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PROJECT NAME

Co-op Store, Calne

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ASSESSOR

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SUSTAINABLE ENERGY STRATEGY



Sustainable Energy Strategy

Project: 5583KJ - 2025.11 SBEM (Former Co-op Store - BBA Architects & Planners)

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Executive Summary

The proposal is for the redevelopment of the site at the former Co-op store on Mill Street, Calne, extending to the south-side of The Pippin.

This would create a new 60-unit care home on the south-side of the site and then seven new assisted living units to the north of the site.

Table 1 – Schedule of Accommodation

Plot	Type	Bedrooms	Storeys
Unit 1, Unit 3	End terrace	3 per unit	2
Unit 2	Mid-terrace	3 per unit	2
Unit 4, Unit 7	End terrace	3 per unit	2
Unit 5, Unit 6	Mid-terrace	3 per unit	2
Care Home	Care home and spaces for ancillary services	60	4

This Sustainable Energy Strategy has been compiled to demonstrate how the design of this site provides opportunities to reduce energy demand and carbon emissions whilst also mitigating against the effects of climate change and building with sustainability in mind, in line with core policy 41 from the Wiltshire Core Strategy (Adopted January 2015).

SAP calculations (using the SAP 10.2 calculation engine) and SBEM Calculations (using v6.1.e.1), have been modelled to demonstrate the low energy design. The proposed specifications are detailed in the sections following. The performance results are summarized below:

Table 2 – Carbon and Energy Performance

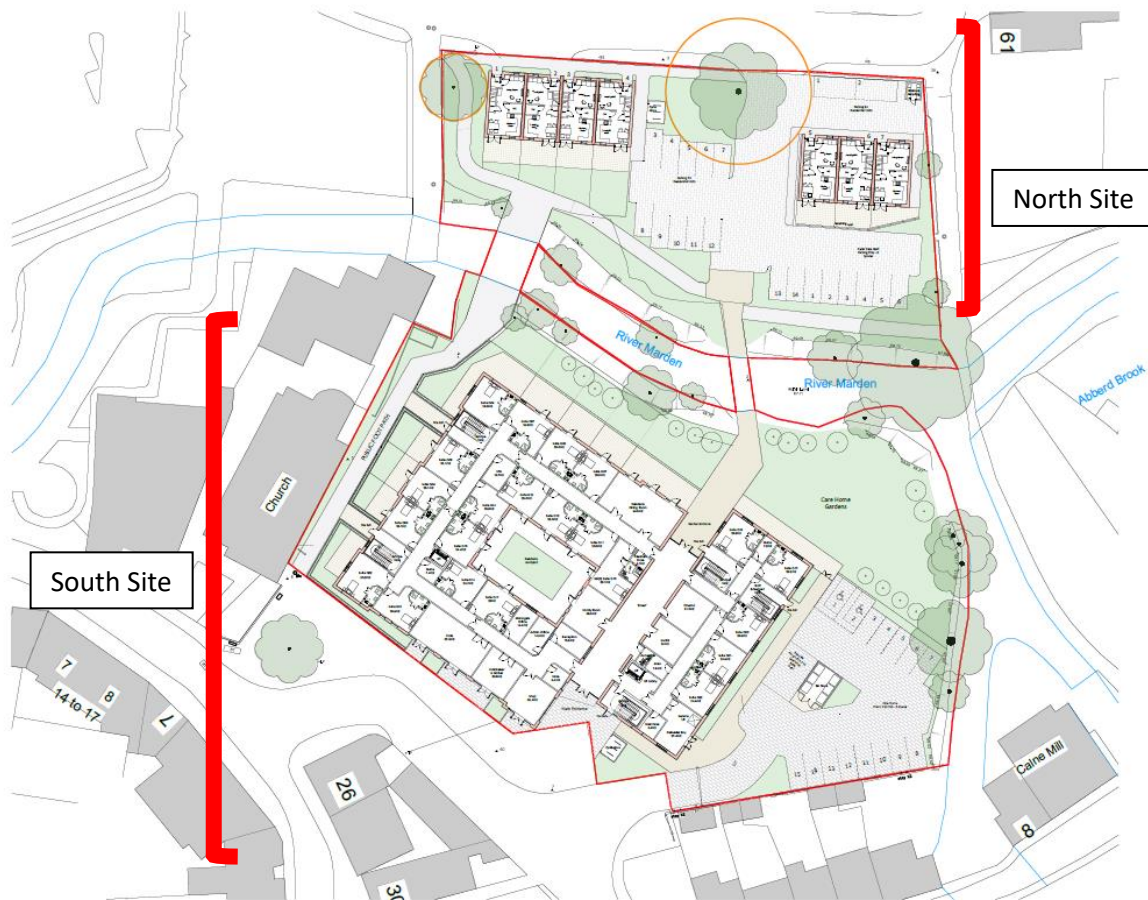
Measure	Percentage
Overall carbon reduction beyond Part L compliance	40.73%
Overall energy reduction beyond Part L compliance	43.56%
Energy reduction from renewable generation	11.65%

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Fig. 1 – Indicative Site Layout

NB all drawings are provided by BBA Architects & Planners



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Design Principles to Reduce Energy Demand and Carbon Emissions

Fabric

The proposed buildings will be constructed to meet the latest notional dwelling specification as defined in Part L (Approved Document L 2021 edition incorporating 2023 amendments – Volume 1 and Volume 2).

This is an advanced specification and demands low U-values, excellent detailing of the non-repeating thermal bridges and the installation of highly efficient services, plus the incorporation of renewable technologies.

SAP and SBEM calculations indicate that these design principles will comfortably exceed the minimum requirements of Part L.

Mechanical Services

A well-designed building envelope must be supplemented by appropriate services within the building.

It is proposed that the heating and hot water to the dwellings and to the care home is provided by air source heat pumps.

Lighting

It is proposed that only energy efficient lighting is installed at this development. This means that all light fittings should have lamps with a luminous efficacy of at least 120 lamp lumens per circuit-watt.

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Renewables

In addition to the air source heat pumps, the most appropriate renewable technology for this site is solar photovoltaic (PV) panels to generate electricity that can be either used within each property or exported to the grid.

For further details, please refer to the section of selecting renewables.

Fenestration and Solar Gain

To provide plenty of daylight to residents, the fenestration design allows for a considerable proportion of the façades to be glazed. Low U-values will need to be specified to limit heat losses through these areas but also low G values are needed to avoid overheating.

This design also allows for passive heating into the buildings. However, to minimise the risk of overheating the dwellings, the glazing will be openable, where practical and internal shading will be employed.

For further details, please refer to the section on passive solar design.

Overall performance

The following sections detail how the proposed buildings have been specified at this stage, incorporating the above principles. Also displayed is how the building performs in relation to the building regulations and designing to generate renewable energy on site.

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Table 3 - Proposed Fabric and Services Specification

Showing the proposed specification compared to Part L minimum requirements.

Category	Item	Value/Details	Part L Standard*
Building Fabric (W/m²K)	Ground floor	0.11	0.18
	External wall (houses)	0.18	0.26
	External wall (care home)	0.26	0.26
	Roofs (houses)	0.11	0.11
	Roofs (care home)	0.16	0.16
Fenestration (W/m²K)	Fenestration (houses)	1.20	1.60
	Fenestration (care home)	1.60	1.60
Thermal Bridging	Recognised Construction Details	y-value = 0.030-0.038	-
Ventilation	Air permeability (houses)	5.00 m ³ /hm ²	8.0 m ³ /hm ²
	Air permeability (care home)	3.00 m ³ /hm ²	8.0 m ³ /hm ²
	Ventilation	Intermittent extract fans	Intermittent extract fans
Heating	Primary Heating System	Air source heat pump	Air source heat pump
	Controls	Time and temperature zone controls	Programmer, room thermostat and TRVs
	Heat Distribution	Radiators (design flow temperature 35°C or less)	Radiators (design flow temperature 45°C or less)
	Water Heating	From air source heat pump to low heat loss cylinders	-
	Secondary Heating System	None	None
	Lighting	120 lm/W	Dwellings: 75 lm/W Commercial: 95 lm/W
Additional Features	SAP Appendix Q	None	-
	Renewables	None	-
	Regulation 36 Compliance	110 litres/person/day	125 litres/person/day

*Represents the minimum backstop standard and not necessarily the values that would be required to achieve overall Part L1 and L2 compliance.

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Selecting Renewables

Table 4 – Feasibility Matrix of Appropriate Renewables

Showing the considerations in choosing a renewable technology for this site.

Technology	Requirements	Requirements Met?	Appropriate?
Photovoltaic panels	Roof facing east to west (through south)	Yes	Yes
	Little/no or modest overshading	Yes*	
	Flat roof or pitched roof not greater than 45°	Yes	
	Any size development	Yes	
Solar thermal	All requirements as for photovoltaic panels	Yes	Yes
	Separate Hot water tank possible in all plots	Yes	
Air source heat pumps	Suitable external wall or other location on-site for equipment	Yes	Yes
	Aesthetic considerations	Yes	
	Noise impact	Yes	
	Any size development	Yes	
Ground source heat pumps	External space for horizontal trench or vertical borehole	Yes	No
	Medium to large sized development	Yes	
	Archaeology	Unknown	
	Best suited to underfloor heating	No	
Biomass	Space needed for plant, fuel storage and deliveries	Yes	No
	Medium to large sized development	Yes	
	Minimal impact on residents (air quality, deliveries)	No	
Combined heat and power	Space need for plant, access and servicing	Yes	No
	Large sized development (large heat demand)	No	
District heating	Available network	No	No
	Very large sized development (substantial heat demand)	No	

**See the following aerial image demonstrating that the overshading risk is low for the likely location of any solar panels.*

Please refer to Appendices A through H for more in-depth information on these technologies.

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Fig. 2 – Aerial Image of the Site – Overshading Risk



There are no obstructions that are likely to create overshading to any potential solar panels.

Feasibility of Appropriate Renewables - Conclusion

Due to the location, size and type of development some renewable technologies are not appropriate for this site.

Solar thermal panels, although feasible, have limited potential to save energy and carbon in domestic applications.

Air source heat pumps are required for baseline Part L compliance. The size of the system selected will be appropriate for each unit.

Photovoltaic (PV) panels are suitable for the site and will contribute to reducing energy demand and carbon emissions, as demonstrated in Table 6. This will need to be confirmed by survey before installation. Electricity tariffs should be chosen that allow generated electricity to be sold back to the grid where it cannot be used or stored within the relevant building.

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Table 5 – Typical PV

Showing the amount of PV proposed to reduce energy demand and carbon emissions on site.

Unit	PV kWp	Set Up
Unit 1	2.70	South-facing at 30°, no shading
Unit 2	2.70	South-facing at 30°, no shading
Unit 3	2.70	South-facing at 30°, no shading
Unit 4	2.70	South-facing at 30°, no shading
Unit 5	2.70	South-facing at 30°, no shading
Unit 6	2.70	South-facing at 30°, no shading
Unit 7	2.70	South-facing at 30°, no shading
Care Home	90.00	Horizontally-mounted, no shading
Site Total	108.90	-

Table 6 – Energy Demand

Showing the energy demand at each stage of the energy hierarchy: baseline compliance with Part L, energy efficiency measures and renewables.

Unit	Baseline (kWh/year)	Additional Measures (kWh/year)	Renewables (kWh/year/year)
Unit 1	4,024.30	2,379.56	47.79
Unit 2	3,447.32	2,249.48	-82.29
Unit 3	3,447.32	2,249.48	-82.29
Unit 4	4,042.88	2,385.71	53.94
Unit 5	4,042.88	2,385.71	53.94
Unit 6	3,447.32	2,249.48	-82.29
Unit 7	4,024.30	2,379.56	47.79
Care Home	1,106,637.88	707,638.44	639,590.75
Site Total	1,133,114.20	723,917.42	639,547.34
Reduction by stage		36.11%	11.65%
		Total Reduction	43.56%

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Table 7 – Carbon Emissions

Showing the carbon emission at each stage of the energy hierarchy: baseline compliance with Part L, energy efficiency measures and renewables.

Unit	Baseline (kgCO ₂ /year)	Additional Measures (kgCO ₂ /year)	Renewables (kgCO ₂ /year)
Unit 1	354.27	345.18	44.59
Unit 2	333.62	325.37	24.77
Unit 3	333.62	325.37	24.77
Unit 4	355.92	346.84	45.42
Unit 5	355.92	346.84	45.42
Unit 6	333.62	325.37	24.77
Unit 7	354.27	345.18	44.59
Care Home	150,806.17	99,277.31	90,565.89
Site Total	153,227.42	101,637.44	90,820.23
Reduction by stage		33.67%	10.64%
Total Reduction			40.73%

Table 8 – Predicted EPC Scores

Unit	Predicted EPC Score
Unit 1	A94
Unit 2	A95
Unit 3	A95
Unit 4	A94
Unit 5	A94
Unit 6	A95
Unit 7	A94
Care Home	A10

For further details please refer to the SAP and BRUKL Reports.

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Passive Solar Design

The following street scenes demonstrate the degree of proposed glazing and the subsequent sections detail the various passive solar design implications considered for these buildings.

Fig. 3 – Plots 1-4 Elevations



Fig. 4 – Plots 5-7 Elevations



Fig. 5 – Care Home Elevations 1



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Fig. 6 – Care Home Elevations 2



Fig. 7 – Care Home Elevations 3



Fig. 8 – Care Home Elevations 4



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Building Orientation

Given the layout of the site, various window orientations are required for the care home. However, where possible, these can be optimally orientated to gain useful heat during winter months. In other cases, the orientation can help to mitigate against overheating.

Where windows are positioned to the west of south, these will catch the late afternoon sun. This can help delay the evening heating period.

Windows that are placed to the east of south will benefit from the morning sun.

For all windows facing east to west through south, particularly those that are within 30° of south, must be carefully placed and appropriate shading will need to be incorporated to ensure that the living spaces do not overheat from excessive solar gain during the hottest parts of the year, when the sun is at its highest.

Building Placement on Southern Slopes

The site is relatively level so there are no opportunities to benefit from placing buildings on southern slopes.

Window Heights

Where practical, openings are typically positioned so that they can benefit from passive heating from the sun when it is lower in the sky during winter months.

This is achieved as many of the openings are full height.

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Green Roofs

Given the amount of roof mounted PV proposed for this scheme and the mix of property types on the site, it will not be practical to incorporate green roofs.

Deciduous Tree Planting

There are some deciduous trees on the site. There may be the potential for these to shade openings that could be exposed to the sun when it is at its most intense during summer, whilst allowing passive heating in winter months.

However, as solar PV panels are proposed, this will need to be balanced with the need to allow plenty of sunlight onto the roofs.

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Water Conservation Measures

Rainwater butts can be included to each house and for the care home, where practical. The water can be used for watering garden plants and other non-potable activities.

Internal potable water will be conserved by installing flow restrictors to taps and showers, installing dual flush toilets and low-capacity baths.

The following schedule provides a suggested specification which has been proven to exceed building regulations requirements for water conservation (Regulation 36 Compliance) of less than 110 litres per person per day.

Table 9 - Water Consumption

Internal Potable Water Fixing	Flow Rate / Capacity
Toilet	Dual Flush 4 and 2.6 litres
Basin Taps	4 litres / minute
Bath	180 litres (capacity to overflow)
Shower	9 litres / minute
Kitchen Taps	6 litres / minute

Please see Tables 10 and 11 following for the full water efficiency calculations.

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Table 10 – The Water Calculator for New Dwellings

Installation type	Unit of Measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/ Person/ Day) (3)	Litres/ Person/ Day = [(1) x (2)] + (3) (4)
WC (single flush)	Flush volume (litres)	0.00	4.42	0.00	0.00
WC (dual flush)	Full flush volume (litres)	4.00	1.46	0.00	5.84
	Part flush volume (litres)	2.60	2.96	0.00	7.70
WCs (multiple fittings)	Average effective flushing volume (litres)	0.00	4.42	0.00	0.00
Taps (excluding kitchen/ Utility room taps)	Flow rate (litres/minute)	4.00	1.58	1.58	7.90
Bath (where shower also present)	Capacity to overflow (litres)	180.00	0.11	0.00	19.80
Shower (where bath also present)	Flow rate (litres/minute)	9.00	4.37	0.00	39.33
Bath only	Capacity to overflow (litres)	0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)	0.00	5.60	0.00	0.00
Kitchen/utility room Sink taps	Flow rate (litres/minute)	6.00	0.44	10.36	13.00
Washing machine*	Litres/kg dry load	8.17	2.10	0.00	17.16
Dishwasher*	Litres/place Setting	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use (If present = 1 If absent = 0)	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	0.00	1.00	0.00	0.00

Notes: All flow rates achieved by fitting flow restrictors into the respective outlet's incoming pipework

*No appliance specified so default values used

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Table 11 – Total Water Consumption and Compliance

Calculation Step (continued from Table 1)	Description	Result
(5)	Total calculated use (litres/person/day) = (Sum column 4 of Table 1)	115.22
(6)	Contribution from greywater (litres/person/day)	0.00
(7)	Contribution from rainwater (litres/person/day)	0.00
(8)	Normalisation factor	0.91
(9)	Total water consumption (Code for Sustainable Homes) = [(5) – (6) – (7)] x (8) (litres/person/day)	104.85
(10)	External water use	5.00
(11)	Total water consumption (Building Regulation 36) = (9) + (10) (litres/person/day)	109.85
Building Regulation 36 Compliance (110 litres/person/day)		Pass

Summary

This proposed scheme has been well designed to cope with and mitigate against the effects of climate change. The energy strategy proposes the installation of air source heat pumps and photovoltaic panels to reduce energy demand and to help offset some of the carbon dioxide emissions associated with the development.

Building orientation and passive solar measures have been incorporated where possible.

Measures to limit water consumption and recycle rainwater can be implemented throughout the site.

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Appendix A – Photovoltaic Panels

What are Photovoltaic Panels?

Photovoltaic Panels (PV) panels convert the energy in light received from the Sun into electricity. There are two types of system – grid connected systems are the most common and allow electricity to be drawn from the national grid during times when the panels are not generating enough electricity to provide all the power needs. This setup also allows any surplus electricity to be sold back to the grid. Conversely, standalone systems are not connected to the grid and so require supplementing with other power generating systems or batteries to ensure that the supply of electricity is not interrupted.



Space Requirements

PV Panels are composed of a series of small solar cells that are connected together. They come in a variety of shapes, sizes and outputs and ideally will be installed on an inclined south-facing roof to maximise the power generated. Larger arrays will result in more power being generated, up to the limits of available roof space. If space is limited, solar tiles can be installed as these can fit more capacity into the same area. However, these are more expensive than traditional panel installations.

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Installation Costs, Funding, Maintenance and Payback

The average cost for a solar panel installation for a small-scale building is approximately £5,000-£9,000, although this is highly dependent on the size of array being installed. Planning permission is not usually required unless the panels are to be installed on a listed building or the property is situated in a conservation area.

The photovoltaic array can be expected to last for up to 25 years, depending on the manufacturer.

On January 1st 2020, a new government incentive scheme was introduced, known as the Smart Export Guarantee (SEG). For those installing small scale renewable technologies, with a maximum capacity of 5MW, the SEG will pay for each unit of electricity fed into the National Grid. It is anticipated that payback for a PV system could be achieved in approximately 12 years.

Advantages of Photovoltaic Panels

- Electricity bills reduced
- Source of renewable energy
- Reduced carbon footprint
- Low maintenance

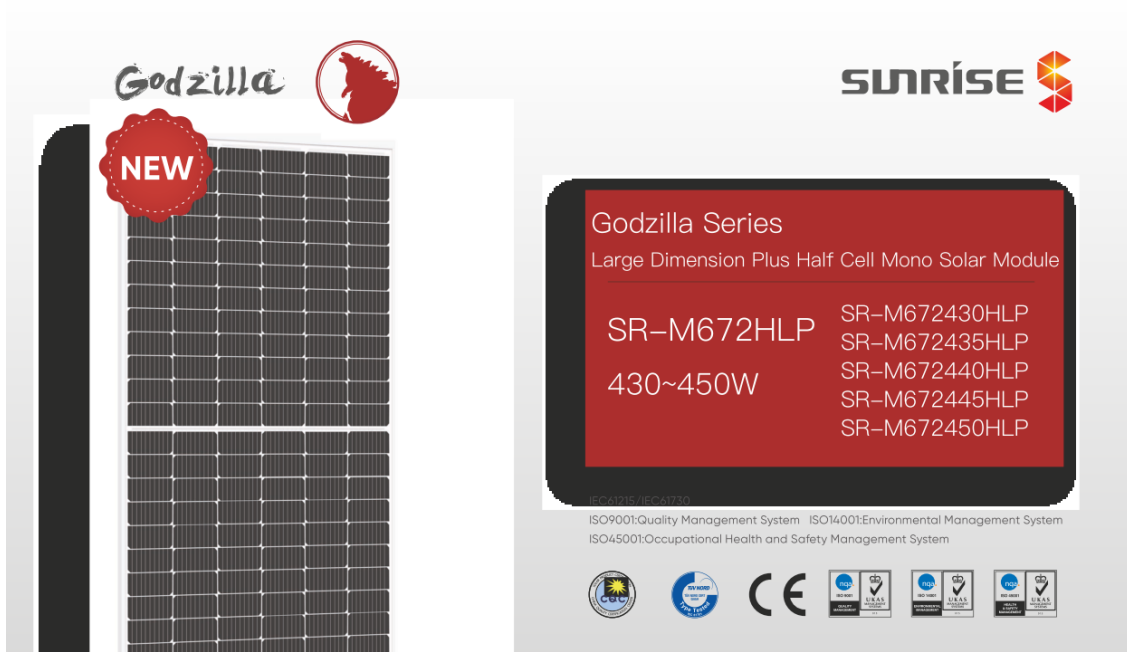
Disadvantages of Photovoltaic Panels

- Relatively high upfront cost
- Energy generation varies with the average annual amount of radiation received
- Power output highly weather dependent
- No electricity produced at night
- Requires a lot of roof space for an effective array.

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Appendix B – Possible Solar Panel



PID Resistance



Better Low-light Performance



9 Bus Bar Half Cut Cell With PERC Technology



Strengthened Mechanical Support 5400 Pa Snow Load, 2400 Pa Wind Load

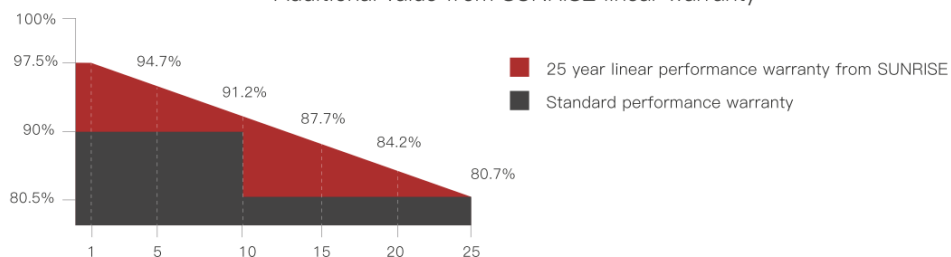


0~3% Positive Tolerance



Higher Power Output

Additional value from SUNRISE linear warranty



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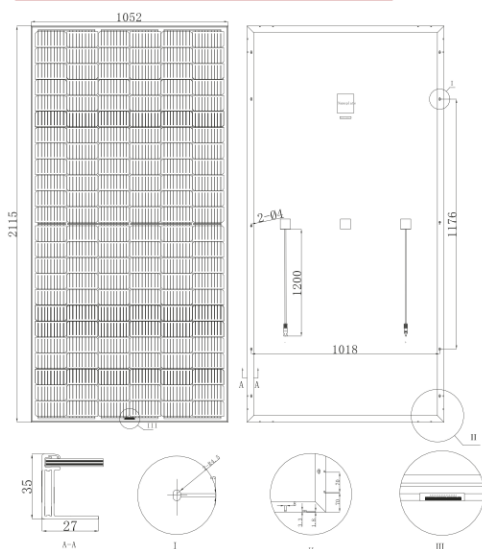
Large Dimension Plus Half Cell(6x24) Mono Solar Module

Module Type		SR - M672430HLP		SR - M672435HLP		SR - M672440HLP		SR - M672445HLP		SR - M672450HLP	
Test Environment		STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Tolerance	(%)	0~+3		0~+3		0~+3		0~+3		0~+3	
Module Efficiency	(%)	19.33		19.56		19.78		20.01		20.23	
Maximum Power	P _{max} (W)	430	318.3	435	322	440	325.8	445	329.5	450	333.2
Open Circuit Voltage	V _{oc} (V)	49.22	45.88	49.42	46.08	49.62	49.28	49.86	49.52	50.1	49.76
Short Circuit Current	I _{sc} (A)	11.21	9	11.28	9.06	11.35	9.11	11.41	9.16	11.48	9.22
Maximum Power Voltage	V _m (V)	40.59	37.48	40.79	37.68	40.99	37.88	41.19	38.07	41.39	38.26
Maximum Power Current	I _m (A)	10.6	8.48	10.67	8.54	10.74	8.59	10.81	8.64	10.88	8.7
Cell Type	(mm)	166x83(9BB Mono-Crystalline Silicon)									
Number of Cells	(Pcs)	144(6×24)									
Maximum System Voltage	(V)	DC1000									
Temp. Coeff. of V _{oc}	(%/°C)	-0.285									
Temp. Coeff. of I _{sc}	(%/°C)	0.055									
Temp. Coeff. of P _m	(%/°C)	-0.365									
Operating Temperature	°C	-40 to 85									
Nominal Operating Cell Temperature (NOCT)	°C	45±2									
Max. Series Fuse	(A)	15									
Pressure Bearing	(Pa)	5400									
Wind Bearing	(Pa)	2400									

STC: Irradiance 1000W/m², Cell temperature 25°C, AM1.5

NOCT: Irradiance 800W/m², Ambient temperature 20°C, Wind speed 1m/s

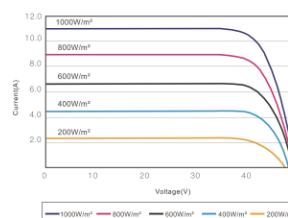
ENGINEERING DRAWINGS



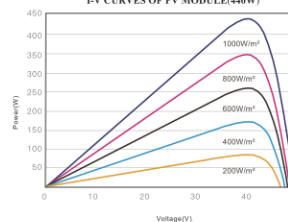
MATERIAL DETAILS

Frame	Anodized aluminum
Glass	3.2mm low-iron tempered suede glass
Cell	6×24pcs 166x83mm mono solar cell
Junction Box	Rated Current ≥15A, IP ≥67, TÜV & UL
Cable&Connector	4mm ² MC4 or MC4 compatible
Cable length	1200mm or as customer's requirements

IV CURVES



I-V CURVES OF PV MODULE(440W)



P-V CURVES OF PV MODULE(440W)

PACKING DETAILS

Dimension	(mm)	2115×1052×35
Weight	(kg)	23.5
Loading Capacity		704 pcs/40'HC
Packing	pcs/pallet	30

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Appendix C – Solar Thermal Panels

What is Solar Thermal Energy?

A solar thermal system uses energy from the Sun to heat water which is then stored in a hot water cylinder.



Space Requirements

For a small scale solar thermal setup, it is suggested that approximately five square meters of south facing space will be required, to ensure that as much solar energy as possible can be collected. A sloping roof is not required as the panels can be fitted to a frame mounted on a flat roof or even hung from a wall.

Before installing a solar thermal system, it is important to check if your current setup is suitable – solar thermal systems require a hot water cylinder to store the heated water and are therefore not compatible with combination boilers or direct acting water heaters. If the cylinder present prior to the installation of the solar thermal system is not a solar cylinder, it will be necessary to either replace the cylinder with one which has a solar heating coil fitted or to add an extra cylinder with a solar coil to ensure that the system works correctly.

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Installation Costs, Funding, Maintenance and Payback

The initial cost of installing a typical small scale solar thermal system is generally between £5,000 and £9,000. There are currently no financial schemes available for solar thermal panels.

Very little maintenance is usually required after the system is installed, although it is important to have the system inspected every three to seven years by a qualified solar panel expert.

The payback costs for solar panels depend greatly on the installation costs. For example, a system costing between £5,000 and £7,000 to install has a typical payback time between 13 and 17 years.

Planning Requirements

Planning permission is generally not required for the installation of a solar thermal system. However, restrictions may apply if the building is listed or sited within a conservation area – it is advisable to check with the local council prior to installation.

Advantages

- Clean and efficient water heating
- Easy to maintain
- Quiet
- Low carbon footprint

Disadvantages

- High initial cost
- Effectiveness depends on the number of hours of sunshine your area gets during the day
- The system is limited to only heating water – no electricity is produced
- Only useful if there is meaningful hot water demand

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Appendix D – Air Source Heat Pumps

What are Air Source Heat Pumps?

Air source heat pumps (ASHPs) extract thermal energy from outside air (using the principles of vapour compression refrigeration), which can then be used to heat the building as well as to provide hot water. Heat pumps can also be run in reverse, cooling the building and transferring the excess heat to the outside.

There are two types of air source heat pump systems:

1. **Air to air** systems transfer the warmed air throughout the building using fans
2. **Air to water** systems transfer heat to water, which is then distributed via plumbing similar to that used in a conventional heating system with a boiler

Air source heat pumps operate at lower temperatures than traditional gas boilers. This means that these systems can be utilised more effectively with an underfloor heating setup compared to using radiators, as with underfloor heating the warmth is distributed more evenly and thus more efficiently. It is vital that the building fabric be well insulated if the benefits of an air source heat pump are to be fully utilised.



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Space Requirements

An area on the exterior of the building, such as on a wall or roof, will be required for the external unit. This ideally should be in a warmer location which not only has enough space for the unit but is also clear of obstructions to allow air to flow freely.

Additionally, space will be required for the internal unit. Typically, these are no larger than a standard hot water cylinder or boiler unit, depending on the exact setup used. However, with many setups a separate hot water cylinder, along with the space for this, is also required.

Installation Costs, Funding, Maintenance and Payback

The cost of purchasing and installing an air source heat pump system is generally between £3,000 and £11,000, depending on the size and complexity of the setup. Additional costs may be incurred if your property is particularly large. However, it may be possible to obtain payments from the Government's Renewable Heat Incentive (RHI), which will offset some of the costs incurred with installing the heat pump.

Air source heat pumps can be expected to last for up to 20 years as long as they are inspected every three to five years by a qualified technician. A typical payback period for ASHPs is around 12 years, once RHI is taken into account.

Planning

It is advisable to consult your local planning authority prior to purchasing the heat pump to establish whether there are any restrictions as to the positioning of the external unit.

Advantages

- Lower fuel bills
- Can provide heating in winter and cooling in the summer as well as hot water year-round
- Low maintenance
- Low carbon footprint

Disadvantages

- Works more efficiently with underfloor heating, or larger radiators
- The outdoor unit produces noise so careful siting is required
- Less efficient in winter due to the need to extract heat from colder air, resulting in lower Coefficient of Performance (COP) values.

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Appendix E – Possible Air Source Heat Pumps

Commercial Heating Product Information

CAHV-R450YA-HPB
Ecodan Air Source Heat Pump



MODEL		CAHV-R450YA-HPB	
Power source		3-phase 4-wire 380-400-415V 50/60 Hz	
Capacity(EN14511) **		40	
	Power input	kW	14.03
	Current input	A	23.7-22.5-21.7
	COP (kW/kW)		2.85
	SCOP Low/Medium		3.57/3.24

TECHNICAL DATA

		HPR2904	HPR29065	HPR2909	HPR29012	HPR290155
VOLTAGE (V)		230	230	230	230	230
PHASE		1	1	1	1	1
FREQUENCY (Hz)		50	50	50	50	50
MAX CURRENT (A)		8.3	12.8	16.8	24.8	29.3
HEATING CAPACITY		A-5W55 (kW)	4.10	6.76	9.21	12.00
BS EN 14511	COP	2.48	2.27	2.31	2.22	1.9
	HEATING CAPACITY	A7W35 (kW)	4.09	7.62	9.38	12.18
	COP	4.99	4.95	4.93	4.81	4.72
	HEATING CAPACITY	A7W55 (kW)	4.36	7.23	9.30	12.21
	COP	3.19	3.00	3.11	3.22	2.87
	ErP RATING (35°C/55°C) HEATING	A+++/A++	A+++/A++	A+++/A++	A+++/A++	A+++/A++
	RATED AIR FLOW (m³/h)	2300	2650	3350	4050	4050
	PRESSURE DROP (Bar)	0.25	0.39	0.38	0.38	0.40
REFRIGERANT		R290	R290	R290	R290	R290
GWP		3	3	3	3	3
MASS OF R290 REFRIGERANT (kg)		0.61	0.83	1.00	1.20	1.65
SOUND POWER LEVEL (dB) (BS EN12102-1)		48	52	54	52	53
QUIET MARK		YES	YES	YES	YES	YES
SOUND PRESSURE LEVEL (G=2)	1m db	40	44	46	44	45
	3m db	31	34	36	34	35
WATER CONNECTIONS		1" BSP	1" BSP	1" BSP	1" BSP	1" BSP
WEIGHT (KG)	EMPTY	99	115	131	153	180
	FULL	102	117	133	157	184
HEIGHT (mm)		803	854	854	1365	1365
WIDTH (mm)		1155	1223	1223	1155	1155
DEPTH (mm)		422	461	461	425	425
OPERATING AMBIENT TEMPERATURE RANGE SPACE HEATING (°C)		-25 to 35	-25 to 35	-25 to 35	-25 to 35	-25 to 35
OPERATING AMBIENT TEMPERATURE RANGE HOT WATER (°C)		-25 to 43	-25 to 43	-25 to 43	-25 to 43	-25 to 43
OPERATING FLOW TEMPERATURE RANGE SPACE HEATING (°C)		25 to 75	25 to 75	25 to 75	25 to 75	25 to 75
OPERATING FLOW TEMPERATURE RANGE HOT WATER (°C)		20 to 70	20 to 70	20 to 70	20 to 70	20 to 70
DNO CONNECTION TYPE		C & N	C & N	C & N	C & N	C & N

AERONA 290 AIR SOURCE HEAT PUMPS

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Appendix F – Ground Source Heat Pumps

What are Ground Source Heat Pumps?

Ground source heat pumps (GSHPs) use pipes, buried in available land close to the building, to extract heat from the ground. Water and antifreeze are circulated around the pipes absorbing heat, which is then transferred through a heat exchanger in the heat pump into the building. From this point, the heat can be used to provide space or hot water heating, or the system can be run in reverse to provide cooling.

Ground source heat pumps operate at lower temperatures than traditional gas boilers. This means that these systems can be utilised more efficiently with an underfloor heating setup than with radiators. It is particularly vital that the building be well insulated to fully take advantage of the benefits of a ground source heat pump.



Space Requirements

There are two types of ground source heat pump systems:

1. **Horizontal** systems, which require an area of approximately 700m²
2. **Vertical** systems, which have a borehole approximately a quarter of a metre across and up to 100m deep.

Larger sites will require either a larger area or more boreholes. Whichever system is chosen, suitable access must be available for the machinery required to install the pipework, especially in the case of the drill rig required for the vertical systems.

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Space must also be available for the internal unit. These are typically larger than a standard gas boiler, approximately the size of a domestic hot water cylinder.

Installation Costs, Funding, Maintenance and Payback

Installing ground source heat pumps can cost between £10,000 and £18,000. The horizontal system is often cheaper as the expensive drill rig required to drill the borehole is unnecessary.

It may be possible to obtain payments from the Government's Renewable Heat Incentive (RHI), which will help to offset some of the costs involved with installing the heat pump. Additionally, the heat pump, if inspected regularly by a qualified servicer, can be expected to last for up to twenty years.

With low running costs and possible income from the RHI, the payback period can typically be between 8 and 12 years.

Planning Requirements

Ground source heat pumps are generally permitted, but some restrictions apply, such as with listed buildings. Consulting your local authority prior to installation is recommended.

Advantages

- Lower fuel bills, especially if used to replace direct electric heating
- Can provide both space and hot water heating
- Can provide heating in winter and cooling in summer as well as hot water year-round
- Lower carbon footprint
- Low maintenance
- More efficient in winter than air source heat pumps due to ground temperatures remaining more constant throughout the year

Disadvantages

- More expensive to install than air source heat pumps
- Suitable land must be available for the pipework or boreholes
- The building must be very well insulated
- Works most efficiently with underfloor heating or warm air distribution

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Appendix G – Biomass

What is Biomass?

Biomass is any fuel obtained from natural or organic material, such as manure, forest debris or agricultural or horticultural waste. The most common biomass energy source is wood in the form of pellets, wood chips or logs. Biomass boilers can be used as a replacement for a fossil fuel-based heat source, and are best suited to medium to large scale sites.



Space Requirements

Typically, biomass boilers are contained in a single plant room serving the whole site. This room needs to be big enough for the boiler or boilers themselves, along with water tanks and space for fuel storage.

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Installation Costs, Funding, Maintenance and Payback

The cost of a biomass boiler depends on a number of factors, including the type of boiler used, the fuel type and storage size. For example, the cost, including installation, of an automatically-fed pellet boiler can be as much as £20,000. It is important to note that biomass boilers are also eligible for the Government Renewable Heat Incentive (RHI) scheme, which provides payments to those using renewable heating systems. Therefore, despite the high initial cost, biomass boilers can have relatively short payback times of around 5-7 years.

Biomass boilers should be serviced every 12 months to ensure continued efficiency and to prevent any breakdowns.

Planning

There may be restrictions on the installation of biomass systems, due to concerns over local pollution and disruption to residents caused by deliveries.

Advantages

- Sustainable energy source
- Reduces dependence on fossil fuels
- Carbon-neutral – the carbon produced is absorbed by plants which can then be used as future biomass fuel
- Reduces waste sent to landfill
- Abundant availability of fuel

Disadvantages

- The burning of biomass fuels produces various gases that can contribute to local air pollution
- Space is required on-site for a plant room and fuel storage, as well as a designated fuel delivery area
- Constructing and operating biomass energy plants are often more expensive than more traditional power plants

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Appendix H – Combined Heat and Power

What is Combined Heat and Power?

Combined Heat and Power (CHP), sometimes referred to as cogeneration, is a setup in which heat and power are generated simultaneously.

Energy which is lost at various steps in producing electricity in a conventional power plant can be captured and used to provide warmth. For example, water which has condensed from the steam used to turn the generating turbine is typically cooled in large cooling towers, with all the energy lost to the air. In a CHP plant, this 'waste' heat is instead used to produce hot water, hot air or steam, which can then be distributed to heat local buildings.



Space Requirements

Significant space is required for the power plant itself, as well as the additional space required for the recovery of the otherwise wasted heat. Additionally, to use this energy effectively, a large pipe network is needed to distribute the heat around the local area.

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Installation Costs, Funding, Maintenance and Payback

The costs involved with setting up a CHP system, especially if the power plant is being constructed along with it rather than converted, are relatively high. As a result of this, these schemes tend to be large-scale long-term projects.

The network must be kept well maintained to avoid loss of service and to ensure continued operation. However, a large-scale network can heat a wide area more efficiently than with individual building heating systems, providing good long-term return on investments.

Advantages

- The CHP process can be applied to power plants that use either renewable or fossil fuels as well as those which use a combination of the two
- Emissions are generally lower than other electricity and heat producing systems
- A variety of energy consumers can benefit from the installation of a CHP plant, including hospitals, schools and industrial sites

Disadvantages

- CHP plants need to be local to their users to ensure as little energy is lost in the transmission as possible.
- The technology needed is expensive and more complex. Maintenance costs can also be greater
- Considerable amount of space is required for a full-size CHP setup, making it suitable only for larger sites

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Appendix I – District Heating

What is District Heating?

Instead of relying on one boiler for each unit on site, district heating utilises hot water or steam from a single communal heat source and distributes that energy to a variety of consumers through a network of insulated pipes. This network can be as large as desired, allowing entire communities to benefit, as well as reducing the need for additional energy to be produced specifically for heating buildings in the local area.

In the individual property or building, a heat interface unit (HIU) gives the consumer control over the hot water they use in a similar manner to that provided by a traditional boiler.



Space Requirements

An energy centre or large plant room would be required for this type of system. Depending on the scale of the heat network, pipework may need to be laid underground to distribute the hot water across the site or to the local area.

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Installation Costs, Funding, Maintenance and Payback

The initial cost of setting up district heating, including the plant and infrastructure needed to deliver the heat, is relatively high and so these large-scale schemes tend to be a long-term investment.

Regular maintenance is essential to ensure continued efficiency and to prevent any breakdowns.

Advantages

- More energy efficient as energy which is otherwise wasted can be used
- Lower carbon emissions
- Has the potential to reduce heating costs

Disadvantages

- If the main fuel source experiences problems, whole areas could potentially be without heating or hot water
- Can in some cases be more expensive than traditional heating
- A large network is required to gain full benefit – it is only suitable for use on very large sites or where there is a network already present