Project Name: 24 BIRCH DRIVE BURFORD OXFORDSHIRE OX18 4XH

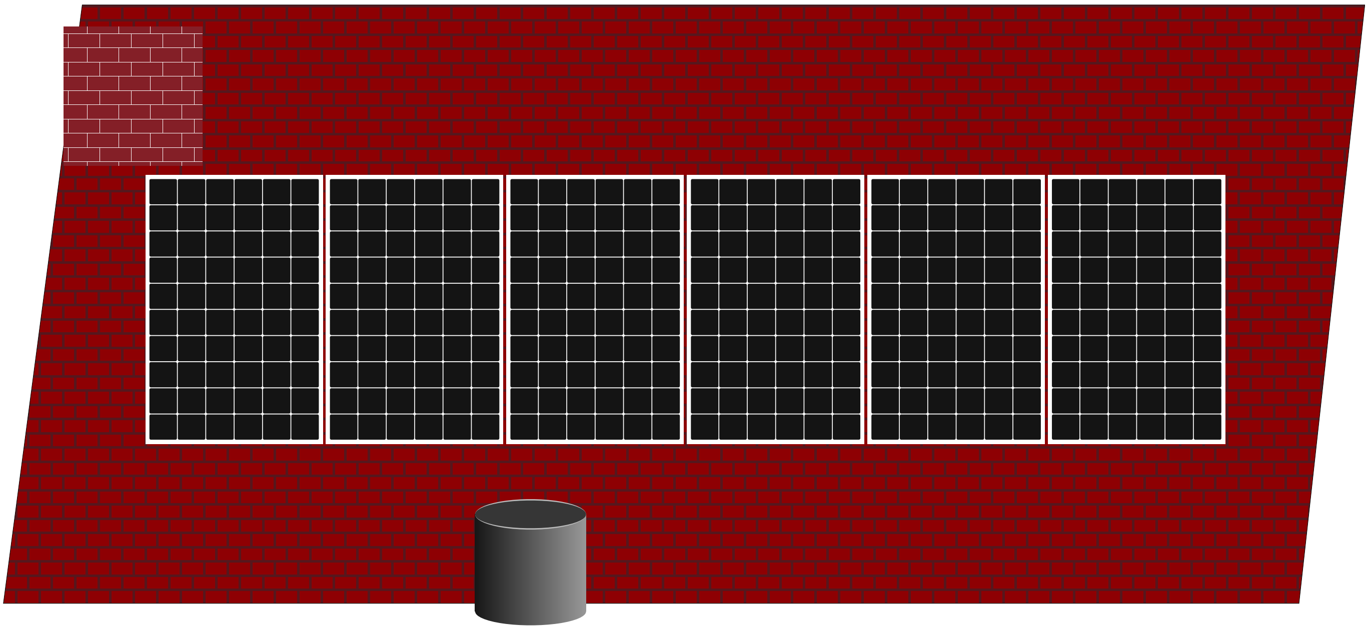
Address: 24 BIRCH DRIVE BURFORD OXFORDSHIRE , OX18 4XH

Date Created: 18th January 2024

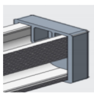
Designer: Craig Edwards

Roof Layout

Roof 1



Component list

	Item	Quantity
	JA Solar Panel 405W solar panel	6
	Solax X1 Mini G3 2.5kW inverter	1
	Emlite ECA2 1ph Meter (Extended Cover)	1
	Label sheet	1
	AC isolator - IMO - 20A 4-pole	2
	Pair of MC4 connectors	2
	50m reel of 4mm2 solar cable	1
	Fastensol silver universal clamp	14
	Fastensol silver end cap	4
	Fastensol portrait flat tile roof hook	14
	Genius flat tile	14
	Fastensol rail splice	2
	Fastensol silver rail 3550mm	4

Inverter checks

Solax X1 Mini G3 2.5kW

Panels

PV power	**2430**	Rated AC output	**2500**

Input 1: 6 JA Solar Panel 405W solar panels in 1 strings

Panels		**Inverter**	
PV power	**2430 W**		
Open circuit voltage at -10° C	**246 V**	Max DC voltage	**550 V**
V_{mpp} at 40° C	**180 V**	V_{mpp} lower limit	**70 V**
V_{mpp} at -10° C	**206 V**	V_{mpp} upper limit	**550 V**
I_{mpp} at 40° C	**13 A**	Max DC input current	**14 A**

Max voltage

The open circuit voltage of the solar panels never exceeds the voltage limit of the inverter.

✓

Max power point range

The maximum power point voltage of the solar panels is always above the lower limit of the inverter MPPT tracker. The maximum power point voltage of the solar panels is always below the upper limit of the inverter MPPT tracker.

✓

Max Current

The maximum power point current of the solar panels is always below the maximum current for the inverter MPPT tracker.

✓

Electrical

Solax X1 Mini G3 2.5kW

AC Isolator

A AC isolator - IMO - 20A 4-pole has been specified for this input

Current

The rated isolator current (20A) is greater than the rated inverter current (11.9A)

✓

Phases

The isolator is suitable for use on a single phase inverter.

✓

Input 1

DC Isolator

Integrated isolator

This inverter contains an integrated DC Isolator.

✓

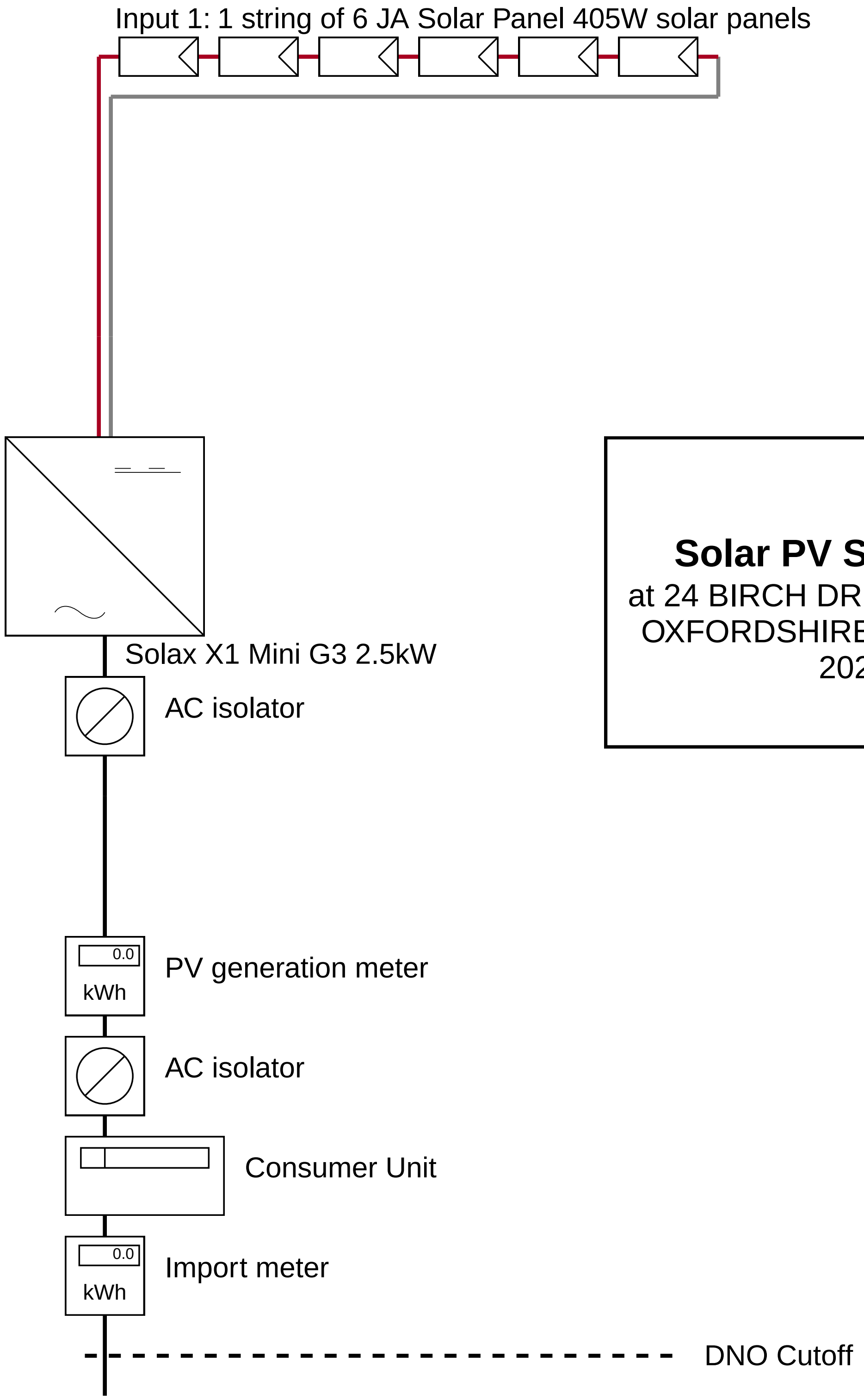
Cable

10m of 4mm2 solar cable has been specified

Voltage drop

Voltage drop at maximum power point at 40°C will be around
1.10 V (0.61 percent)

Schematic diagram



Solar PV Schematic
at 24 BIRCH DRIVE BURFORD OXFORDSHIRE 18th January 2024

Structural calculations

Weight loading calculations

For a traditional cut roof with rafters and purlins we recommend also using our rafter calculator to check the load-bearing capacity of the rafters. Even if the increase in loading is more than 15% the rafters may well be able to take the additional weight.

Please note that this method does not calculate the strength of the roof, and if a roof was badly constructed, does not meet existing building regulations, or is in poor condition then it may still not be appropriate to install an array.

Roof 1

Dead load from roof covering	0.73 kN/m^2
Imposed load	0.75 kN/m^2
Total loading without solar array	**1.48 kN/m^2**

Weight of solar panels and mounting	150 kg
Area covered by solar array	11.7 m^2
Loading imposed by solar array	0.13 kN/m^2
Total loading with solar array	**1.6 kN/m^2**

Increase in loading due to solar array: 8.8%

An increase of less than 15% in the load imposed on a roof is not considered to be a significant change (The Building Regulations 2010, Approved Document A). ✓

Weight loading calculations

Roof 1

Weight of solar panels and mounting	150 kg
Area of solar array	11.7 m^2
Loading imposed by solar array	0.13 kN/m^2
Dead load from roof covering	0.73 kN/m^2
Total dead load of solar array, mounting and roof covering	**0.86 kN/m^2**
Permitted dead load	**0.785 kN/m^2**

The solar array, mounting system, and roof covering are expected to impose a total dead load on the roof of **0.86kN/m^2**. This is more than the permitted dead load for the roof of **0.785kN/m^2**.

Span tables calculations

Roof 1

Total dead load of solar array, mounting and roof covering	0.85 kN/m^2
Roof pitch	37
Rafter depth	100
Rafter breadth	38
Maximum unsupported span	**1.76**
Maximum permitted span	**1.77**

For a dead load of between 0.75 and 1.00kN/m^2 and a roof pitch of 30 to 45 degrees, with roof timbers of 38 x 100 mm at 600 centers, the maximum permitted unsupported span according to Trada span tables is 1.77m.

The maximum unsupported length of the roof timbers is within the permitted span. ✓

Wind loading calculations

The maximum force acting on a solar array from wind loading is given by the following formula in BRE Digest 489:

$$F = q_p \times C_{p\ net} \times C_a \times C_t \times A_{ref}$$

Roof 1

Q_p		966 Pa
From Fig 34 in Guide to the Installation of Photovoltaic Systems for a building 20 m high, in windzone 1, in urban terrain, at a distance of greater than 20km from the sea		
$C_{p\ net}$	Roof Centre	Roof edge
Uplift	-1.3	-2.2
Pressure	1	1.1
C_a		1.048
At an altitude of 12m		
C_t		1
When there is no significant topography		
A_{ref}		$11.72m^2$
F	Roof Centre	Roof edge
Uplift	**-15420N**	**-26095N**
Pressure	**11861N**	**13048N**

With 14 roof hooks we should allow for an uplift force per hook in the central zone of **1101N**, rising to **1864N** at the edges. If 2 screws are used per roof hook, this equates to **551N**per fixing in the central zone, and **932N** at the edges.

Flat tile roof hooks are fixed with screws that pass through the 5mm plate of the roof hook and are then buried fully into the rafter beneath. So there is approximately 65 mm of thread in the timber. The pull-out force in C16 timber is given by tables and formulae in BS5268 Part 2:

$$17.3 \times 1.25 \times 65 = \mathbf{1406N}$$

The pullout force on the fixings is more than the expected wind loading, even when the fixings are close to the edge of the roof. ✓

Performance Estimate

Site details

Client

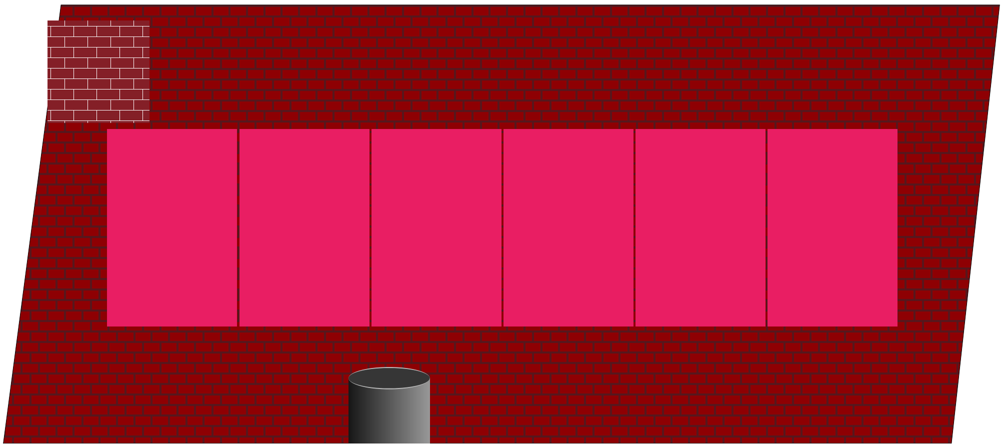
Address 24 BIRCH DRIVE BURFORD OXFORDSHIRE

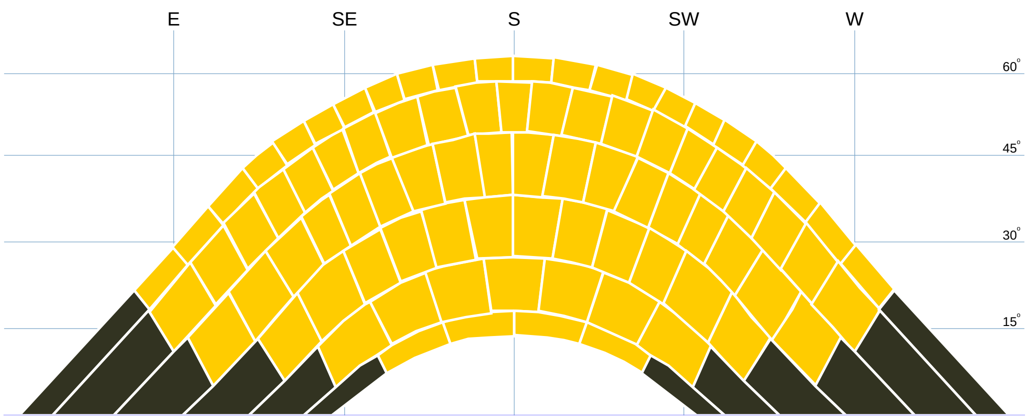
The sunpath diagram shows the arcs of the sky that the sun passes through at different times of the day and year as yellow blocks. The shaded area indicates the horizon as seen from the location of the solar array. Where objects on the horizon are within 10m of the array, an added semi-circle is drawn to represent the increased shading. Blocks of the sky that are shaded by objects on the horizon are coloured red, and a shading factor is calculated from the number of red blocks. The performance of the solar array is calculated by multiplying the size of the array (kWp) by the shading factor (sf) and a site correction factor (kk), taken from tables which take account of the geographical location, orientation and inclination of the array.

Inverter 1

Solax X1 Mini G3 2.5kW

Input 1





A. Installation data		
Installed capacity of PV system - kWp (stc)	**2.430**	kWp
Orientation of the PV system - degrees from South	**73**	°
Inclination of system - degrees from horizontal	**37**	°
Postcode region	**1**	

B. Performance calculations		
kWh/kWp (Kk)	**833**	kWh/kWp
Shade factor (SF)	**1.00**	
Estimated output (kWp x Kk x SF)	**2024**	kWh

Performance Summary

A. Installation data		
Installed capacity of PV system - kWp (stc)	**2.43**	kWp
Orientation of the PV system - degrees from South	**See individual inputs**	
Inclination of system - degrees from horizontal	**See individual inputs**	
Postcode region	**1**	
B. Performance calculations		
kWh/kWp (Kk)	**See individual inputs**	
Shade factor (SF)	**See individual inputs**	
Estimated output (kWp x Kk x SF)	**2024**	kWh

Important Note: The performance of solar PV systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate is based upon the standard MCS procedure is given as guidence only for the first year of generation. It should not be considered as a guarantee of performance.

This system performance calculation has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values.

Self consumption

We model here the performance of a solar PV system over the course of a year, using high resolution minute-by-minute generation data for a typical PV system and consumption data for a typical house, and calculating the flow of energy from the solar panels to the house during the day, and from the grid back to the house at night.

We provide yearly profiles of generation, consumption and import / export, along with detailed profiles for a typical spring day.

Consumption 3100 kWh

Electricity consumed in the property each year

Generation 2023 kWh

Electricity generated by the PV array each year

Self consumption 43 %

Proportion of PV generation used in the property

Independence 28 %

Proportion of electricity consumption provided by PV

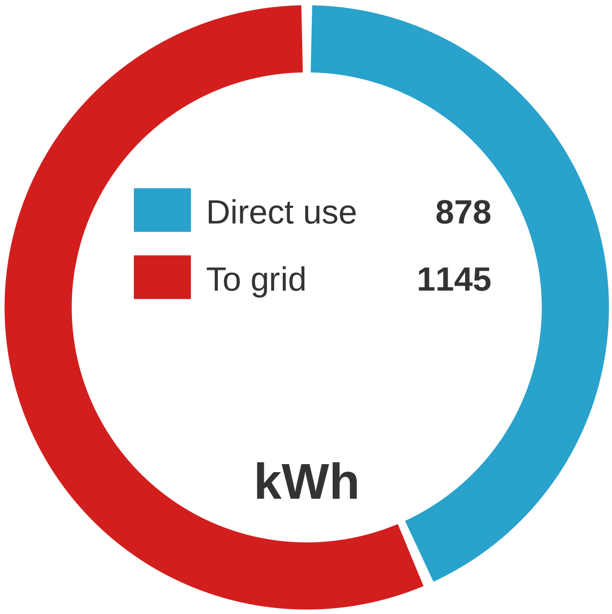
Import / Export 2230 / 1145 kWh

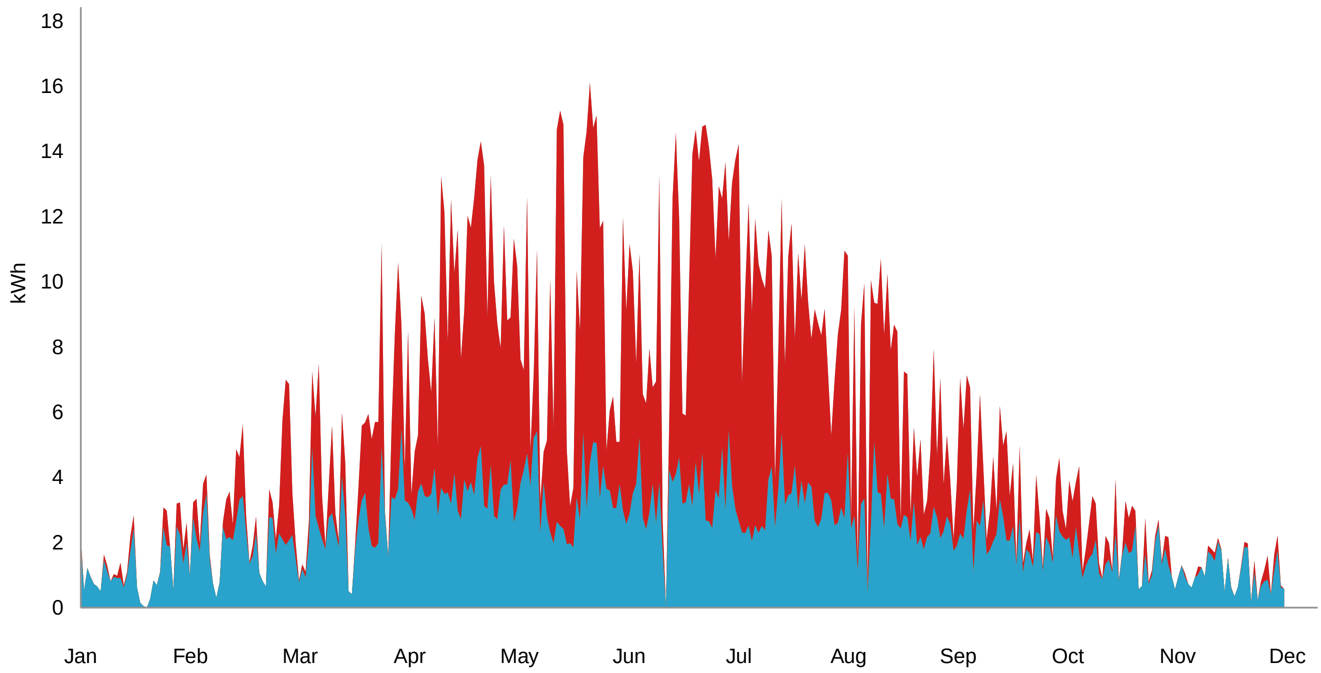
Electricity import / export each year from the property

Yearly generation

The solar PV array is expected to generate 2023 kWh over a typical year. The graph shows whether the generated energy is used directly in the house or exported to the grid.

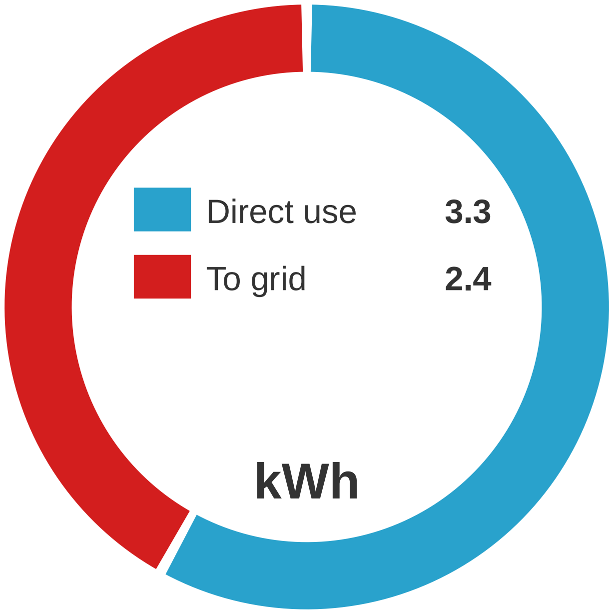
43% (878 kWh) of the electricity generated is expected to be used directly in the property. The remaining generation (1145 kWh, or 57% of the total) is exported to the grid.

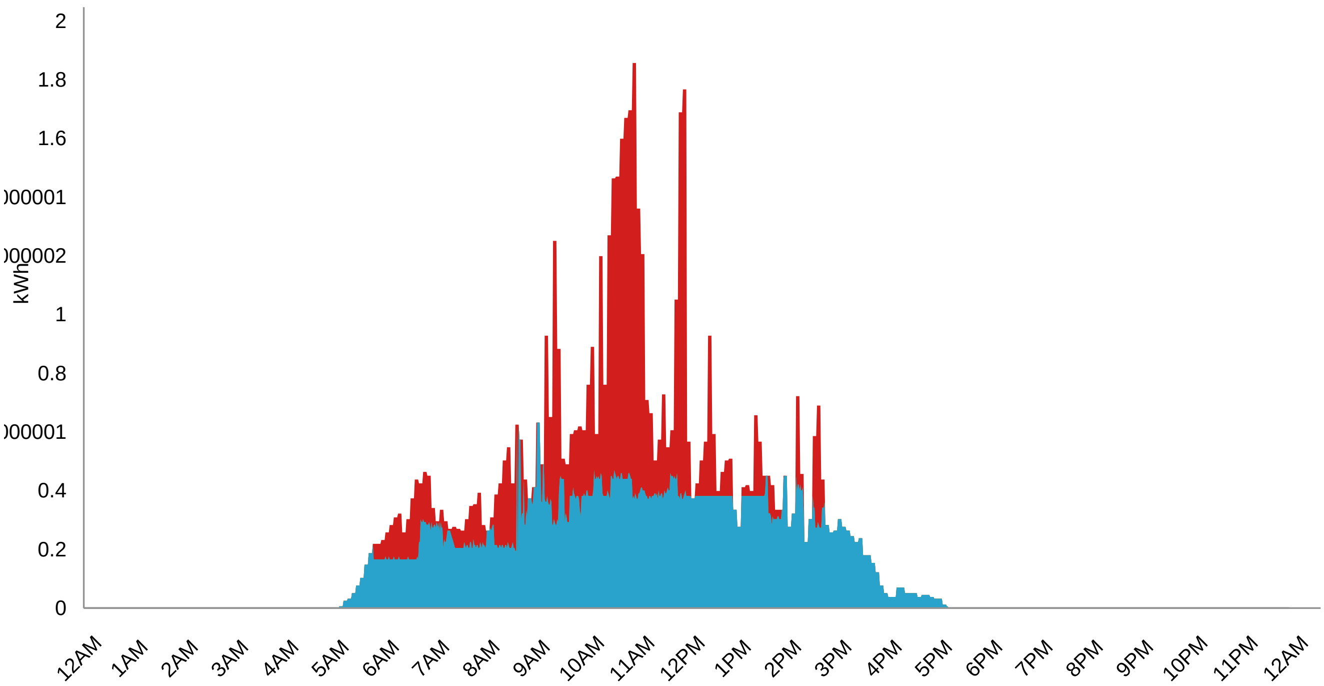




Daily generation

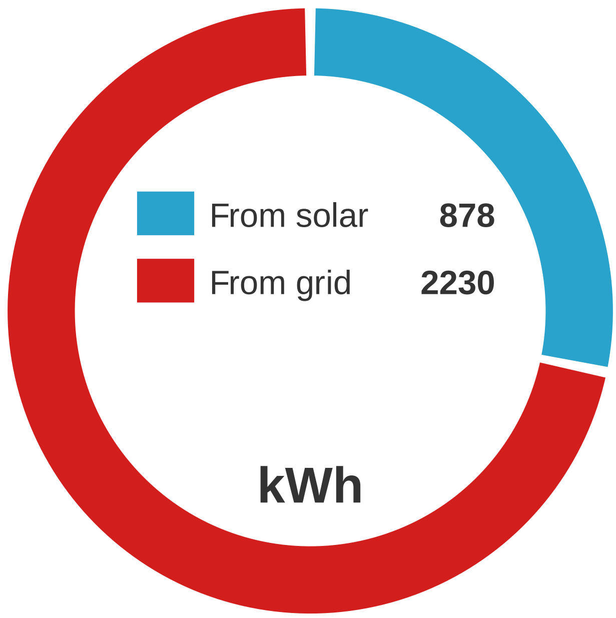
This graph shows the modelled profile of electricity generated by the PV array on a selected day (March 27th). On this day the PV system is expected to generate 5.7 kWh. Of this, 3.3 kWh (58%) is used directly in the property, and 2.4 kWh (42%) is exported to the grid.

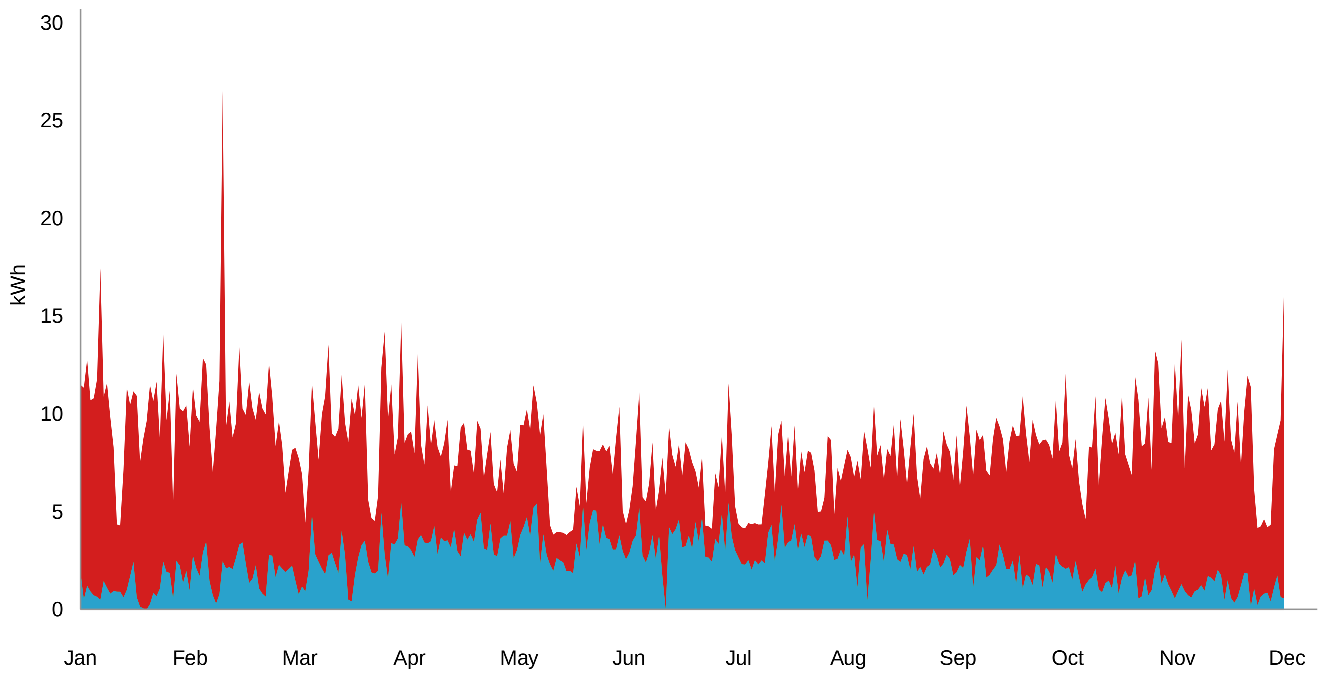




Yearly consumption

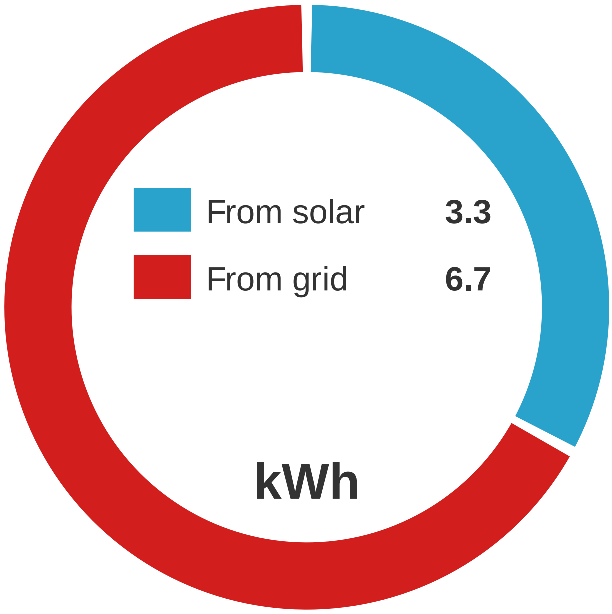
The property is expected to consume 3100kWh of electricity each year. Around 28% of this (878 kWh) is expected to be supplied directly by the solar array. The remaining 72% (2230 kWh) is supplied from the grid.

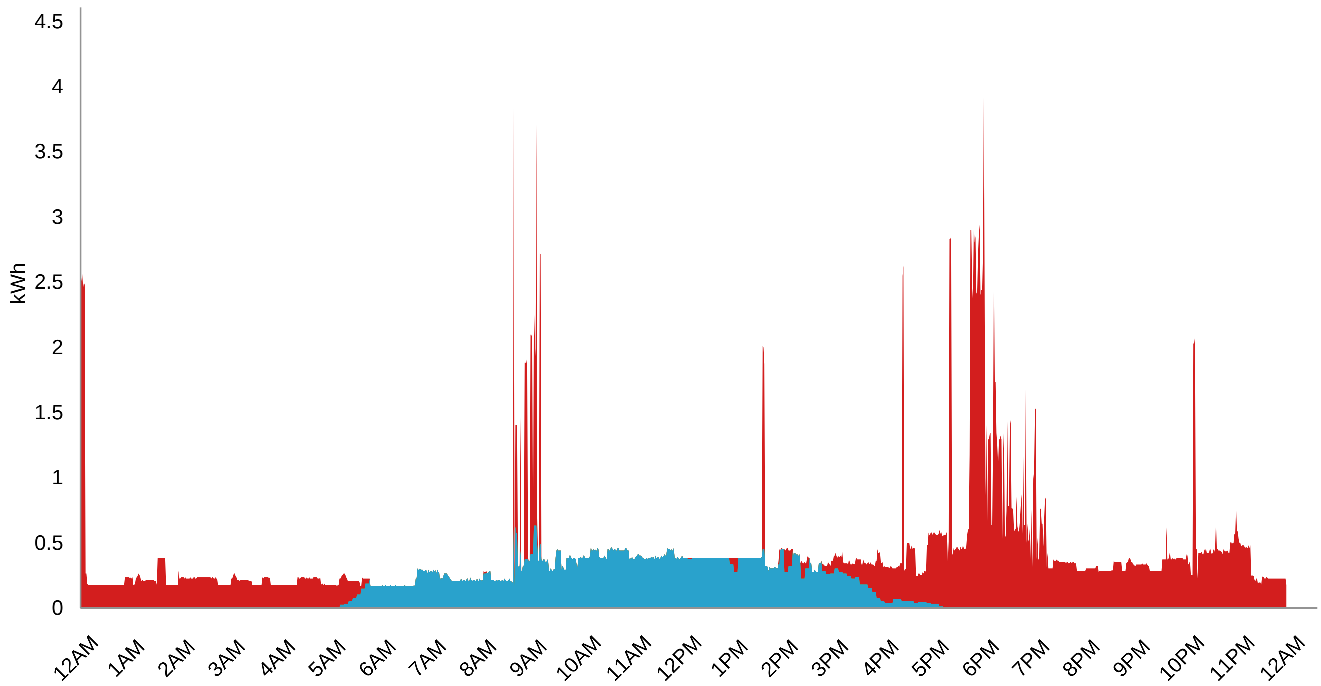




Daily consumption

This graph shows modelled consumption data over the course of the selected day (March 27th). Total electricity consumption on this day was 10.1 kWh, of which 3.3 kWh (33%) is expected to be supplied directly by the solar array. The remaining 6.7 kWh (66%) is imported from the grid.

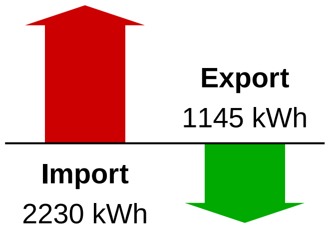


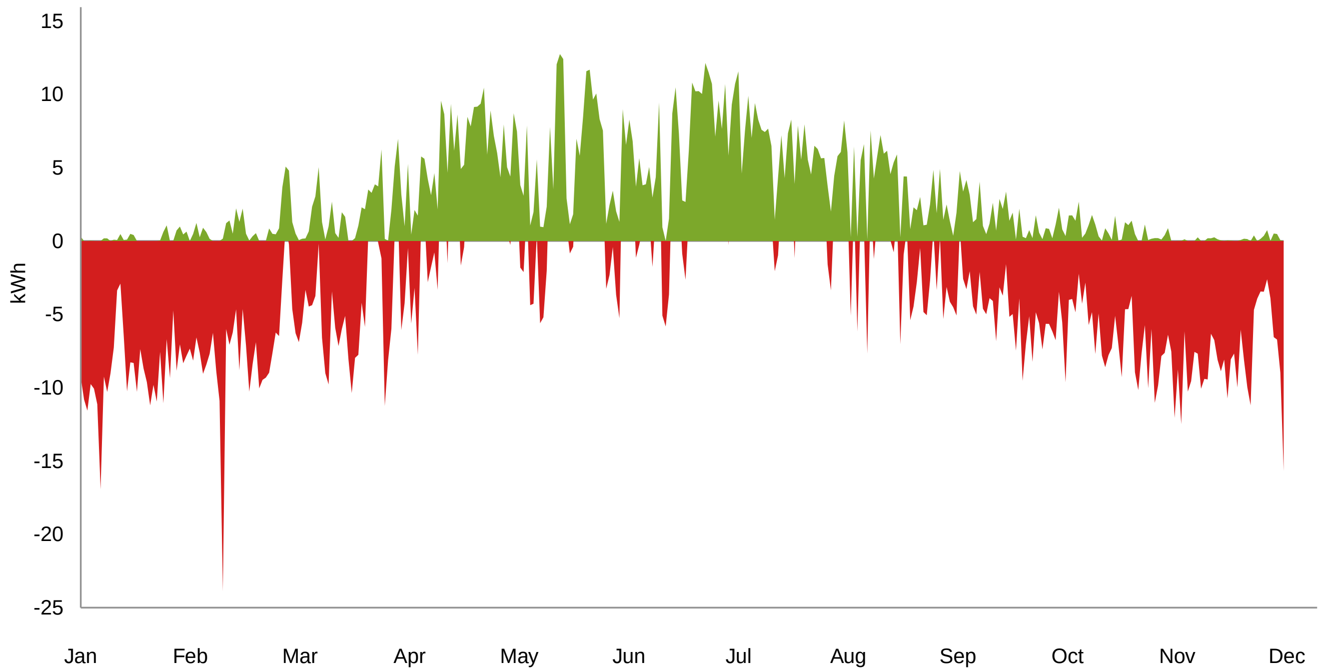


Yearly import and export

This graph shows modelled profiles of electricity imported and exported to and from the grid over the course of a year. The red area above the horizontal axis represents imported electricity, and the green area beneath the axis exported electricity.

Over the course of the year, a total of 2230 kWh is expected to be imported by the property, and 1145 kWh exported back to the grid.





Daily import and export

This graph shows the modelled import and export of electricity over a selected day (March 27th). On this day 6.70 kWh is expected to be imported from the grid, and 2.4 kWh exported.