RAMKI
Heating | Renewables | Maintenance

Amit Depala

Project Name: 28 Westfields Avenue

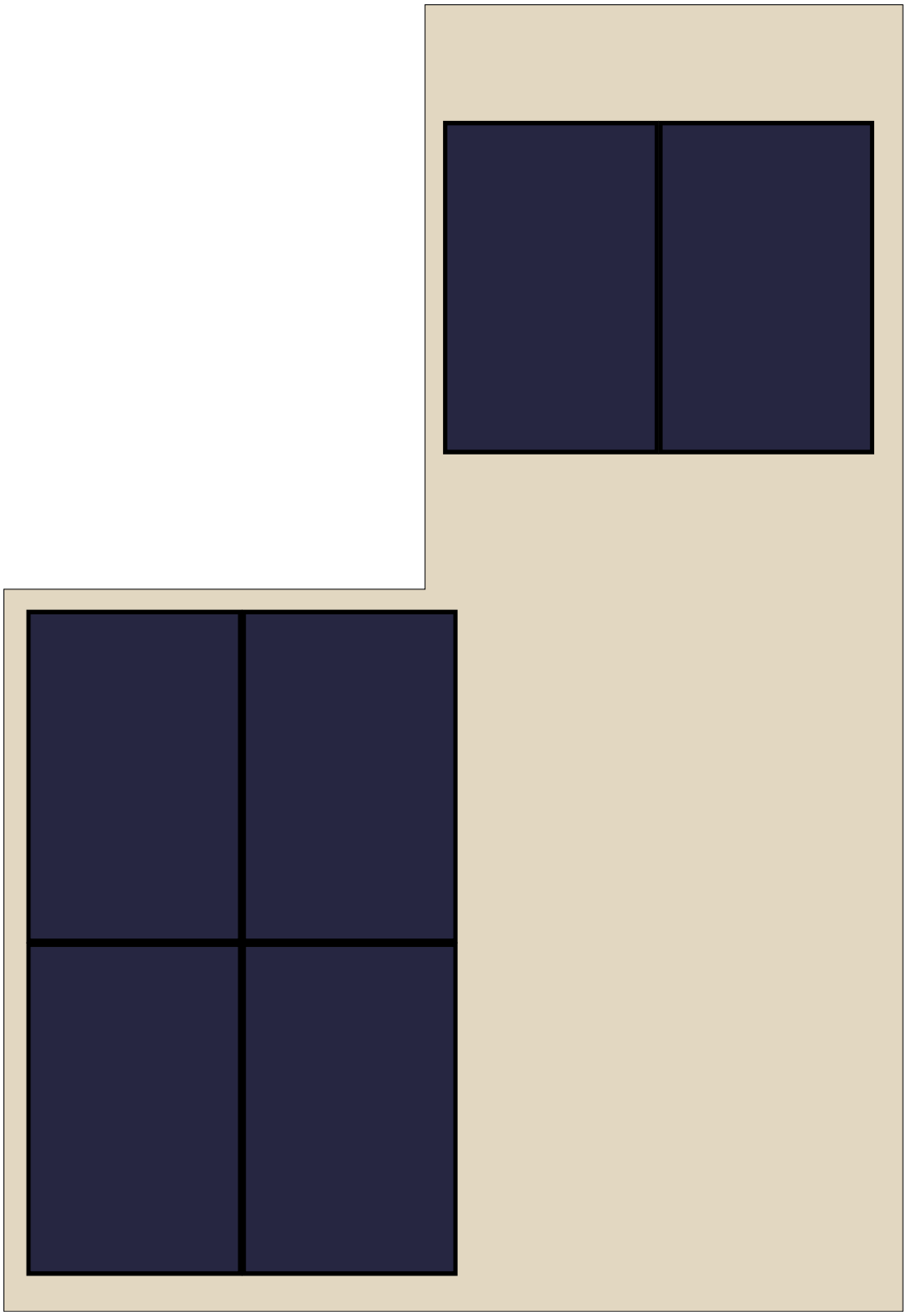
Address: 28 Westfields Avenue Richmond Upon Thames , SW13 0AU

Date Created: 17th July 2024

Designer: Jignesh Patel

Roof Layout

Crown Flat Roof



Component list

Item	Quantity
DMEGC DM450M10RT-54HBB 450W ALL BLACK PANEL solar panel	6
Fox ESS H1 G2 3.0kW 1ph Hybrid Inverter inverter	1
NET Emlite Bi-directional Meter ECA2.n*	1
Label sheet	1
AC isolator - IMO - 20A 4-pole	2
Fox ESS CM2900 2.88kWh Li-ion Battery - Master	1
Fox ESS CS2900 2.88kWh Li-ion Battery - Slave	1
K&N DC isolator - KG20-4	2
MC4 6mm Connector Pair	4
100m reel of 6mm2 solar cable	1

Inverter checks

Fox ESS H1 G2 3.0kW 1ph Hybrid Inverter

Panels			
PV power	**2700**	Rated AC output	**3000**

Input 1: 3 DMEGC DM450M10RT-54HBB 450W ALL BLACK PANEL solar panels in 1 strings

Panels		Inverter	
PV power	**1350 W**		
Open circuit voltage at -10° C	**130 V**	Max DC voltage	**550 V**
V_{mpp} at 40° C	**96 V**	V_{mpp} lower limit	**80 V**
V_{mpp} at -10° C	**109 V**	V_{mpp} upper limit	**550 V**
I_{mpp} at 40° C	**14 A**	Max DC input current	**16 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.

Input 2: 3 DMEGC DM450M10RT-54HBB 450W ALL BLACK PANEL solar panels in 1 strings

Panels		**Inverter**	
PV power	**1350 W**		
Open circuit voltage at -10° C	**130 V**	Max DC voltage	**550 V**
V_{mpp} at 40° C	**96 V**	V_{mpp} lower limit	**80 V**
V_{mpp} at -10° C	**109 V**	V_{mpp} upper limit	**550 V**
I_{mpp} at 40° C	**14 A**	Max DC input current	**16 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

Fox ESS H1 G2 3.0kW 1ph Hybrid Inverter

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 (15A)

Phases

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

Input 01

DC Isolator

A K&N DC isolator - KG20-4 has been specified for this input

Current

The isolator is rated for a current of 18A, which is more than the expected maximum current of 16.15A.

Voltage

At 18A the isolator is rated for a voltage of 800V, which is more than the expected maximum voltage of 149.25V.

Cable

10m of 6mm2 solar cable has been specified

Voltage drop

Voltage drop at maximum power point at 40°C will be around **0.81 V (0.84 percent)**

Input 11

DC Isolator

A K&N DC isolator - KG20-4 has been specified for this input

Current

The isolator is rated for a current of 18A, which is more than the expected maximum current of 16.15A.

Voltage

At 18A the isolator is rated for a voltage of 800V, which is more than the expected maximum voltage of 149.25V.

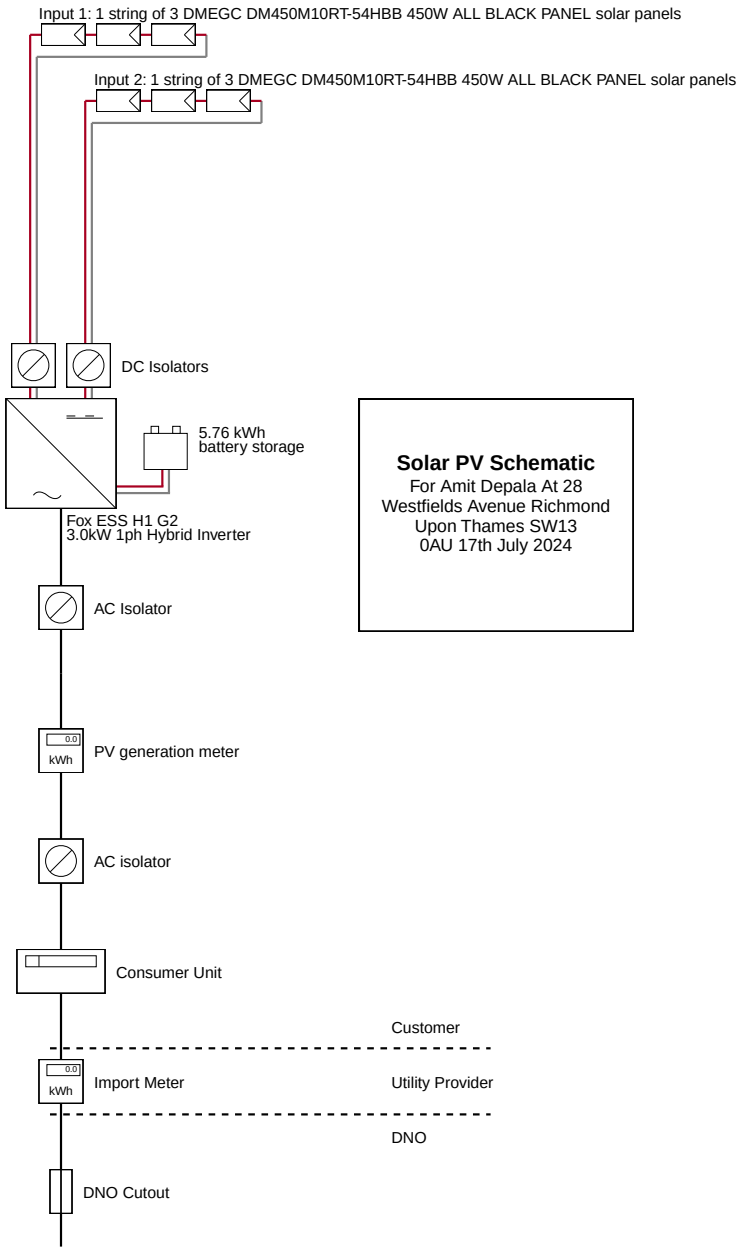
Cable

10m of 6mm2 solar cable has been specified

Voltage drop

Voltage drop at maximum power point at 40°C will be around **0.81 V (0.84 percent)**

Schematic diagram



Performance Estimate

Site details

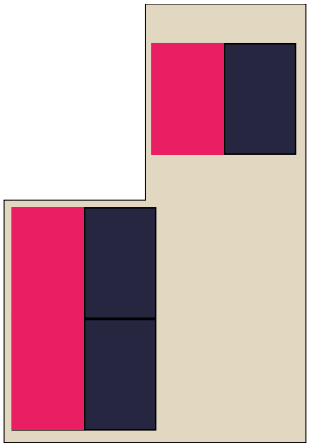
Client	Amit Depala
Address	28 Westfields Avenue Richmond Upon Thames

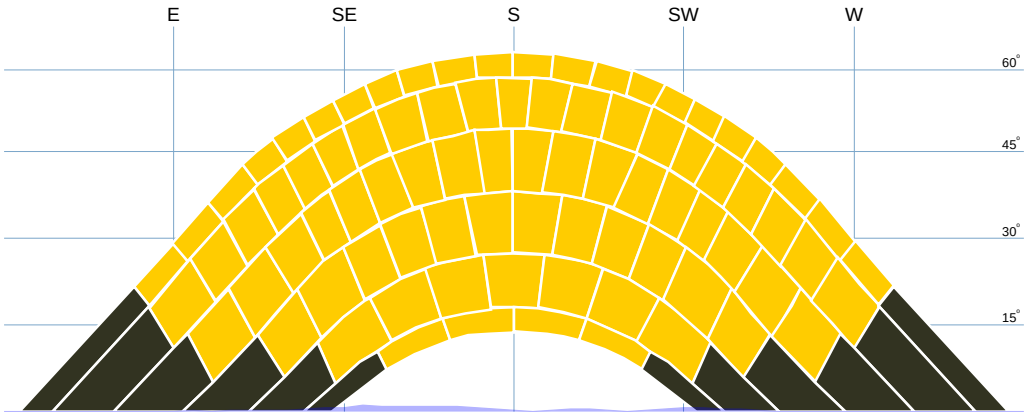
The sunpath diagram shows the arcs of the sky that the sun passes through at different times of the day and year as yellow blocks. The shaded area indicates the horizon as seen from the location of the solar array. Where objects on the horizon are within 10m of the array, an added semi-circle is drawn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

Fox ESS H1 G2 3.0kW 1ph Hybrid Inverter

Input 1

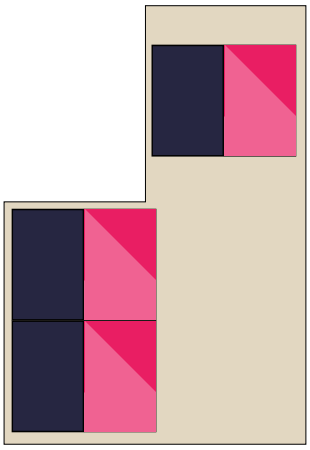


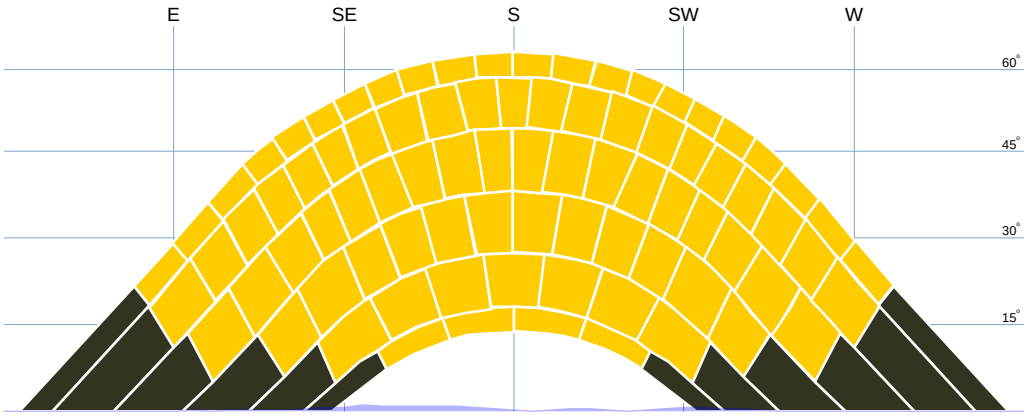


A. Installation data		
Installed capacity of PV system – kWp (stc)	**1.350**	kWp
Orientation of the PV system – degrees from South	**0**	°
Inclination of system – degrees from horizontal	**10**	°
Postcode region	**1**	

B. Performance calculations		
kWh/kWp (Kk)	**896**	kWh/kWp
Shade factor (SF)	**1.00**	
Estimated output (kWp x Kk x SF)	**1210**	kWh

Input 2





A. Installation data		
Installed capacity of PV system – kWp (stc)	**1.350**	kWp
Orientation of the PV system – degrees from South	**0**	°
Inclination of system – degrees from horizontal	**10**	°
Postcode region	**1**	

B. Performance calculations		
kWh/kWp (Kk)	**896**	kWh/kWp
Shade factor (SF)	**1.00**	
Estimated output (kWp x Kk x SF)	**1210**	kWh

Performance Summary

A. Installation data		
Installed capacity of PV system – kWp (stc)	**2.7**	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)	**2420**	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.

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

Fox ESS H1 G2 3.0kW 1ph Hybrid Inverter with 2 Fox ESS ECS2900 2.88kWh Li-ion Battery batteries

Charge rate is directly taken from the inverter specification; this value can be less depending on the type of battery connected.

Charge rate	**2910 W**
Inverter charge efficiency	**95 %**
Inverter discharge efficiency	**95 %**
Battery efficiency	**95 %**
Round trip efficiency	**86 %**
Battery bank capacity	**5.8 kWh**
Max discharge depth	**90 %**
Usable capacity	**5.2 kWh**

Consumption

Electricity consumed in the property each year

3900 kWh

Generation

Electricity generated by the PV array each year

2420 kWh

Self consumption

Proportion of PV generation used in the property

80 %

Independence

Proportion of electricity consumption provided by PV

48 %

Import / Export

Electricity import / export each year from the property

2024 kWh / 429 kWh

Utilisation

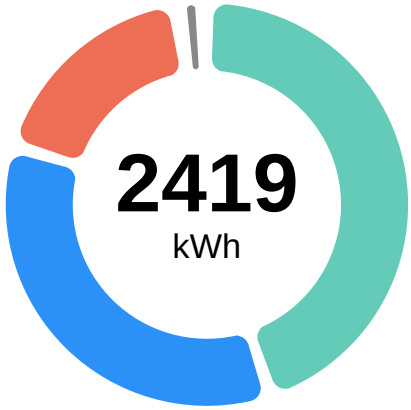
Average daily utilisation of the storage battery

45 %

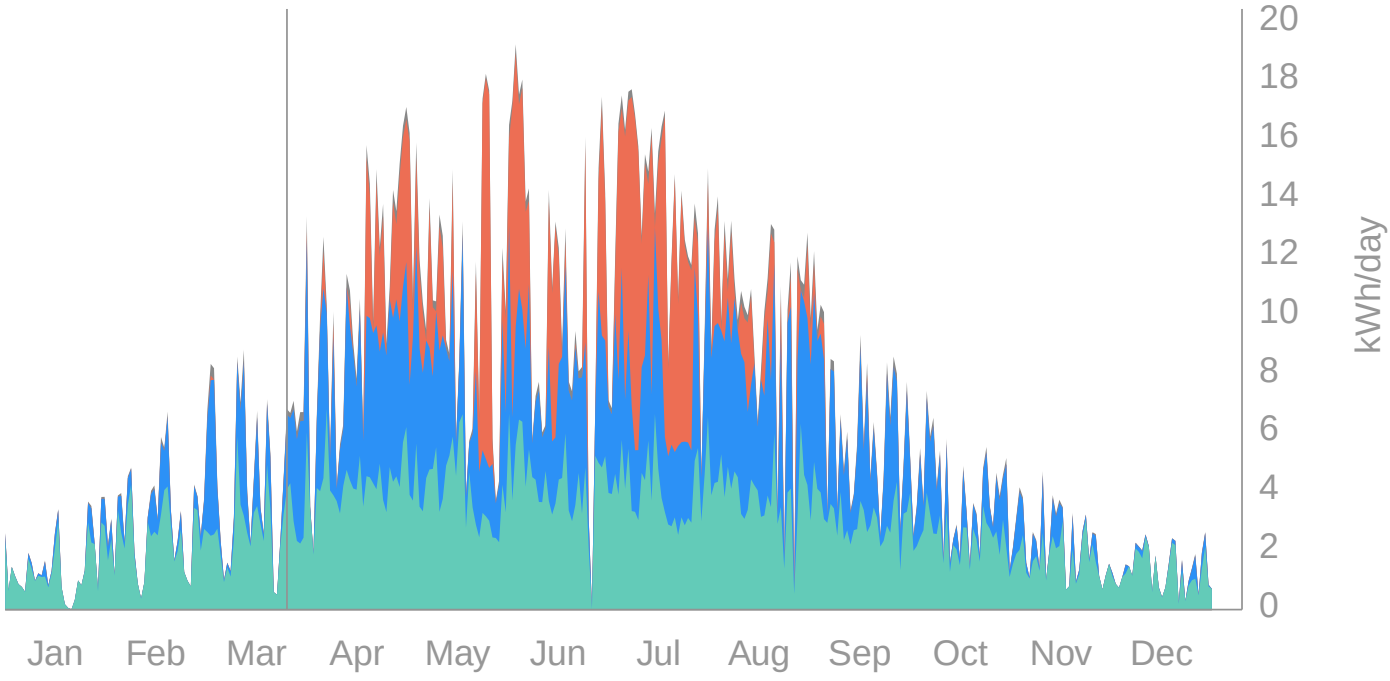
Yearly generation

The solar PV array is expected to generate 2420 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.

45% (1085 kWh) of the electricity generated is expected to be used directly in the property. 37% (906 kWh) is directed to the battery for later use, although 62 kWh of this is lost during battery charging, leaving 844 kWh for use in the property. The remaining generation (429 kWh, or 18% of the total) is exported to the grid.

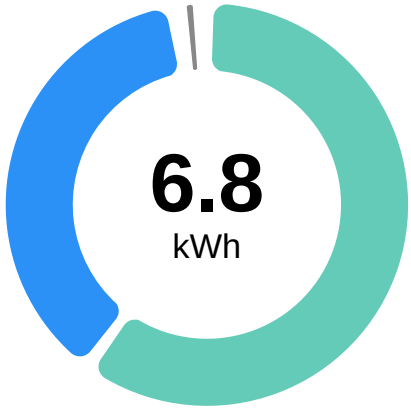


Direct use	Via battery	To grid	Losses
1085 kWh	**843** kWh	**429** kWh	**62** kWh

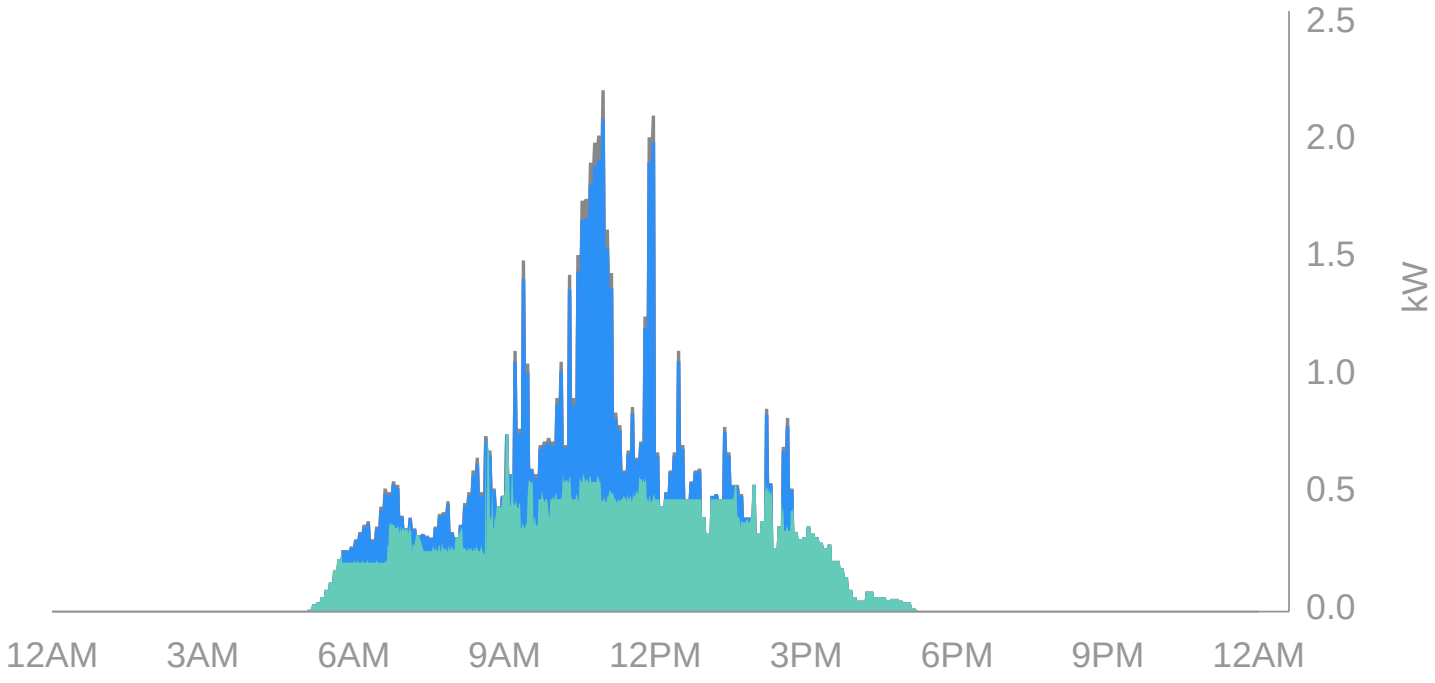


Daily generation

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 6.8 kWh. Of this, 4.1 kWh (60%) is used directly in the property, 2.7 kWh (40%) is stored in the battery for later re-use, and 0 kWh (0%) is exported to the grid.



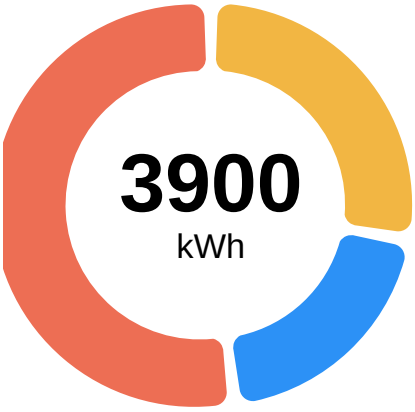
Direct use	Via battery	To grid	Losses
4.1 kWh	**2.5** kWh	**0.00** kWh	**0.19** kWh



Yearly consumption

The property is expected to consume 3900 kWh of electricity each year. Around 28% of this (1085 kWh) is expected to be supplied directly by the solar array. Another 20% (791 kWh) is supplied from the storage battery. The remaining 52% (2024 kWh) is supplied from the grid.

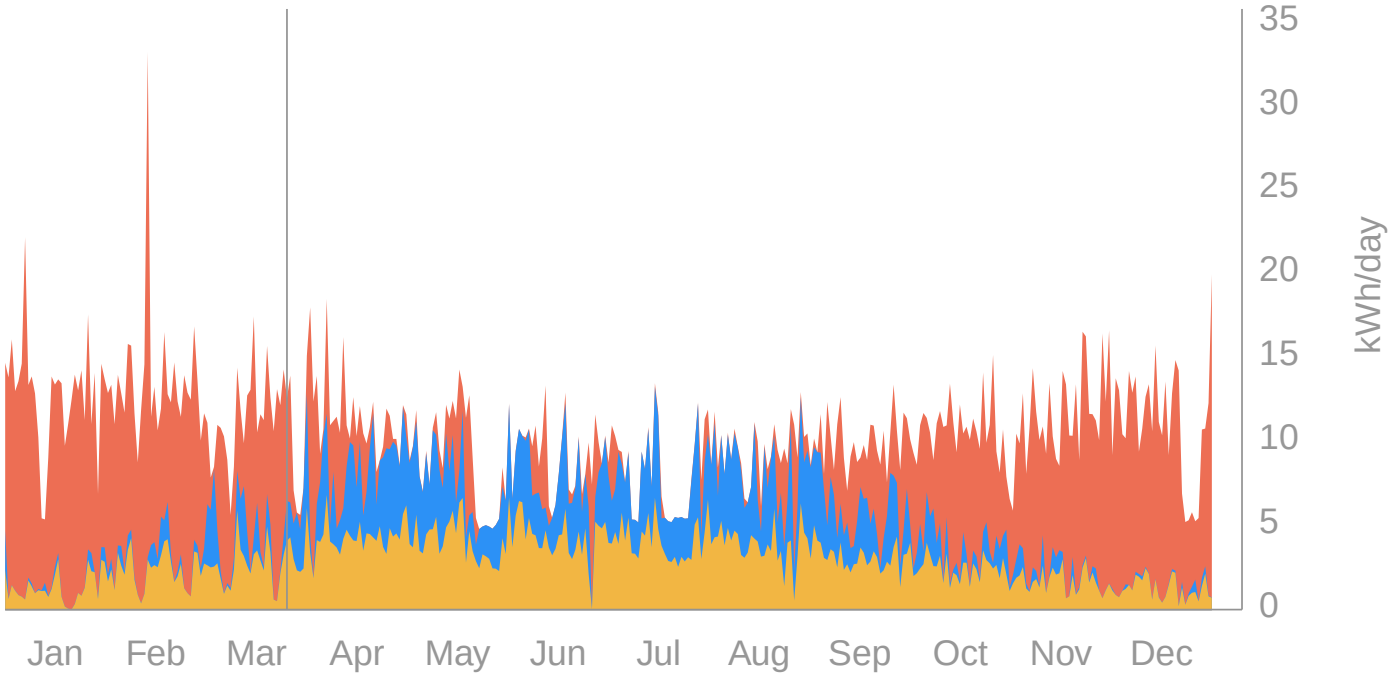
Overall, 48% (1876 kWh) of the electricity used in the property is expected to be supplied by the solar array and battery storage system. Without battery storage it would be 28% (1085 kWh).



From solar **1085** kWh

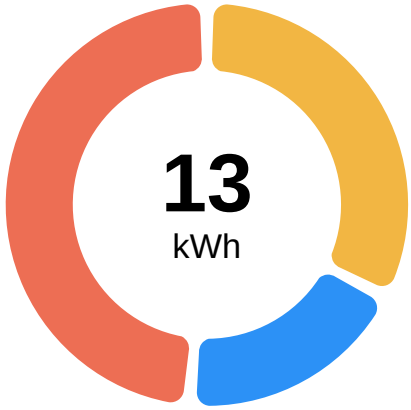
From battery **791** kWh

From grid **2024** kWh



Daily consumption

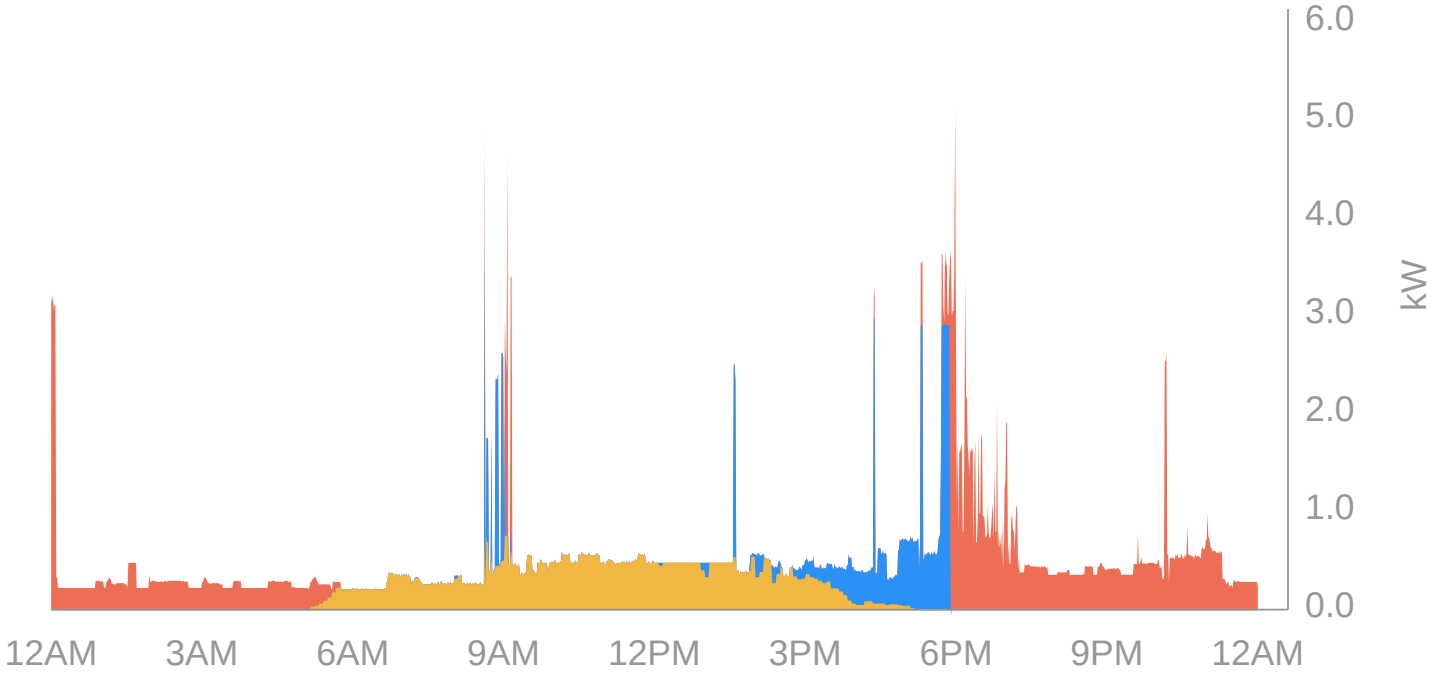
This graph shows modelled consumption data over the course of the selected day (March 27th). Total electricity consumption on this day was 12.6 kWh, of which 4.1 kWh (33%) is expected to be supplied directly by the solar array, and a further 2.4 kWh (19%) drawn from the battery storage system. The remaining 6.1 kWh (48%) is imported from the grid.



From solar **4.1** kWh

From battery **2.4** kWh

From grid **6.1** kWh



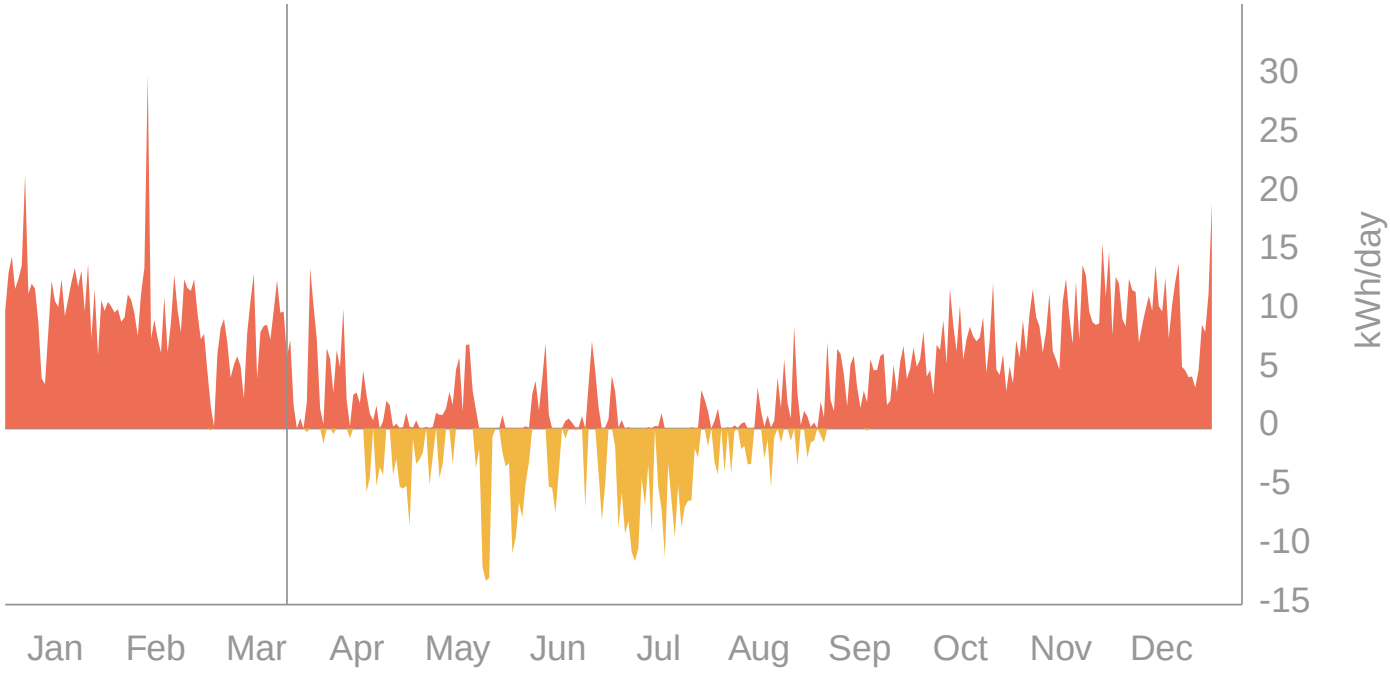
Yearly import and export

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 yellow area beneath the axis exported electricity.

Over the course of the year, a total of 2024 kWh is expected to be imported by the property, and 429 kWh exported back to the grid.

Importing
2024 kWh

Exporting
429 kWh

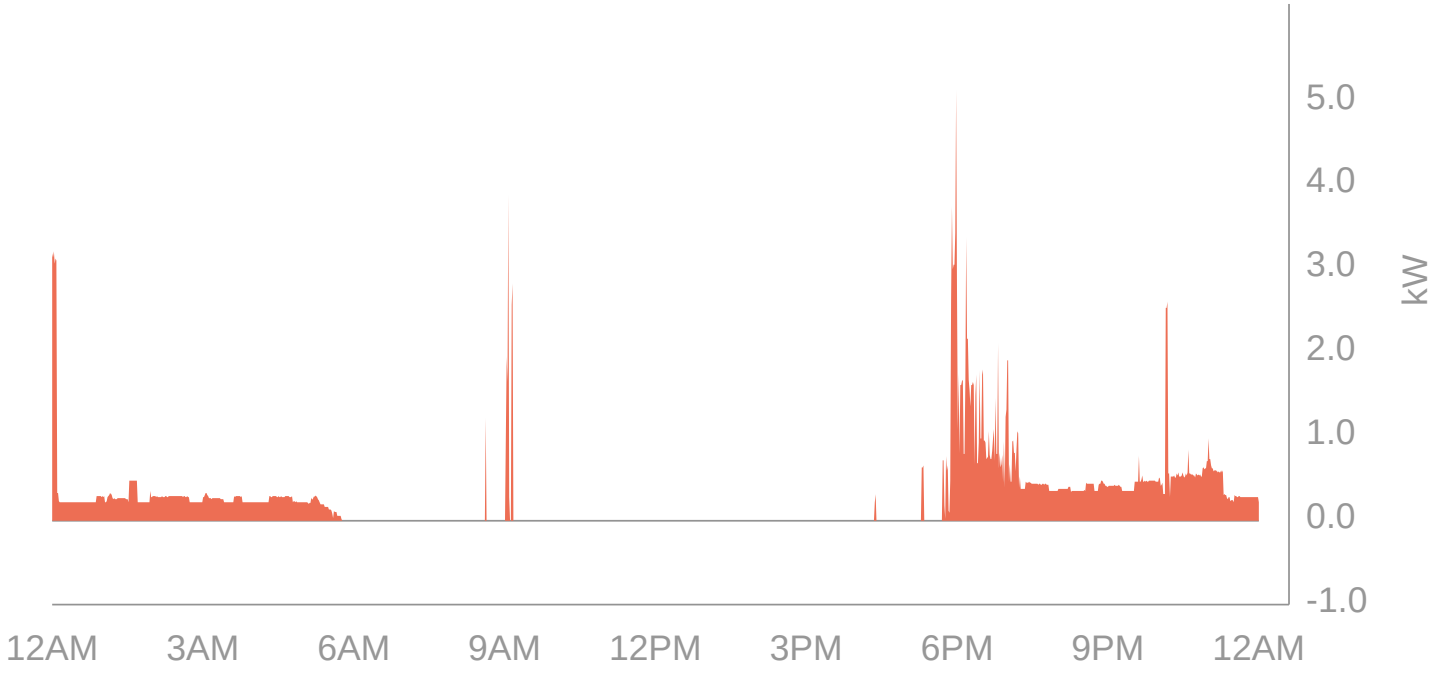


Daily import and export

This graph shows the modelled import and export of electricity over a selected day (March 27th). On this day 6.10 kWh is expected to be imported from the grid, and 0.0 kWh exported.At times when no import or export is shown the battery storage system is charging or discharging.

Importing
6.1 kWh

Exporting
0.00 kWh



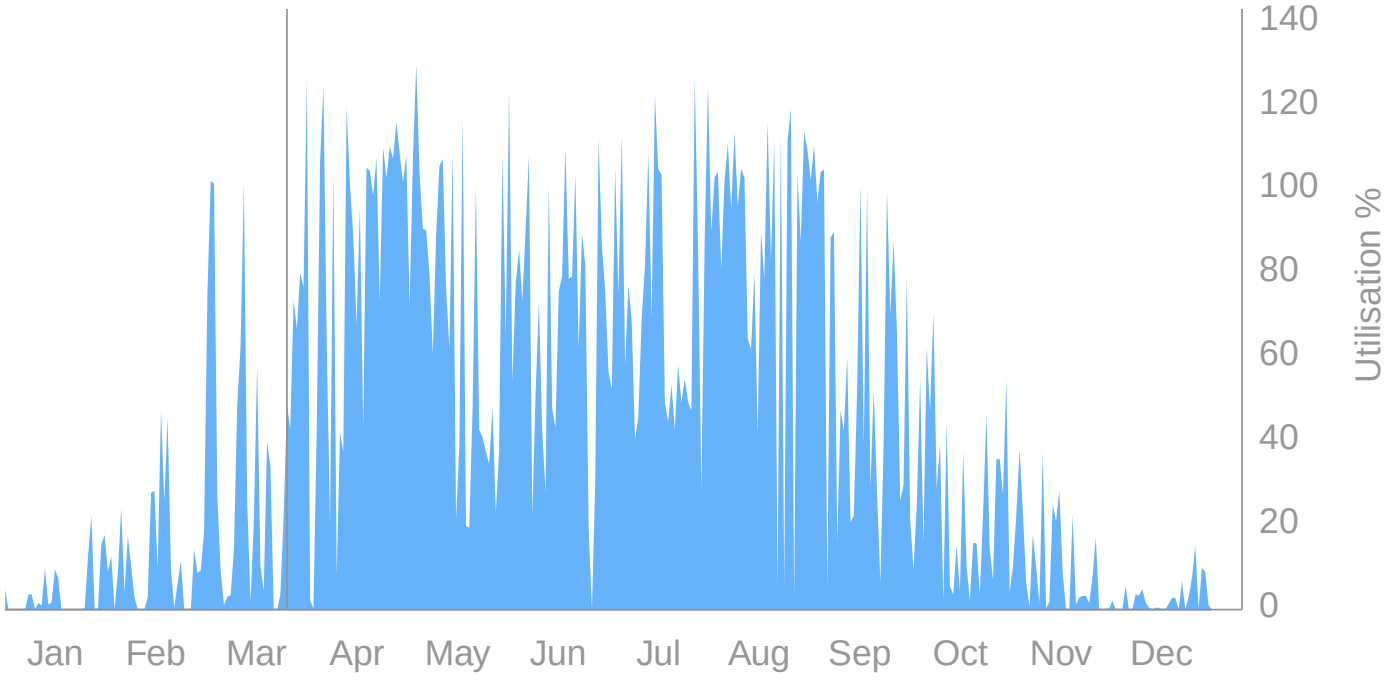
Yearly battery utilisation

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.

45%

Avg Battery Utilisation



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, 49.0% of the battery capacity was utilised.

49%

Avg Battery Utilisation