SOLAR AIR UK

SOLAR & AIR SOURCE SPECIALISTS

Andrew Bagnall

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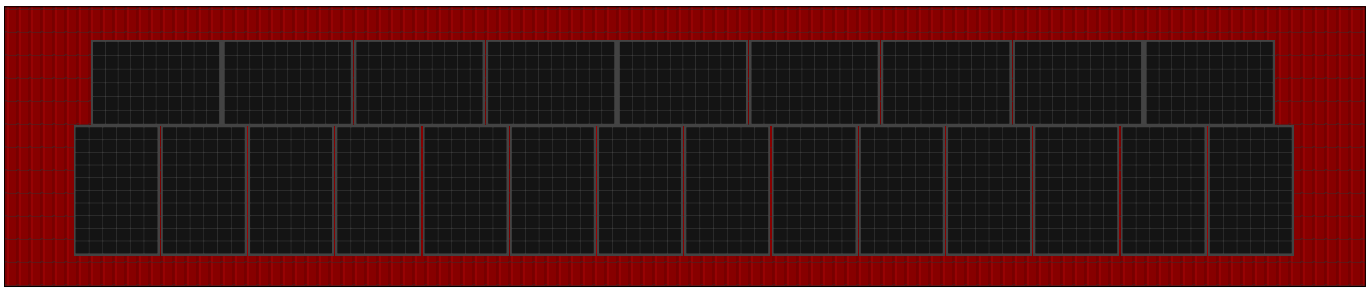
Date Created: 4th September 2023

Designer: Kane Kupperblatt

Roof Layout

Roof 1



Component list

Item	Quantity
 Longi - Hi-Mo5 415w Solar Panels solar panel	23
 SolaX X3 G4 Hybrid 10.0D inverter	1
 Giv.AC 3.0 inverter	1
 Emlite EMP1 Three Phase meter	1
 Label sheet	2
 GEM-CT-45/100	1
 GivEnergy WiFi Dongle	1
 Reinforced BirdBlocker for Solar Panels	1
 GivEnergy All-in-one to Ring Terminal Cable	1
 AC isolator - Projoy 20A 4-pole	4
 K&N DC isolator - KGD40-3	1
 Pair of MC4 connectors	2
 Gen2 GivEnergy 9.5kWh LiFePO4 Battery (integrated DC breaker)	2
 50m reel of 4mm2 solar cable	1
 Fastensol end clamp (30mm black)	40

	Fastensol mid clamp (30mm black)	26
	Fastensol black end cap	40
	Fastensol portrait concrete tile roof hook	30
	Fastensol rail splice	8
	Fastensol landscape concrete tile roof hook	36
	Fastensol silver rail 3300mm	19

Inverter checks

SolaX X3 G4 Hybrid 10.0D

Panels

PV power	**9545**	Rated AC output	**10000**

Input 1: 23 Longi - Hi-Mo5 415w Solar Panels solar panels in 1 strings

Panels		**Inverter**	
PV power	**9545 W**		
Open circuit voltage at -10° C	**950 V**	Max DC voltage	**1000 V**
V_{mpp} at 40° C	**700 V**	V_{mpp} lower limit	**180 V**
V_{mpp} at -10° C	**799 V**	V_{mpp} upper limit	**950 V**
I_{mpp} at 40° C	**13 A**	Max DC input current	**20 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.

Giv.AC 3.0

Panels

PV power	**0**	Rated AC output	**null**

Electrical

SolaX X3 G4 Hybrid 10.0D

AC Isolator

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

Current

The rated isolator current (20A) is greater than the rated inverter current (16.1A)

Phases

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

Input 1

DC Isolator

A K&N DC isolator - KGD40-3 has been specified for this input

Current

The isolator is rated for a current of 20A, which is more than the expected maximum current of 14A.

Voltage

At 20A the isolator is rated for a voltage of 1000V, which is more than the expected maximum voltage of 950V.

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 (0.16 percent)**

Giv.AC 3.0

AC Isolator

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

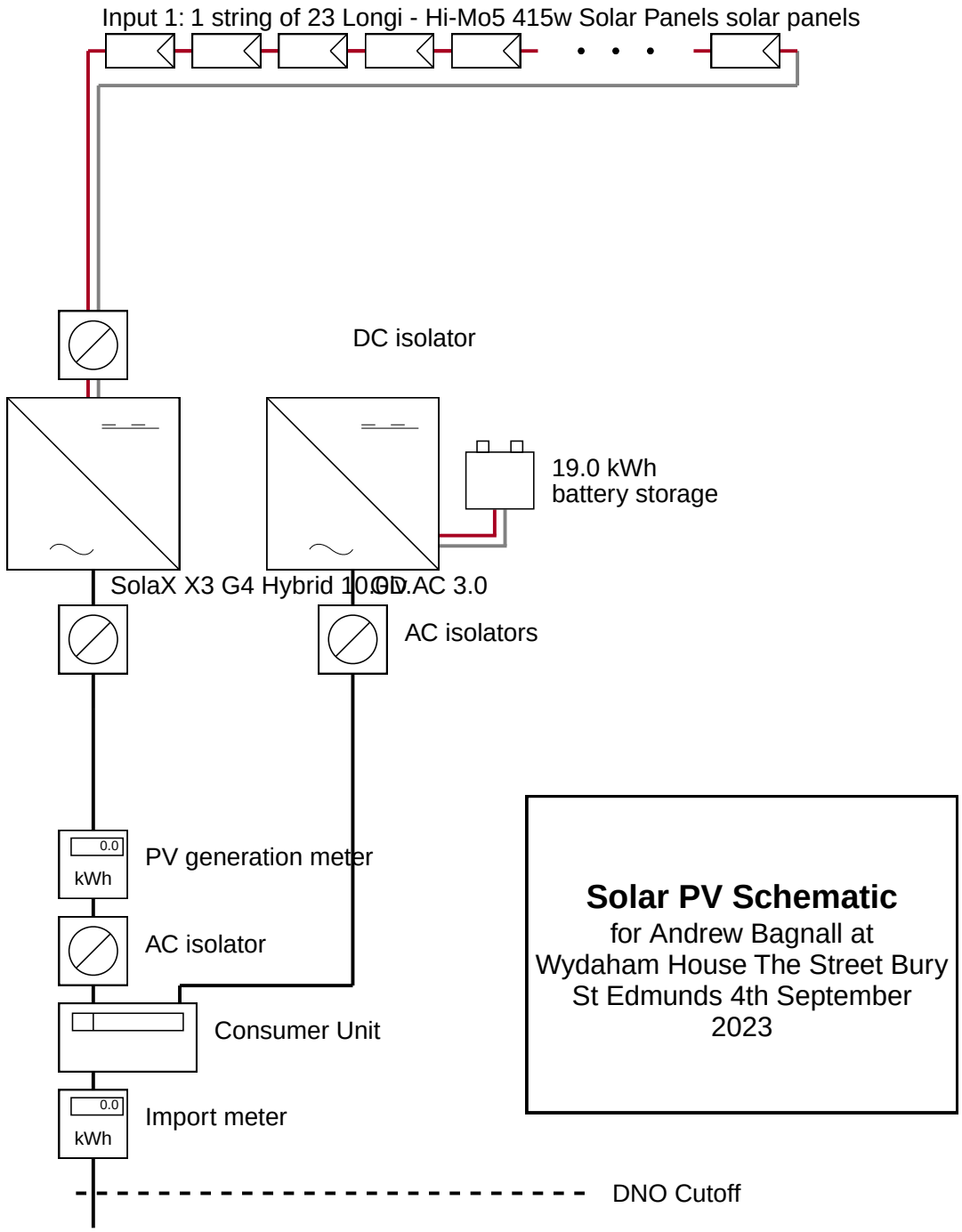
Current

The rated isolator current (20A) is greater than the rated inverter current (13.6A)

Phases

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

Schematic diagram



Performance Estimate

Site details

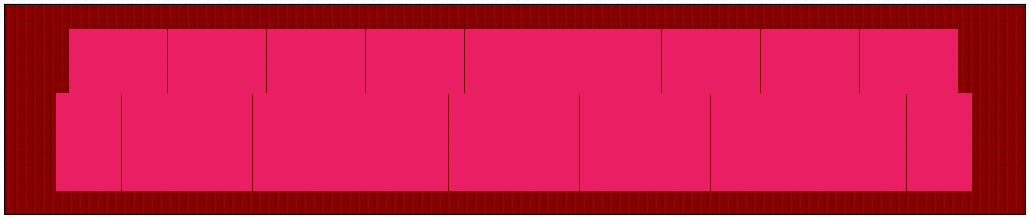
Client	Andrew Bagnall
Address	Wydaham House The Street Bury St Edmunds

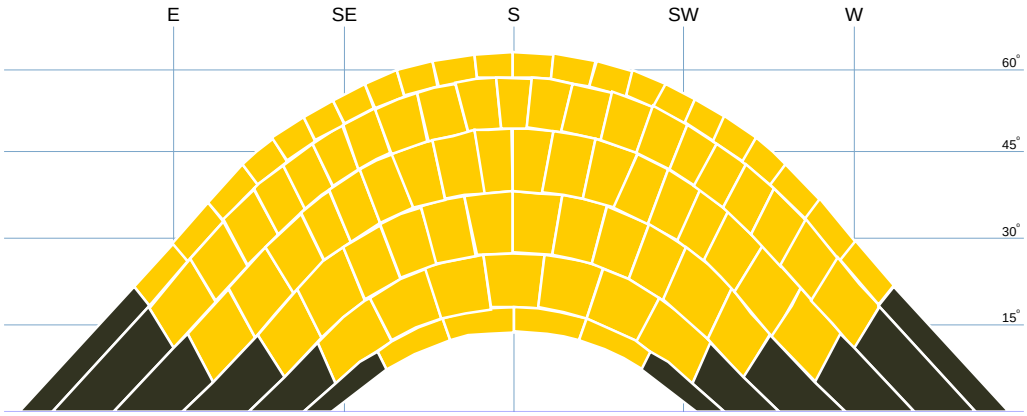
The sunpath diagram shows the arcs of the sky that the sun passes through at different times of the day and year as yellow blocks. The shaded area indicates the horizon as seen from the location of the solar array. Where objects on the horizon are within 10m of the array, an added semi-circle is drawn 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 X3 G4 Hybrid 10.0D

Input 1





A. Installation data		
Installed capacity of PV system - kWp (stc)	**9.545**	kWp
Orientation of the PV system - degrees from South	**-35**	°
Inclination of system - degrees from horizontal	**30**	°
Postcode region	**12**	

B. Performance calculations		
kWh/kWp (Kk)	**922**	kWh/kWp
Shade factor (SF)	**1.00**	
Estimated output (kWp x Kk x SF)	**8800**	kWh

Performance Summary

A. Installation data		
Installed capacity of PV system - kWp (stc)	**9.545**	kWp
Orientation of the PV system - degrees from South	**See individual inputs**	
Inclination of system - degrees from horizontal	**See individual inputs**	
Postcode region	**12**	
B. Performance calculations		
kWh/kWp (Kk)	**See individual inputs**	
Shade factor (SF)	**See individual inputs**	
Estimated output (kWp x Kk x SF)	**8800**	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 with battery storage 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 and the battery during the day, and from the storage battery back to the house at night - or from the grid to the house when the battery is empty or loads exceed the discharge capacity of the system.

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

Battery system specification

Giv.AC 3.0 with 2 Gen2 GivEnergy 9.5kWh LiFePO4 Battery (integrated DC breaker) batteries

Charge rate	**3000 W**
Inverter charge efficiency	**96.5 %**
Inverter discharge efficiency	**96.5 %**
Battery efficiency	**95.0 %**
Round trip efficiency	**88.5 %**
Battery bank capacity	**19 kWh**
Max discharge depth	**100 %**
Usable capacity	**19 kWh**

Consumption

Electricity consumed in the property each year

3500 kWh

Generation

Electricity generated by the PV array each year

8802 kWh

Self consumption

Proportion of PV generation used in the property

35 %

Independence

Proportion of electricity consumption provided by PV

85 %

Import / Export

Electricity import / export each year from the property

534 / 5645 kWh

Utilisation

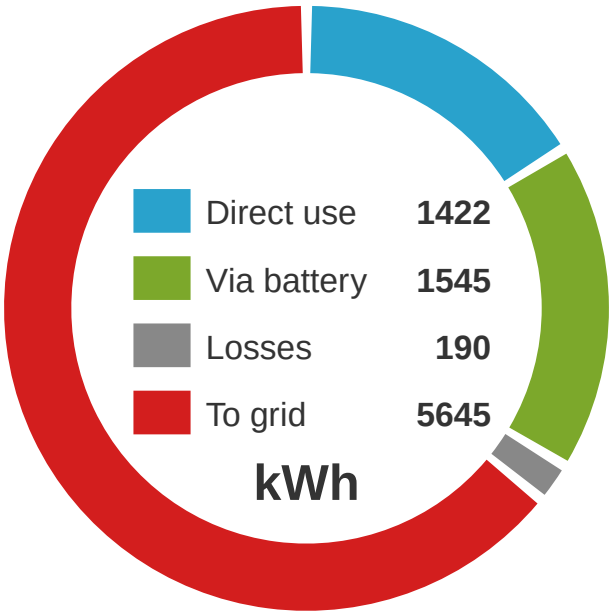
Average daily utilisation of the storage battery

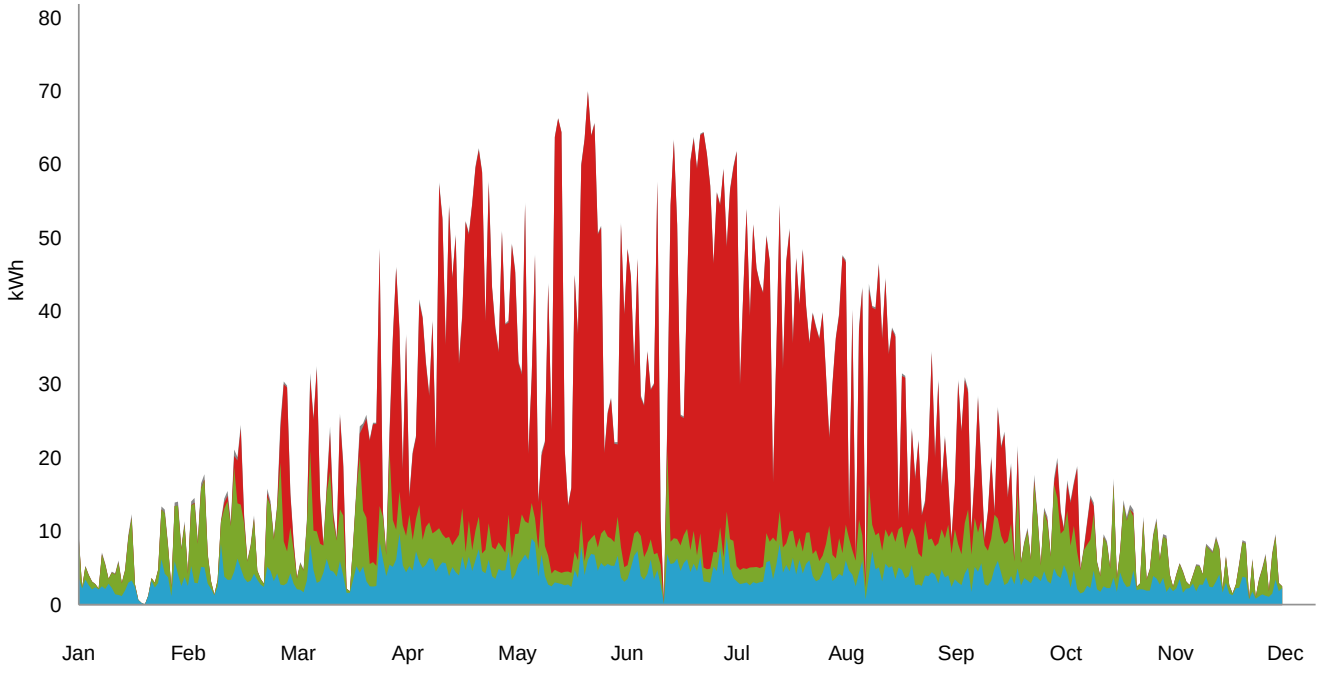
23 %

Yearly generation

The solar PV array is expected to generate 8802 kWh over a typical year. The graph shows whether the generated energy is used directly in the house, used to charge the storage battery, or exported to the grid.

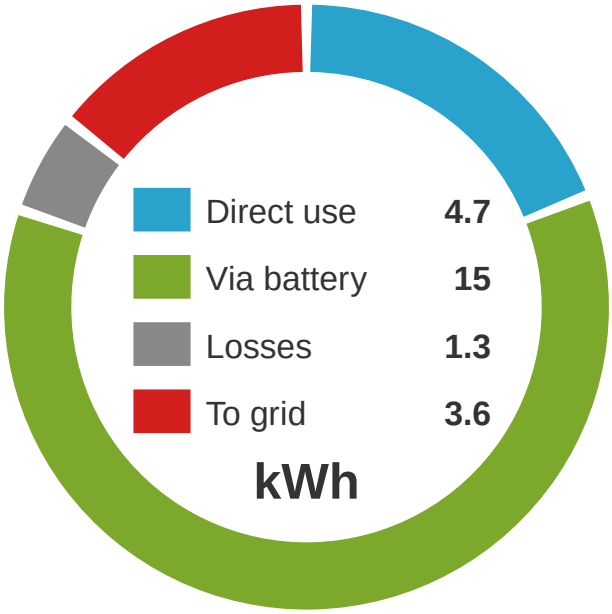
16% (1422 kWh) of the electricity generated is expected to be used directly in the property. 20% (1735 kWh) is directed to the battery for later use, although 190 kWh of this is lost during battery charging and discharging, leaving 1545 kWh for use in the property. The remaining generation (5645 kWh, or 64% of the total) is exported to the grid.

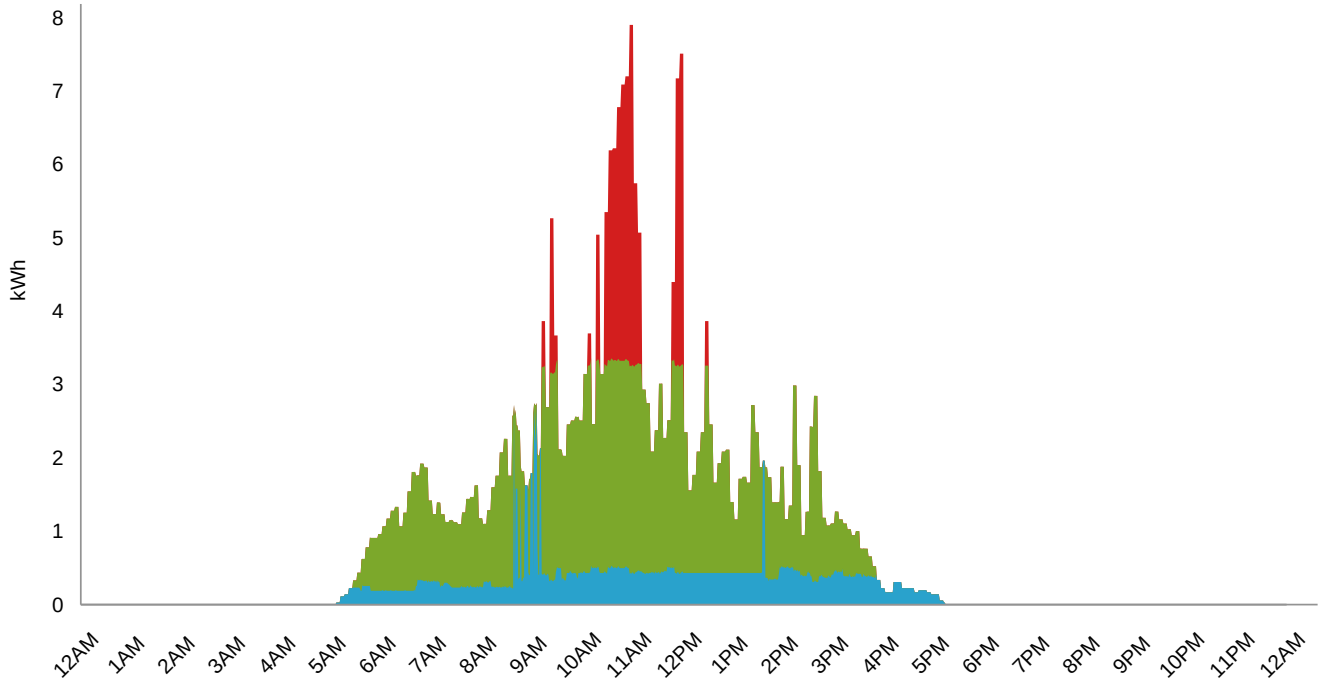




Daily generation

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 24.8 kWh. Of this, 4.7 kWh (19%) is used directly in the property, 17 kWh (69%) is stored in the battery for later re-use, and 3.6 kWh (15%) is exported to the grid.

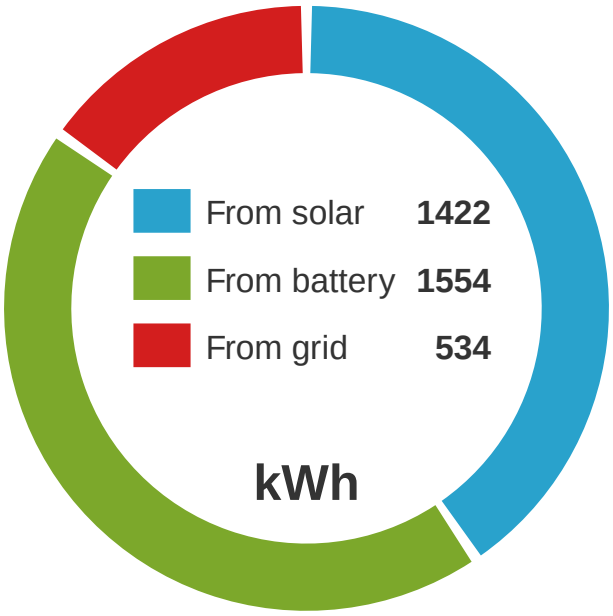


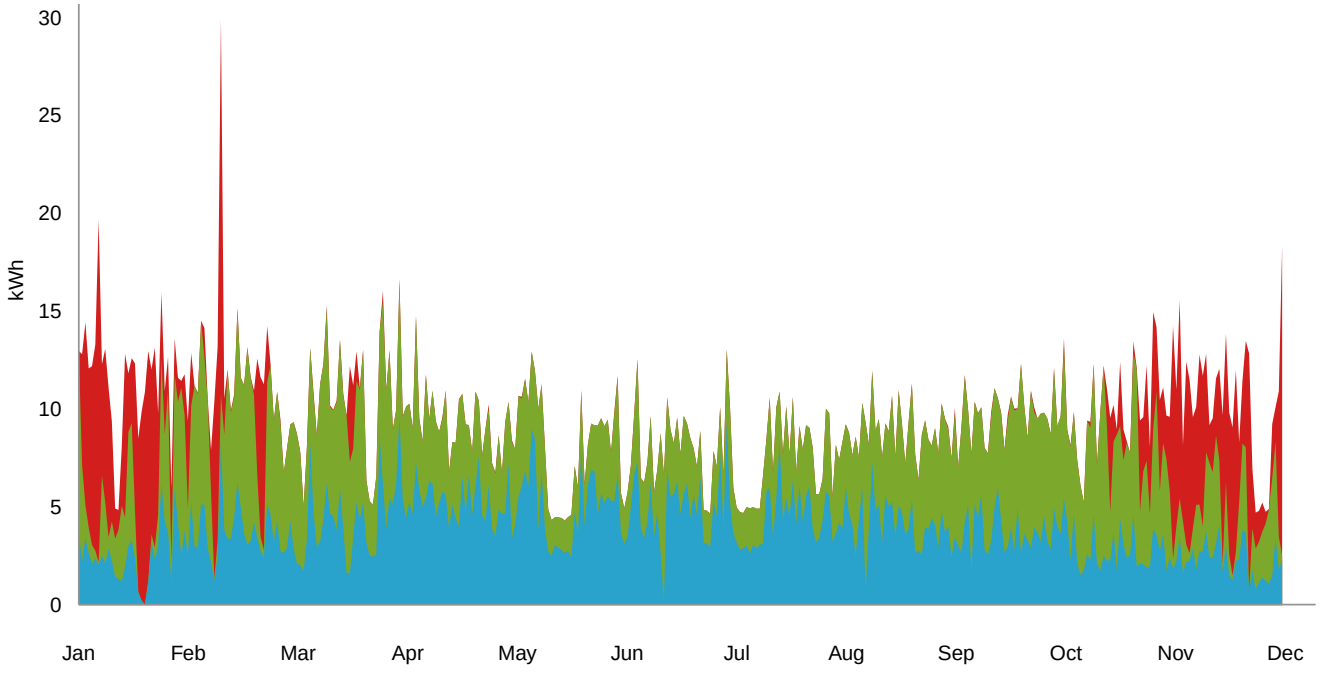


Yearly consumption

The property is expected to consume 3500kWh of electricity each year. Around 41% of this (1422 kWh) is expected to be supplied directly by the solar array. Another 44% (1554 kWh) is supplied from the storage battery. The remaining 15% (534 kWh) is supplied from the grid.

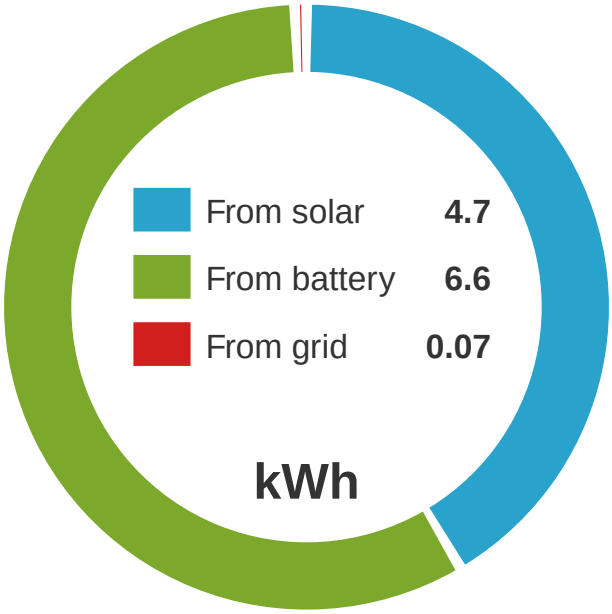
Overall, 85% (2976 kWh) of the electricity used in the property is expected to be supplied by the solar array and battery storage system. Without battery storage it would be 41% (1422 kWh).

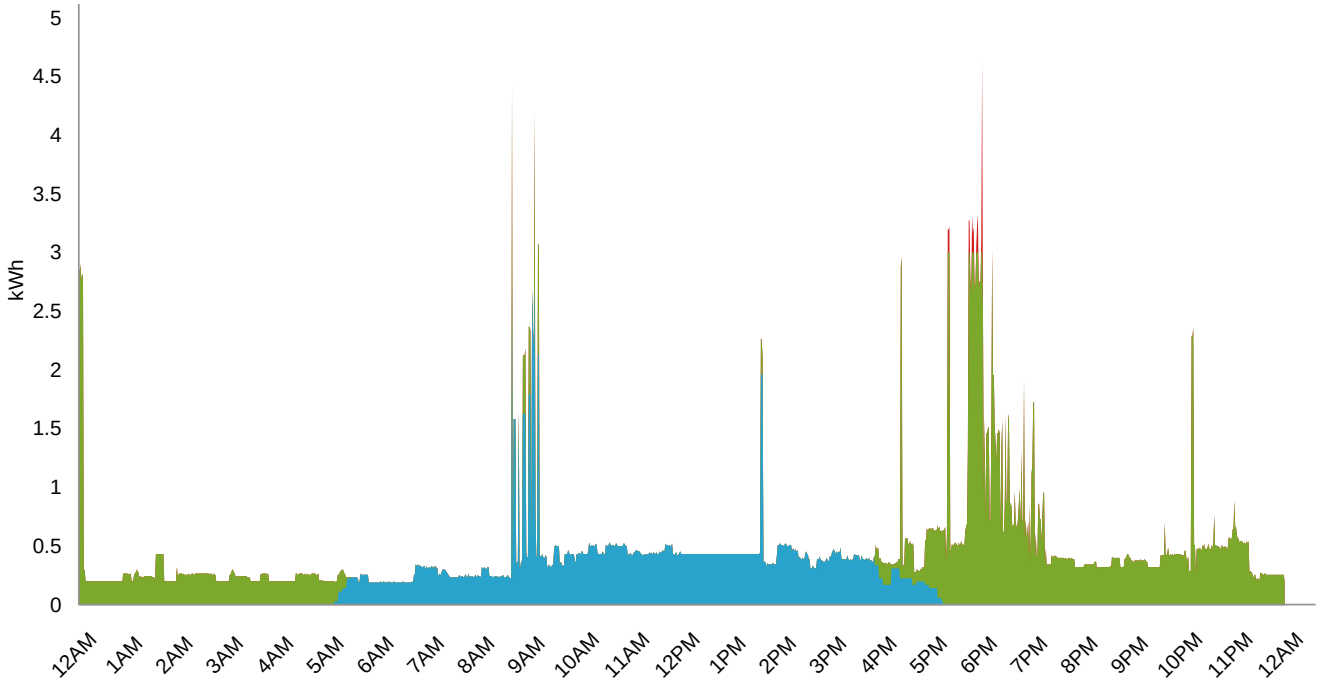




Daily consumption

This graph shows modelled consumption data over the course of the selected day (March 27th). Total electricity consumption on this day was 11.4 kWh, of which 4.7 kWh (41%) is expected to be supplied directly by the solar array, and a further 6.6 kWh (58%) drawn from the battery storage system. The remaining 0.1 kWh (1%) is imported from the grid.

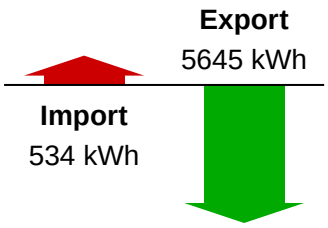


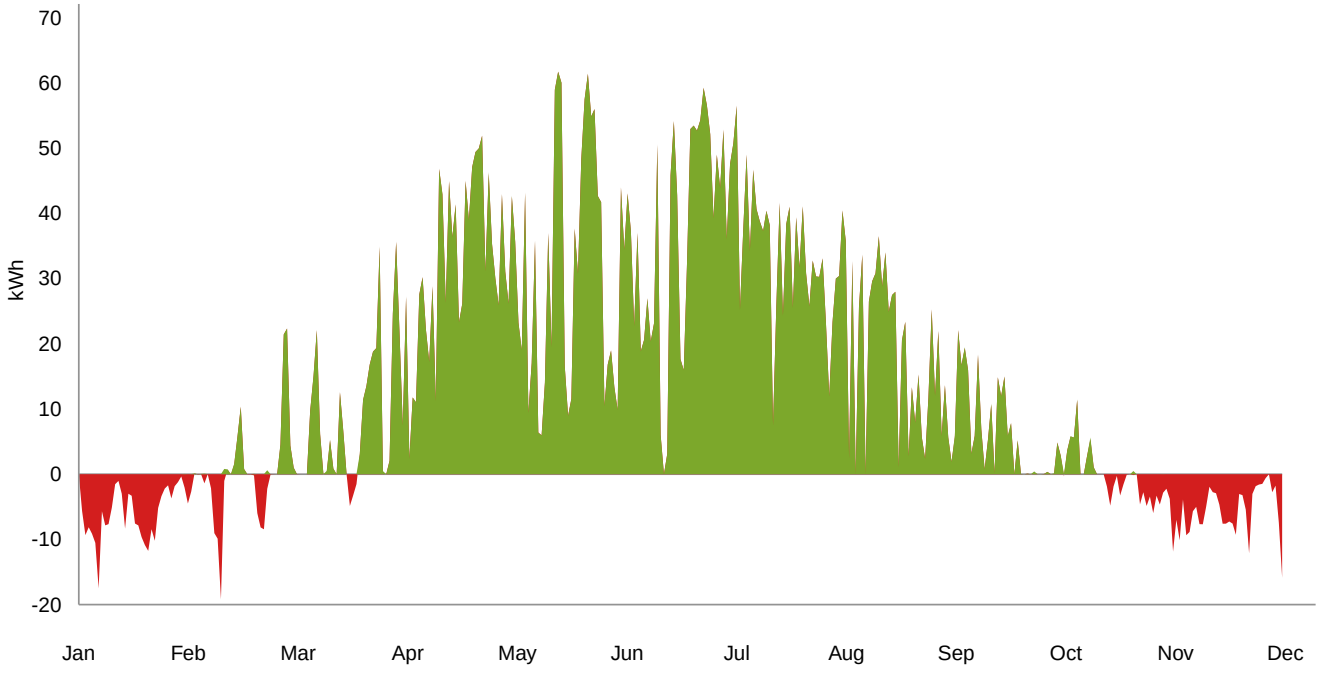


Yearly import and export

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.

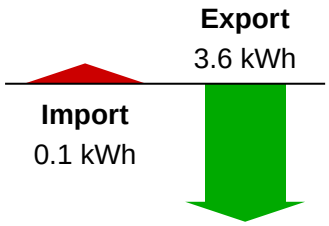
Over the course of the year, a total of 534 kWh is expected to be imported by the property, and 5645 kWh exported back to the grid.

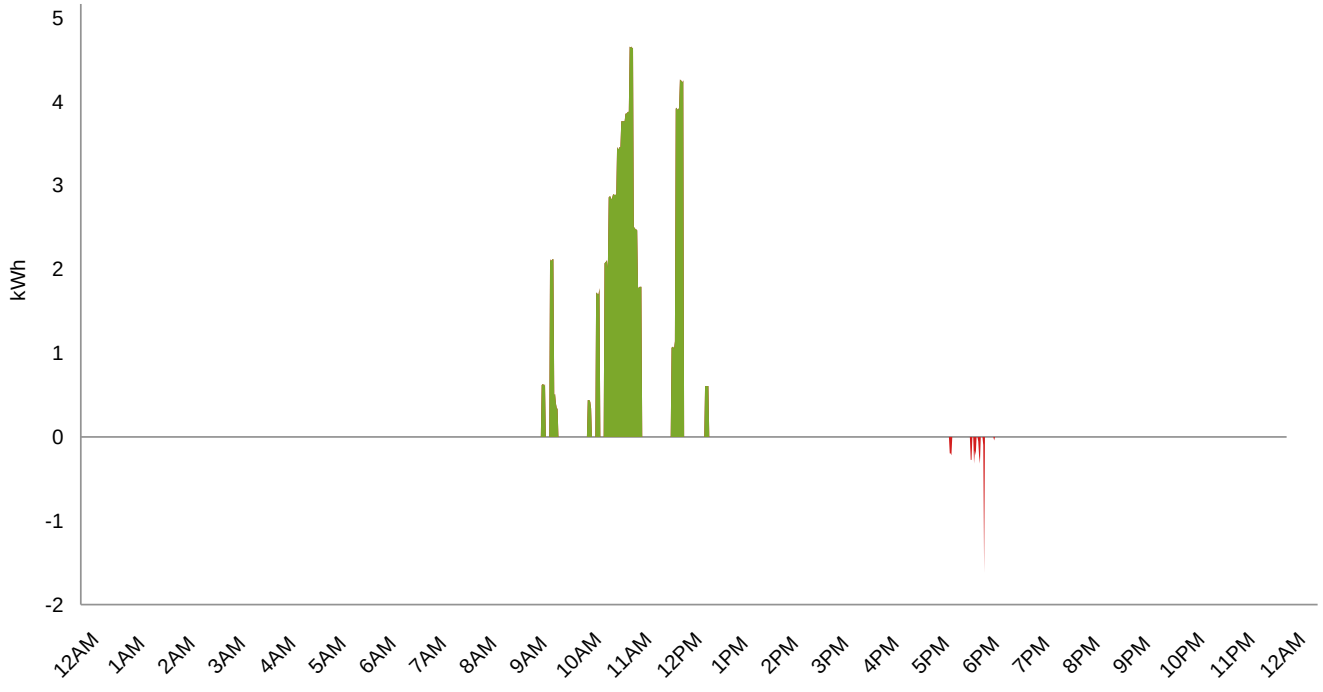




Daily import and export

This graph shows the modelled import and export of electricity over a selected day (March 27th). On this day 0.10 kWh is expected to be imported from the grid, and 3.6 kWh exported.At times when no import or export is shown the battery storage system is charging or discharging.





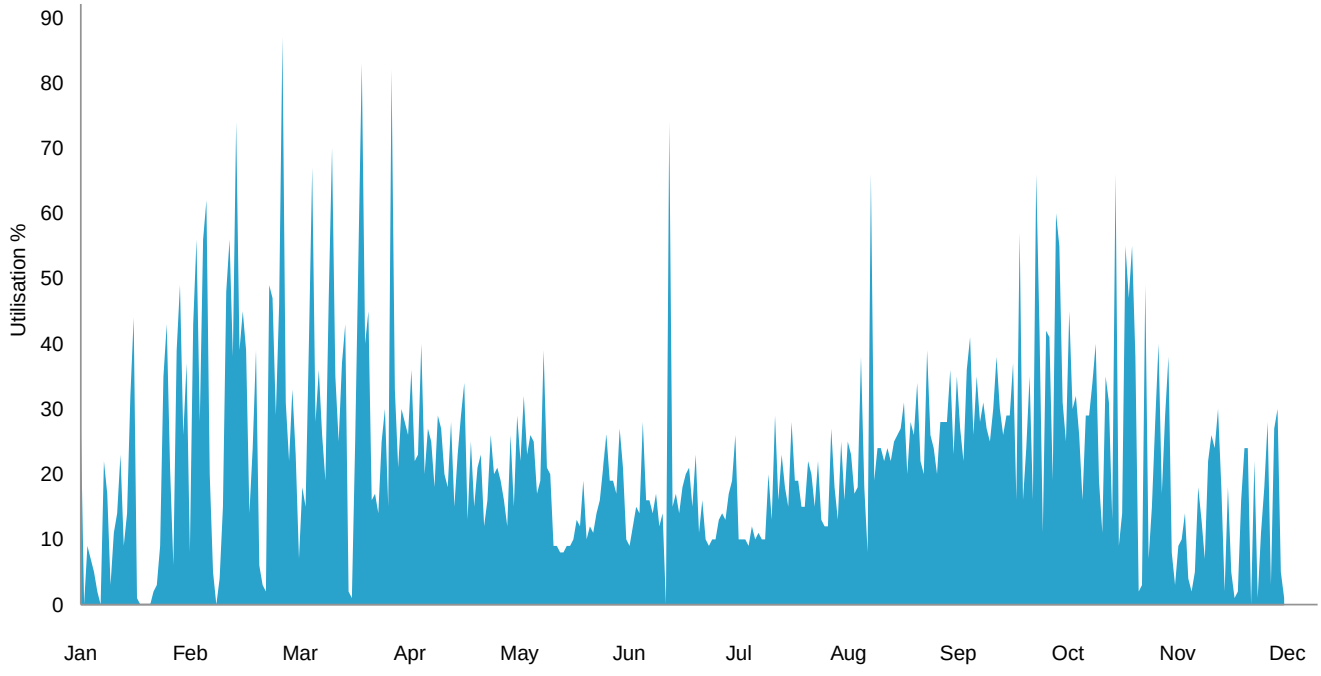
Yearly battery utilisation

The graph shows the modelled utilisation of the battery over the course of the year - the fraction of the available battery capacity that is actually charged and discharged each day. Utilisation of over 100% is possible at times where a battery is charged and discharged more than once during a day.

Low battery utilisation can be due to either insufficient spare PV generation to charge the battery (often the case in winter, or on cloudy days), or because loads are small overnight and the battery does not fully discharge.

Average battery utilisation

23%

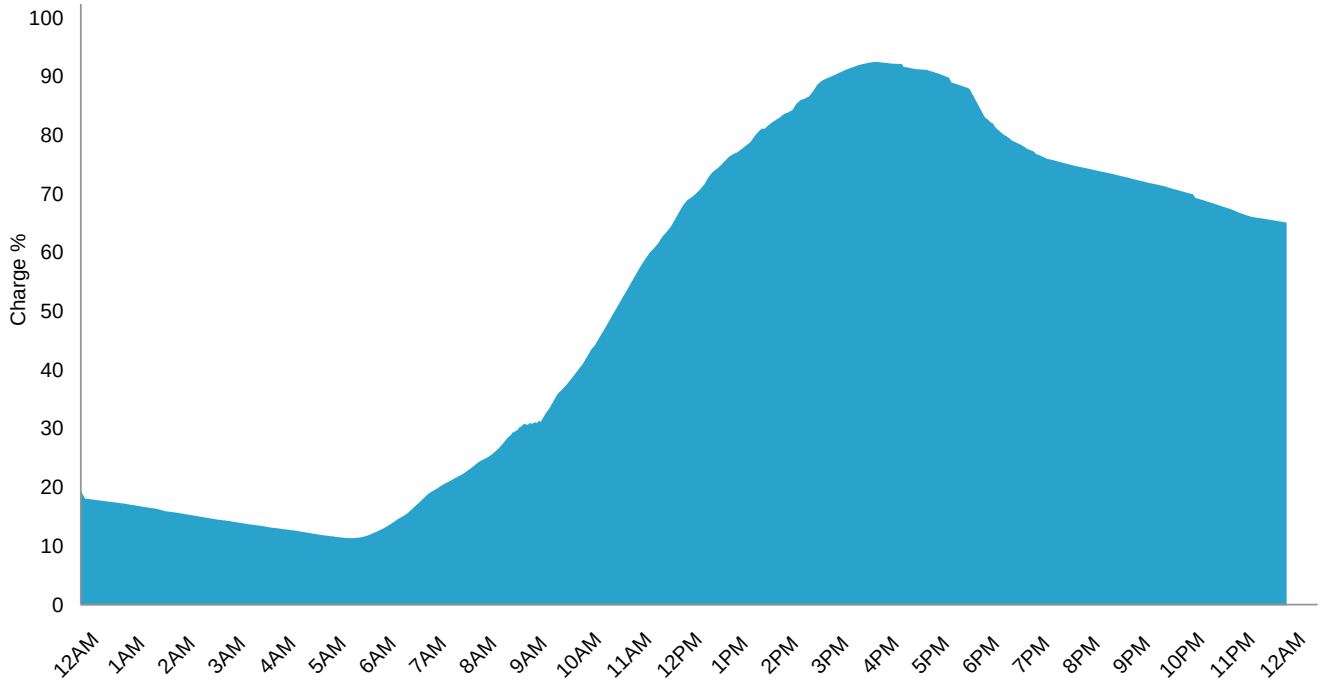


Daily battery utilisation

The state of charge of the battery over a selected day (March 27th) is shown in the graph below. The battery discharges overnight or when there is heavy demand during the day, and charges when there is excess solar PV generation during the day. On this day, 82% of the battery capacity was utilised.

Average battery utilisation

82%



Equipment and Services

Equipment Costs	
Package	£13,405.00
Large Battery	£9,995.00
Bird Proofing	£800.00
Total equipment cost	**£24,200.00**

Services Costs	
Scaffold	£800.00
Total services cost	**£800.00**

Totals	
Total before tax	**£25,000.00**
VAT at 0%	**£0.00**
Total including tax	**£25,000.00**