4.5309	4.5309	4.5377	4.5167	4.4944	4.4787	4.4625
util living area	0.9975	0.9943	0.9852	0.9550	0.8734	0.7177	0.5559	0.6172	0.8529	0.9740	0.9949	0.9981 (86)
MIT	19.5240	19.7053	19.9996	20.3873	20.7220	20.9215	20.9806	20.9695	20.8185	20.3800	19.8817	19.4950 (87)
Th 2	19.8016	19.8043	19.8069	19.8191	19.8214	19.8321	19.8321	19.8341	19.8280	19.8214	19.8168	19.8119 (88)
util rest of house	0.9966	0.9922	0.9797	0.9373	0.8237	0.6173	0.4189	0.4780	0.7765	0.9605	0.9928	0.9974 (89)
MIT 2	17.8538	18.1199	18.5484	19.1077	19.5520	19.7809	19.8253	19.8220	19.6834	19.1087	18.3868	17.8184 (90)
Living area fraction	18.3342	18.5759	18.9658	19.4757	19.8885	20.1090	20.1576	20.1521	20.0099	19.4743	18.8168	18.3006 (92)
MIT	18.3342	18.5759	18.9658	19.4757	19.8885	20.1090	20.1576	20.1521	20.0099	19.4743	18.8168	18.3006 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3342	18.5759	18.9658	19.4757	19.8885	20.1090	20.1576	20.1521	20.0099	19.4743	18.8168	18.3006 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9950	0.9892	0.9744	0.9307	0.8270	0.6432	0.4586	0.5182	0.7904	0.9551	0.9901	0.9961 (94)
Useful gains	525.2136	619.6184	703.1987	764.9140	737.8932	567.5461	385.5839	401.4942	552.8235	574.5635	518.7898	494.4847 (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	1593.7607	1549.1383	1408.5568	1180.9957	912.3868	607.4781	392.3027	412.9399	654.3085	988.8037	1311.3793	1585.5712 (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	794.9990	624.6374	524.7864	299.5788	129.8232	0.0000	0.0000	0.0000	0.0000	308.1948	570.6645	811.7684 (98)
Space heating												4064.4524 (98)
Space heating per m2												48.3288 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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	4351.6621	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	794.9990 624.6374 524.7864 299.5788 129.8232 0.0000 0.0000 0.0000 0.0000 308.1948 570.6645 811.7684	(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)	851.1767 668.7766 561.8698 320.7482 138.9970 0.0000 0.0000 0.0000 0.0000 329.9730 610.9898 869.1310	(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	205.0022 180.7546 188.1102 166.8442 161.5347 142.2707 136.3062 151.9495 153.6276 174.9356 186.6922 200.1416	(64)
Efficiency of water heater	88.1276 87.9182 87.4961 86.5078 84.5070 80.3000 80.3000 80.3000 80.3000 86.4623 87.6814 88.2057	(216)
Fuel for water heating, kWh/month	232.6196 205.5941 214.9926 192.8661 191.1495 177.1740 169.7462 189.2272 191.3170 202.3259 212.9210 226.9033	(219)
Water heating fuel used		2406.8365 (219)
Annual totals kWh/year		
Space heating fuel - main system		4351.6621 (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)		360.3375 (232)
Total delivered energy for all uses		7193.8362 (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	0.2160	939.9590 (261)
Space heating - secondary	0.0000	0.0000 (263)
Water heating (other fuel)	0.2160	519.8767 (264)
Space and water heating		1459.8357 (265)
Pumps and fans	0.5190	38.9250 (267)
Energy for lighting	0.5190	187.0152 (268)
Total CO2, kg/m2/year		1685.7759 (272)
Emissions per m2 for space and water heating		17.3583 (272a)
Fuel factor (mains gas)		1.0000
Emissions per m2 for lighting		2.2237 (272b)
Emissions per m2 for pumps and fans		0.4628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3583 * 1.00) + 2.2237 + 0.4628, rounded to 2 d.p.		20.0400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Bungalow 2			Issued on Date	09/02/2021
Assessment Reference	001	Prop Type Ref			
Property	Canal Mews , Bognor Regis, Barnham				
SAP Rating	86 B	DER	16.30	TER	19.60
Environmental	87 B	% DER<TER	16.83		
CO ₂ Emissions (t/year)	1.19	DFEE	51.46	TFEE	63.05
General Requirements Compliance	Pass	% DFEE<TFEE	18.39		
Assessor Details	Mr. Neil Rotheron, Neil Rotheron, Tel: 02037358169, neil@nrgconsulting.org			Assessor ID	L759-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 94 m²

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) 19.60 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.30 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)63.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
DEFAULT DEFAULT
Combi boiler
Efficiency: 90%
Minimum: 88% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading: Average

Windows facing North East: 9.39 m², No overhang

Windows facing South East: 1.56 m², No overhang

Windows facing South West: 5.61 m², No overhang

Windows facing North West: 3.12 m², No overhang

Air change rate: 6.00 ach

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

10 Key features

Roof U-value 0.12 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 0.65 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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	94.3200 (1b)	x 2.4500 (2b)	= 231.0840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.0840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) = 0.1298 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3798 (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) = 0.3513 (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	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3513	0.3777	0.3953	0.4128 (22b)
Effective ac	0.6003	0.5964	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.40)			19.6800	1.3258	26.0909		(27)
Opening Type 2			2.1000	1.4000	2.9400		(26)
Heat Loss Floor 1			94.3200	0.1400	13.2048		(28a)
External Wall 1	97.3900	21.7800	75.6100	0.2000	15.1220		(29a)
External Roof 1	94.3200		94.3200	0.1200	11.3184		(30)
Total net area of external elements Aum(A, m ²)			286.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.6761		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9084 (36)
Total fabric heat loss							(33) + (36) = 75.5845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	45.7799	45.4828	45.1916	43.8237	43.5678	42.3765	42.3765	42.1559	42.8354	43.5678	44.0855	44.6268 (38)
Heat transfer coeff	121.3644	121.0673	120.7761	119.4083	119.1523	117.9610	117.9610	117.7404	118.4199	119.1523	119.6701	120.2113 (39)
Average = Sum(39)m / 12 =												119.4070 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2867	1.2836	1.2805	1.2660	1.2633	1.2506	1.2506	1.2483	1.2555	1.2633	1.2688	1.2745 (40)
HLP (average)												1.2660 (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												2.6804 (42)
Average daily hot water use (litres/day)												97.8585 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.6444	103.7300	99.8157	95.9013	91.9870	88.0727	88.0727	91.9870	95.9013	99.8157	103.7300	107.6444 (44)
Energy conte	159.6335	139.6165	144.0717	125.6052	120.5212	104.0006	96.3718	110.5881	111.9089	130.4190	142.3625	154.5965 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6954 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.9450	20.9425	21.6108	18.8408	18.0782	15.6001	14.4558	16.5882	16.7863	19.5629	21.3544	23.1895 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi loss	50.9589	46.0274	50.8650	47.2938	46.8756	43.4331	44.8809	46.8756	47.2938	50.8650	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554 (64)
Heat gains from water heating, kWh/month	65.8179	57.9293	60.6201	53.5872	51.7922	45.4385	43.2639	48.4894	49.0332	56.0806	59.6643	64.1431 (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	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0735	19.6055	15.9443	12.0708	9.0231	7.6177	8.2312	10.6992	14.3604	18.2338	21.2816	22.6870 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.8049	249.3660	242.9122	229.1728	211.8293	195.5289	184.6392	182.0782	188.5320	202.2713	219.6148	235.9152 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018 (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)	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143 (71)
Water heating gains (Table 5)	88.4649	86.2043	81.4786	74.4266	69.6131	63.1090	58.1503	65.1740	68.1016	75.3771	82.8671	86.2138 (72)
Total internal gains	423.5487	421.3812	406.5404	381.8757	356.6709	332.4609	317.2261	324.1567	337.1993	362.0876	389.9689	411.0214 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				9.3900	11.2829		0.7200		0.7000		0.7700		37.0043 (75)
Southeast				1.5600	36.7938		0.7200		0.7000		0.7700		20.0476 (77)
Southwest				5.6100	36.7938		0.7200		0.7000		0.7700		72.0944 (79)
Northwest				3.1200	11.2829		0.7200		0.7000		0.7700		12.2953 (81)
Solar gains	141.4417	257.3028	395.5488	563.0097	697.1627	721.3921	683.3178	578.7586	452.8352	296.1020	172.3966	119.1149	(83)
Total gains	564.9903	678.6840	802.0892	944.8854	1053.8337	1053.8530	1000.5439	902.9153	790.0345	658.1897	562.3655	530.1364	(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	53.9697	54.1021	54.2326	54.8538	54.9716	55.5268	55.5268	55.6309	55.3117	54.9716	54.7338	54.4874
alpha	4.5980	4.6068	4.6155	4.6569	4.6648	4.7018	4.7018	4.7087	4.6874	4.6648	4.6489	4.6325
util living area	0.9980	0.9949	0.9851	0.9474	0.8435	0.6666	0.5071	0.5770	0.8378	0.9748	0.9957	0.9985 (86)
MIT	19.5787	19.7616	20.0652	20.4640	20.7861	20.9487	20.9886	20.9798	20.8483	20.4170	19.9245	19.5491 (87)
Th 2	19.8512	19.8537	19.8561	19.8676	19.8697	19.8797	19.8797	19.8815	19.8758	19.8697	19.8654	19.8609 (88)
util rest of house	0.9973	0.9932	0.9796	0.9277	0.7893	0.5695	0.3839	0.4479	0.7601	0.9618	0.9939	0.9980 (89)
MIT 2	18.5650	18.7491	19.0514	19.4453	19.7315	19.8576	19.8770	19.8762	19.7943	19.4098	18.9213	18.5430 (90)
Living area fraction									fLA = Living area / (4) =			0.2868 (91)
MIT	18.8557	19.0395	19.3422	19.7374	20.0340	20.1705	20.1958	20.1927	20.0966	19.6986	19.2090	18.8315 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7057	18.8895	19.1922	19.5874	19.8840	20.0205	20.0458	20.0427	19.9466	19.5486	19.0590	18.6815 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9962	0.9911	0.9754	0.9217	0.7901	0.5826	0.4027	0.4674	0.7658	0.9569	0.9921	0.9972 (94)
Ext temp.	562.8641	672.6273	782.3292	870.8572	832.6159	613.9364	402.9562	422.0296	605.0064	629.8031	557.9030	528.6397 (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	1748.3439	1693.6696	1532.9114	1276.1682	975.1398	639.4091	406.4704	428.8909	692.3502	1066.2525	1431.1328	1740.8430 (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	881.9970	686.1404	558.4332	291.8239	106.0378	0.0000	0.0000	0.0000	0.0000	324.7183	628.7255	901.8793 (98)
Space heating per m2												4379.7553 (98)
										(98) / (4) =		46.4351 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													89.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4893.5813 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	881.9970	686.1404	558.4332	291.8239	106.0378	0.0000	0.0000	0.0000	0.0000	324.7183	628.7255	901.8793	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	985.4715	766.6374	623.9477	326.0602	118.4779	0.0000	0.0000	0.0000	0.0000	362.8137	702.4866	1007.6863	(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													
Water heating requirement	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554	(64)
Efficiency of water heater	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(216)
Fuel for water heating, kWh/month	235.2988	207.4233	217.8063	193.1832	187.0355	164.7304	157.8243	175.9371	177.8801	202.5519	214.1649	229.6708	(219)
Water heating fuel used													2363.5066 (219)
Annual totals kWh/year													
Space heating fuel - main system													4893.5813 (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)													389.8250 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.65 * 1004 * 1.00) =										-522.0780			-522.0780 (233)
Total delivered energy for all uses													7199.8350 (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	4893.5813	0.2160	1057.0136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2363.5066	0.2160	510.5174 (264)
Space and water heating			1567.5310 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.8250	0.5190	202.3192 (268)
Energy saving/generation technologies			
PV Unit	-522.0780	0.5190	-270.9585 (269)
Total CO2, kg/year			1537.8167 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3000 (273)

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

DER			16.3000 ZC1
Total Floor Area		TFA	94.3200
Assumed number of occupants		N	2.6804
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.5059 ZC2
CO2 emissions from cooking, equation (L16)			1.9437 ZC3
Total CO2 emissions			33.7496 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			33.7496 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 ²)	Storey height (m)	Volume (m ³)
Ground floor	94.3200 (1b)	x 2.4500 (2b)	= 231.0840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 231.0840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1298 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3798 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3513 (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	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3513	0.3777	0.3953	0.4128 (22b)
	0.6003	0.5964	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852 (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			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			19.6800	1.3258	26.0909			(27)					
Heat Loss Floor 1			94.3200	0.1300	12.2616			(28a)					
External Wall 1	97.3900	21.7800	75.6100	0.1800	13.6098			(29a)					
External Roof 1	94.3200		94.3200	0.1300	12.2616			(30)					
Total net area of external elements Aum(A, m2)			286.0300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3239			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.7770 (36)					
Total fabric heat loss						(33) + (36) =		79.1009 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 45.7799	Feb 45.4828	Mar 45.1916	Apr 43.8237	May 43.5678	Jun 42.3765	Jul 42.3765	Aug 42.1559	Sep 42.8354	Oct 43.5678	Nov 44.0855	Dec 44.6268	(38)
Heat transfer coeff	124.8808	124.5837	124.2925	122.9247	122.6687	121.4774	121.4774	121.2568	121.9363	122.6687	123.1865	123.7277	(39)
Average = Sum(39)m / 12 =												122.9234	(39)
HLP	Jan 1.3240	Feb 1.3209	Mar 1.3178	Apr 1.3033	May 1.3006	Jun 1.2879	Jul 1.2879	Aug 1.2856	Sep 1.2928	Oct 1.3006	Nov 1.3060	Dec 1.3118	(40)
HLP (average)												1.3033	(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												2.6804 (42)
Average daily hot water use (litres/day)												97.8585 (43)
Daily hot water use	Jan 107.6444	Feb 103.7300	Mar 99.8157	Apr 95.9013	May 91.9870	Jun 88.0727	Jul 88.0727	Aug 91.9870	Sep 95.9013	Oct 99.8157	Nov 103.7300	Dec 107.6444 (44)
Energy conte	159.6335	139.6165	144.0717	125.6052	120.5212	104.0006	96.3718	110.5881	111.9089	130.4190	142.3625	154.5965 (45)
Energy content (annual)												Total = Sum(45)m = 1539.6954 (45)
Distribution loss (46)m = 0.15 x (45)m	23.9450	20.9425	21.6108	18.8408	18.0782	15.6001	14.4558	16.5882	16.7863	19.5629	21.3544	23.1895 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	46.0274	50.8650	47.2938	46.8756	43.4331	44.8809	46.8756	47.2938	50.8650	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554 (64)
Heat gains from water heating, kWh/month	65.8179	57.9293	60.6201	53.5872	51.7922	45.4385	43.2639	48.4894	49.0332	56.0806	59.6643	64.1431 (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	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	134.0179	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0735	19.6055	15.9443	12.0708	9.0231	7.6177	8.2312	10.6992	14.3604	18.2338	21.2816	22.6870	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	246.8049	249.3660	242.9122	229.1728	211.8293	195.5289	184.6392	182.0782	188.5320	202.2713	219.6148	235.9152	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	36.4018	(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)	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	-107.2143	(71)
Water heating gains (Table 5)	88.4649	86.2043	81.4786	74.4266	69.6131	63.1090	58.1503	65.1740	68.1016	75.3771	82.8671	86.2138	(72)
Total internal gains	423.5487	421.3812	406.5404	381.8757	356.6709	332.4609	317.2261	324.1567	337.1993	362.0876	389.9689	411.0214	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				9.3900	11.2829	0.6300	0.7000	0.7700	32.3787 (75)			
Southeast				1.5600	36.7938	0.6300	0.7000	0.7700	17.5417 (77)			
Southwest				5.6100	36.7938	0.6300	0.7000	0.7700	63.0826 (79)			
Northwest				3.1200	11.2829	0.6300	0.7000	0.7700	10.7584 (81)			
Solar gains	123.7615	225.1399	346.1052	492.6335	610.0174	631.2181	597.9030	506.4138	396.2308	259.0893	150.8470	104.2256 (83)
Total gains	547.3101	646.5212	752.6456	874.5092	966.6883	963.6790	915.1291	830.5705	733.4301	621.1769	540.8159	515.2470 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4500	52.5751	52.6983	53.2847	53.3958	53.9195	53.9195	54.0176	53.7166	53.3958	53.1714	52.9388	
alpha	4.4967	4.5050	4.5132	4.5523	4.5597	4.5946	4.5946	4.6012	4.5811	4.5597	4.5448	4.5293	
util living area	0.9982	0.9959	0.9886	0.9612	0.8808	0.7236	0.5625	0.6320	0.8722	0.9804	0.9964	0.9986	(86)
MIT	19.5145	19.6848	19.9776	20.3735	20.7196	20.9222	20.9808	20.9681	20.8043	20.3538	19.8639	19.4872	(87)
Th 2	19.8221	19.8245	19.8269	19.8383	19.8404	19.8503	19.8503	19.8521	19.8465	19.8404	19.8361	19.8316	(88)
util rest of house	0.9976	0.9944	0.9843	0.9457	0.8332	0.6245	0.4263	0.4931	0.8016	0.9698	0.9948	0.9982	(89)
MIT 2	17.8538	18.1040	18.5312	19.1040	19.5662	19.7992	19.8435	19.8392	19.6862	19.0866	18.3742	17.8203	(90)
Living area fraction	18.3300	18.5574	18.9460	19.4680	19.8970	20.1212	20.1697	20.1630	20.0068	19.4500	18.8014	18.2984	(91)
MIT	18.3300	18.5574	18.9460	19.4680	19.8970	20.1212	20.1697	20.1630	20.0068	19.4500	18.8014	18.2984	(92)
Temperature adjustment	18.3300	18.5574	18.9460	19.4680	19.8970	20.1212	20.1697	20.1630	20.0068	19.4500	18.8014	18.2984	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9963	0.9920	0.9797	0.9393	0.8359	0.6499	0.4657	0.5331	0.8133	0.9649	0.9927	0.9972	(94)
Ext temp.	545.2962	641.3701	737.3966	821.4427	808.0519	626.2901	426.1433	442.7480	596.5033	599.3571	536.8736	513.7959	(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	1752.0836	1701.4864	1546.9468	1299.0736	1005.5161	670.7053	433.6360	456.2857	720.2573	1085.6173	1441.4570	1744.3597	(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	897.8499	712.3982	602.3053	343.8942	146.9133	0.0000	0.0000	0.0000	0.0000	361.7775	651.3000	915.5394	(98)
Space heating per m2												4631.9779	(98)
												49.1092	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

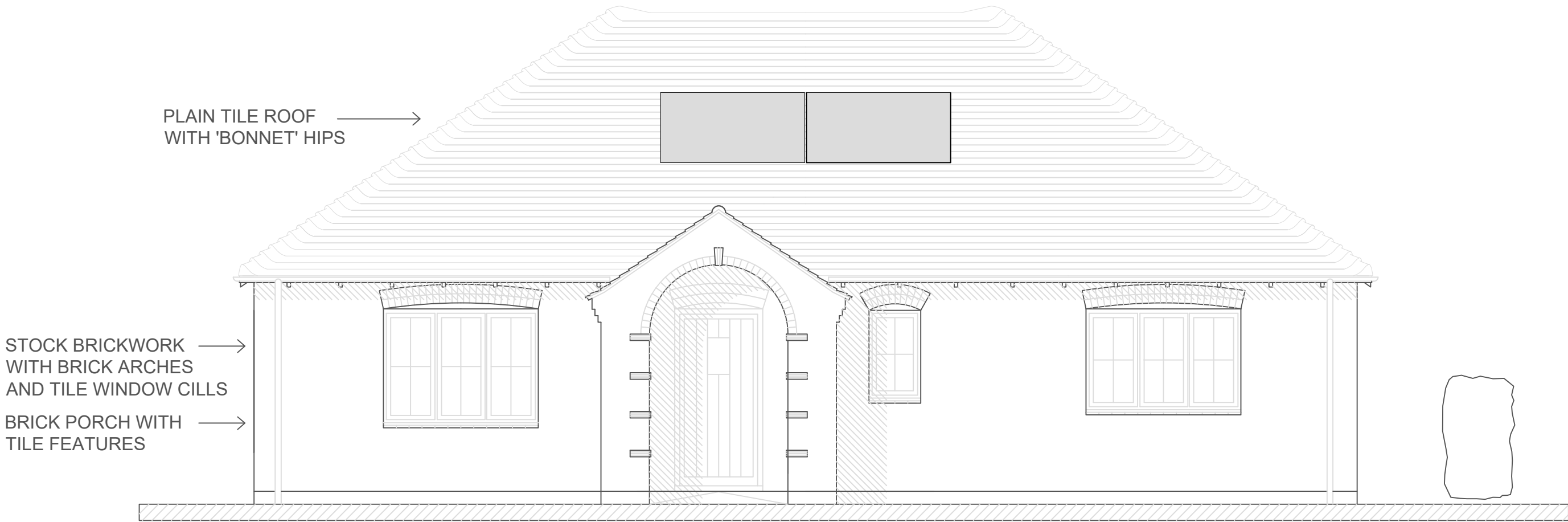
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4959.2911 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	897.8499	712.3982	602.3053	343.8942	146.9133	0.0000	0.0000	0.0000	0.0000	361.7775	651.3000	915.5394 (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)	961.2954	762.7389	644.8665	368.1951	157.2948	0.0000	0.0000	0.0000	0.0000	387.3421	697.3234	980.2350 (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	210.5924	185.6439	194.9367	172.8990	167.3967	147.4337	141.2527	157.4637	159.2027	181.2840	191.6776	205.5554 (64)
Efficiency of water heater (217)m	88.2902	88.1091	87.7027	86.7495	84.7245	80.3000	80.3000	80.3000	80.3000	86.7573	87.8865	80.3000 (216)
Fuel for water heating, kWh/month	238.5230	210.6978	222.2697	199.3083	197.5777	183.6036	175.9062	196.0942	198.2599	208.9553	218.0968	232.6282 (219)
Water heating fuel used												2481.9208 (219)
Annual totals kWh/year												
Space heating fuel - main system												4959.2911 (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)												389.8250 (232)
Total delivered energy for all uses												7906.0370 (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	4959.2911	0.2160	1071.2069 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.9208	0.2160	536.0949 (264)
Space and water heating			1607.3018 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.8250	0.5190	202.3192 (268)
Total CO2, kg/m2/year			1848.5460 (272)
Emissions per m2 for space and water heating			17.0409 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1450 (272b)
Emissions per m2 for pumps and fans			0.4127 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.0409 * 1.00) + 2.1450 + 0.4127, rounded to 2 d.p.			19.6000 (273)

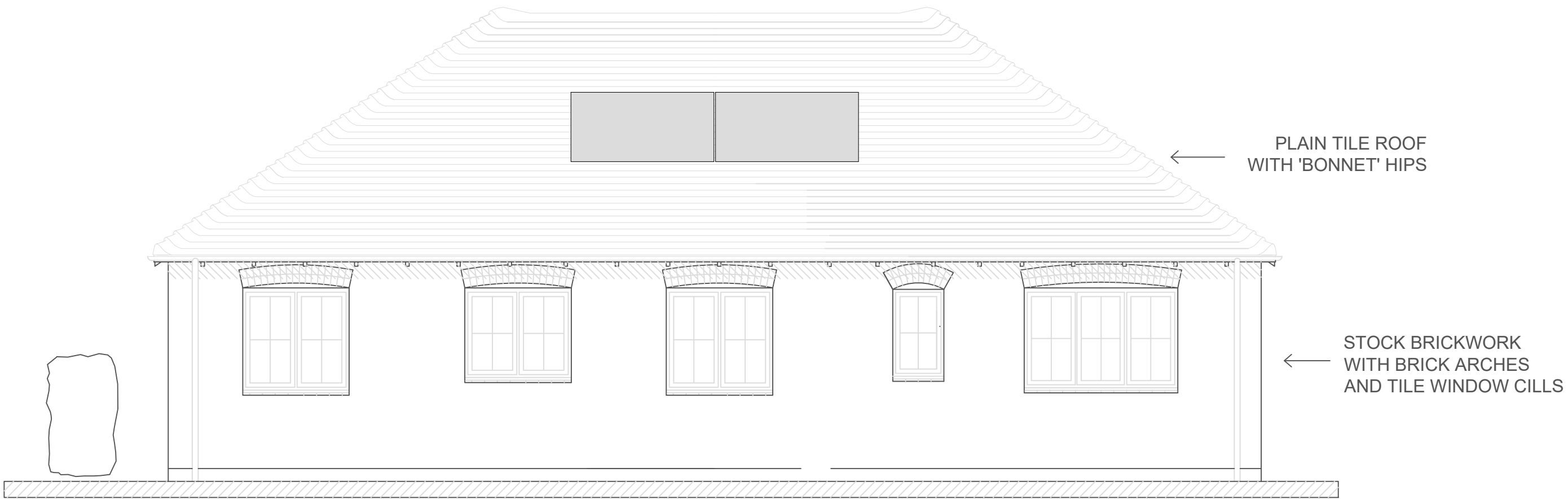
Appendix 4





South West Elevation

PLOT 2



South West Elevation

PLOT 1

Scale 1:50 @ A1



Rev.	Date	Revision	Drawn	Checked
NRG PV NRG PV Unit 219, PillBox 115, Coventry Road, London E2 6GG T: +44 (0)203 735 8169 E: admin@nrgconsulting.org				
Site:		Client:		
CANAL MEWS		-		
Drawing Title:				
PV LAYOUT				
Job Number:	Drawing Number:	Revision:	Date:	
MW086	1	-	February 2021	



MBB

5BB

*Black frame product can be provided upon request.

KuPower

HIGH EFFICIENCY MONO PERC MODULE

CS3K-315|320|325|330|335MS

(1000 V / 1500 V)

MORE POWER



Low power loss in cell connection



Low NMOT: 42 ± 3 °C
Low temperature coefficient (Pmax): -0.36 % / °C



Better shading tolerance



High PTC rating of up to: 93.24 %

MORE RELIABLE



Lower hot spot temperature



Minimizes micro-cracks



Heavy snow load up to 6000 Pa,
wind load up to 4000 Pa*



linear power output warranty*



enhanced product warranty on materials
and workmanship*

*According to the applicable Canadian Solar Limited Warranty Statement.

MANAGEMENT SYSTEM CERTIFICATES

ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730: VDE / CE / MCS / CQC
UL 1703: CSA / IEC 61701 ED2: VDE / IEC 62716: VDE / IEC 60068-2-68: SGS
Take-e-way



* As there are different certification requirements in different markets, please contact your local Canadian Solar sales representative for the specific certificates applicable to the products in the region in which the products are to be used.

CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. No. 1 module supplier for quality and performance/price ratio in IHS Module Customer Insight Survey. As a leading PV project developer and manufacturer of solar modules with over 36 GW deployed around the world since 2001.

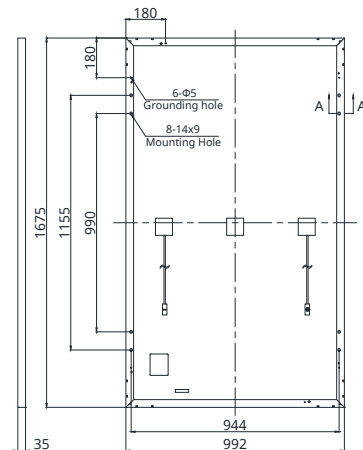
* For detailed information, please refer to the Installation Manual.

CANADIAN SOLAR INC.

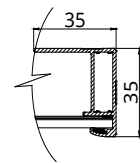
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

ENGINEERING DRAWING (mm)

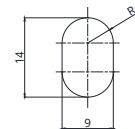
Rear View



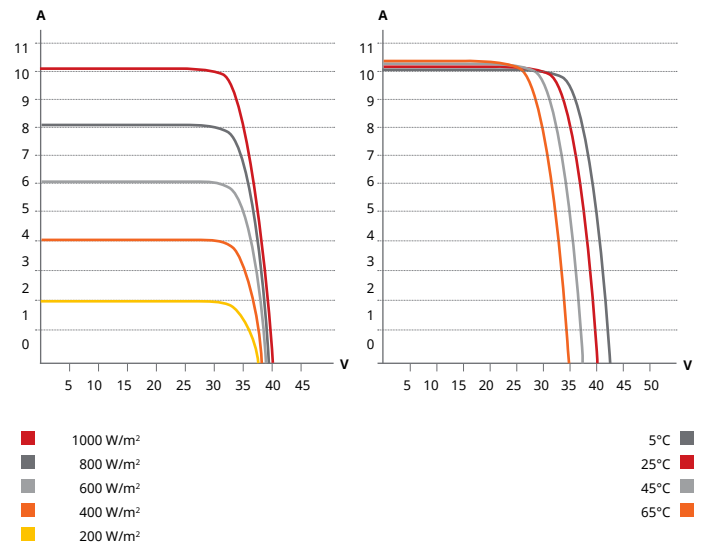
Frame Cross Section A-A



Mounting Hole



CS3K-320MS / I-V CURVES



MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline
Cell Arrangement	120 [2 X (10 X 6)]
Dimensions	1675 X 992 X 35 mm (65.9 X 39.1 X 1.38 in)
Weight	18.5 kg (40.8 lbs)
Front Cover	3.2 mm tempered glass
Frame	Anodized aluminium alloy
J-Box	IP68, 3 bypass diodes
Cable	4.0 mm² (IEC), 12 AWG (UL)
Cable Length (Including Connector)	Portrait: 400 mm (15.7 in) (+) / 280 mm (11.0 in) (-); landscape: 1160 mm (45.7 in)*
Connector	T4 series or H4 UTX or MC4-EVO2
Per Pallet	30 pieces
Per Container (40' HQ)	840 pieces

* For detailed information, please contact your local Canadian Solar sales and technical representatives.

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.36 % / °C
Temperature Coefficient (Voc)	-0.29 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	42 ± 3°C

PARTNER SECTION



ELECTRICAL DATA | STC*

CS3K	315MS	320MS	325MS	330MS	335MS
Nominal Max. Power (Pmax)	315 W	320 W	325 W	330 W	335 W
Opt. Operating Voltage (Vmp)	33.1 V	33.3 V	33.5 V	33.7 V	33.9 V
Opt. Operating Current (Imp)	9.52 A	9.61 A	9.71 A	9.80 A	9.89 A
Open Circuit Voltage (Voc)	39.9 V	40.1 V	40.3 V	40.5 V	41.2 V
Short Circuit Current (Isc)	10.06 A	10.14 A	10.22 A	10.30 A	10.39 A
Module Efficiency	18.96%	19.26%	19.56%	19.86%	20.16%
Operating Temperature	-40°C ~ +85°C				
Max. System Voltage	1500V (IEC/UL) or 1000V (IEC/UL)				
Module Fire Performance	TYPE 1 (UL 1703) or Class C (IEC 61730)				
Max. Series Fuse Rating	30 A				
Application Classification	Class A				
Power Tolerance	0 ~ + 5 W				

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

ELECTRICAL DATA | NMOT*

CS3K	315MS	320MS	325MS	330MS	335MS
Nominal Max. Power (Pmax)	235 W	238 W	242 W	246 W	249 W
Opt. Operating Voltage (Vmp)	30.8 V	31.0 V	31.2 V	31.4 V	31.6 V
Opt. Operating Current (Imp)	7.61 A	7.69 A	7.76 A	7.84 A	7.91 A
Open Circuit Voltage (Voc)	37.4 V	37.6 V	37.8 V	38.0 V	38.6 V
Short Circuit Current (Isc)	8.12 A	8.18 A	8.24 A	8.31 A	8.38 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Canadian Solar Inc. reserves the right to make necessary adjustments to the information described herein at any time without further notice. Please be kindly advised that PV modules should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

CANADIAN SOLAR INC.

545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

5. CONCLUSION

5.1 This document illustrates the reduction in carbon emissions of the proposed development in-line with the requirements of the Local Authority and in-line with current best practice guidance. This has been done via;

- Low U-Values
- Low Air Permeability
- Modern Controls for Heating
- 100% Low Energy Lighting

5.2 Measures implemented for this scheme in order to obtain the on-site reduction of CO₂ emissions are:

“Energy Efficiency Measures”

- U-Values are at least 50% better than the Part L limiting parameters.
- Air Permeability 50% better than the Part L limiting parameter.
- Natural Ventilation
- 100% low energy lighting

“Renewable Energy”

- PV Array of 1.30 kWp to be installed split across the two dwellings.

FINAL CARBON EMISSIONS – SAP 12		
	CO ₂ Emissions (Tonnes per Annum)	
	Regulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)	3.53	Renewable Energy Contribution 13.82%
DER: Pre-PV	3.45	
DER: PV	2.96	
Overall Reduction	16.18	