



Rob Partington

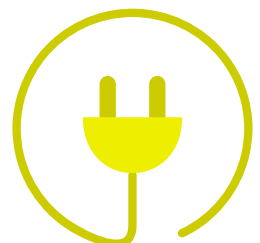
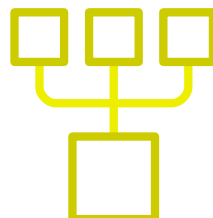
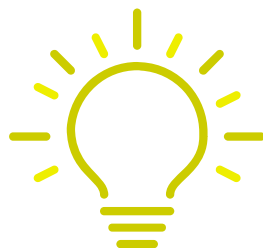
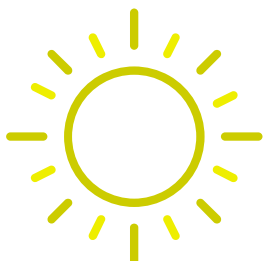
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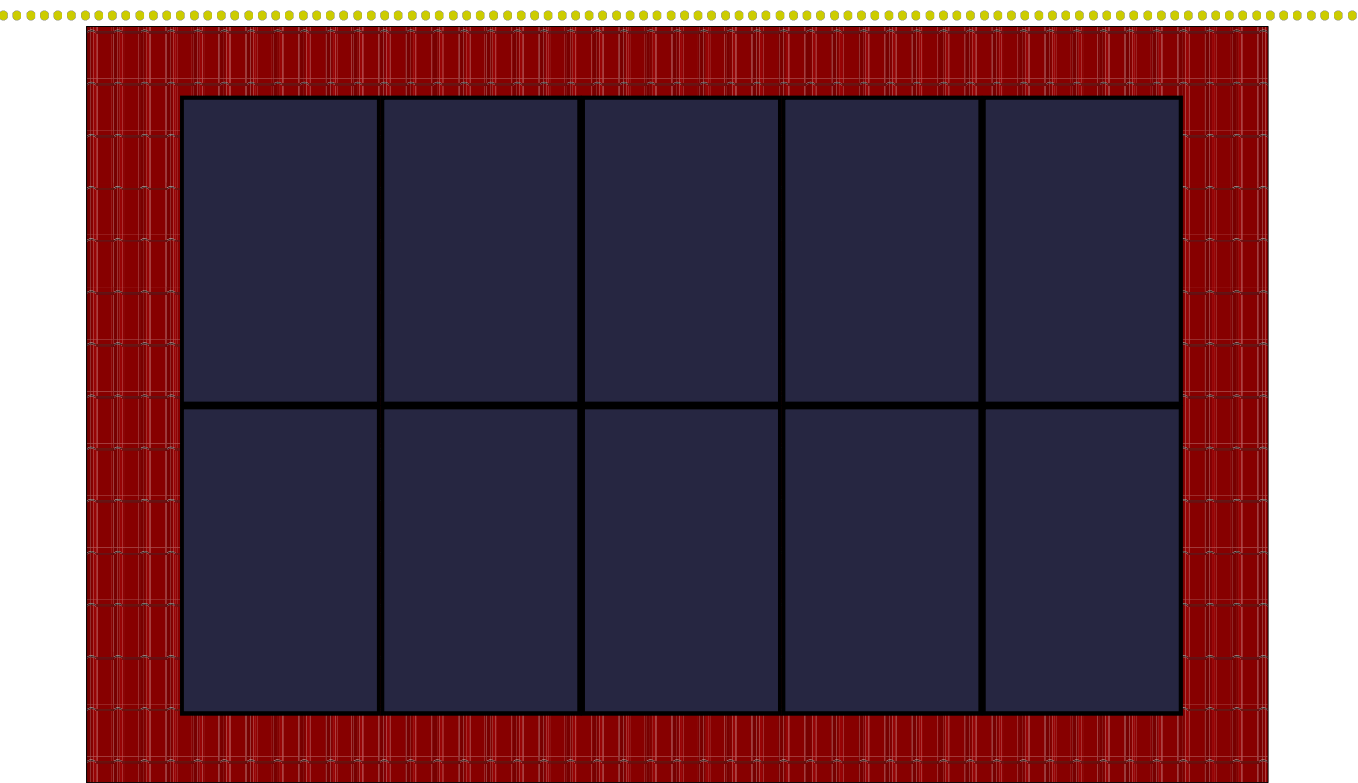
Date Created: 5th June 2023

Designer: Matt Parker

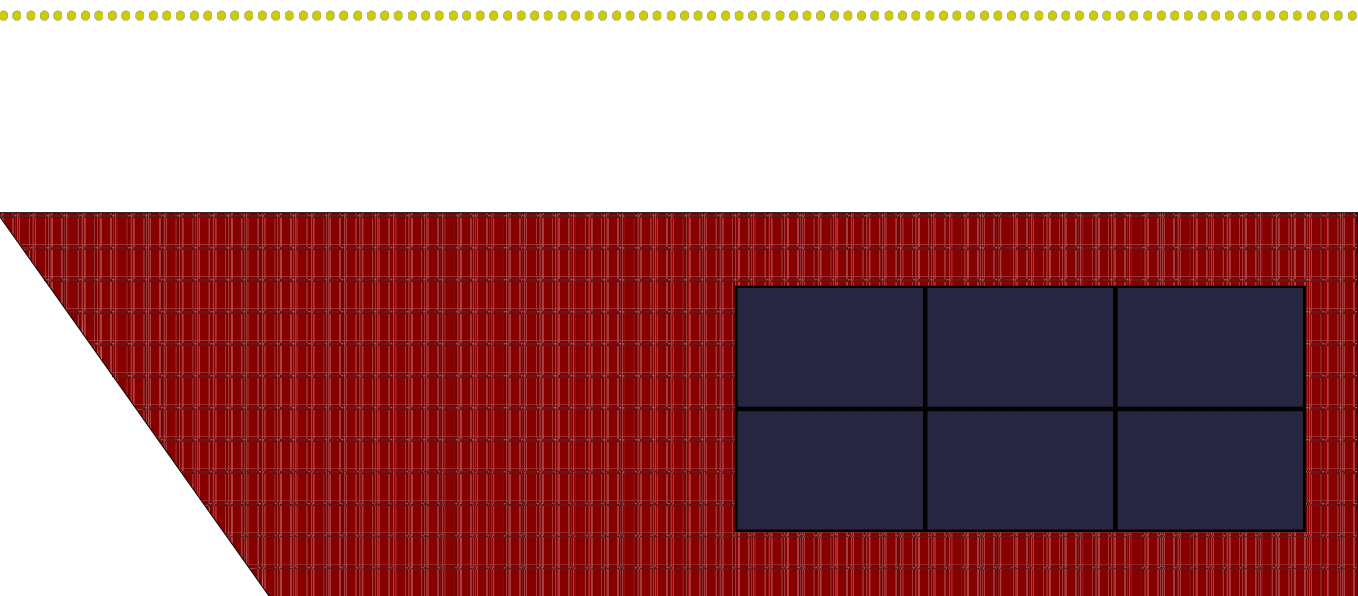


Roof Layout

Roof 1



Roof 2



Component list

Item	Quantity
	16
	1
	1
	1
	1
	3
	1
	1
	3
	1
	1
	1
	6
	1
	2



Pair of MC4 connectors

4



50m reel of 4mm² solar cable

1



Fastensol end clamp (30mm black)

20



Fastensol mid clamp (30mm black)

22



Fastensol black end cap

20



Fastensol portrait concrete tile roof hook

24



Fastensol rail splice

4



Fastensol silver rail 3300mm

14



Fastensol landscape concrete tile roof hook

18



Inverter checks

Giv.AC 3.0

Panels

PV power 0 Rated AC output null

S6 Mini 2kW 1MPPT 1PH Inverter

Panels

PV power 2490 Rated AC output 2000

Input 1: 6 Trina Vertex S 415W All Black Mono solar panels in 1 strings

Panels

Inverter

PV power	2490 W		
Open circuit voltage at -10° C	323 V	Max DC voltage	600 V
V _{mpp} at 40° C	237 V	V _{mpp} lower limit	80 V
V _{mpp} at -10° C	268 V	V _{mpp} upper limit	500 V
I _{mpp} at 40° C	10 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.



Solis 3.6kW S6 Dual MPPT - Single Phase

Panels

PV power	4150	Rated AC output	3600
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Input 1: 10 Trina Vertex S 415W All Black Mono solar panels in 1 strings

Panels

Inverter

PV power	4150 W		
Open circuit voltage at -10° C	539 V	Max DC voltage	600 V
V _{mpp} at 40° C	395 V	V _{mpp} lower limit	150 V
V _{mpp} at -10° C	447 V	V _{mpp} upper limit	520 V
I _{mp} at 40° C	10 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**

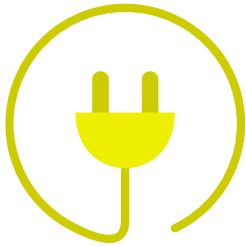
The maximum power point voltage of the solar panels is always above the lower limit of the inverter MPPT tracker. The maximum power point voltage of the solar panels is always below the upper limit of the inverter MPPT tracker.

**Max Current**

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



Input 2: No panels



Electrical

Giv.AC 3.0



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 (13.6A)



Phases

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



S6 Mini 2kW 1MPPT 1PH 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 (10A)



Phases

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



Input 1



DC Isolator

A IMO DC isolator 16A 2p 1string has been specified for this input

Current

The isolator is rated for a current of 16A, which is more than the expected maximum current of 11A.



Voltage

At 16A the isolator is rated for a voltage of 600V, which is more than the expected maximum voltage of 323V.



Cable

10m of 4mm² solar cable has been specified

Voltage drop

Voltage drop at maximum power point at 40°C will be around
0.85 V (0.36 percent)



Solis 3.6kW S6 Dual MPPT - Single Phase



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 (16A)



Phases

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



Input 1



DC Isolator

A IMO DC isolator 16A 2p 1string has been specified for this input

Current

The isolator is rated for a current of 16A, which is more than the expected maximum current of 11A.



Voltage

At 16A the isolator is rated for a voltage of 600V, which is more than the expected maximum voltage of 539V.





Cable

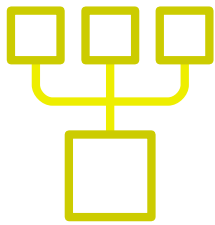
10m of 4mm² solar cable has been specified

Voltage drop

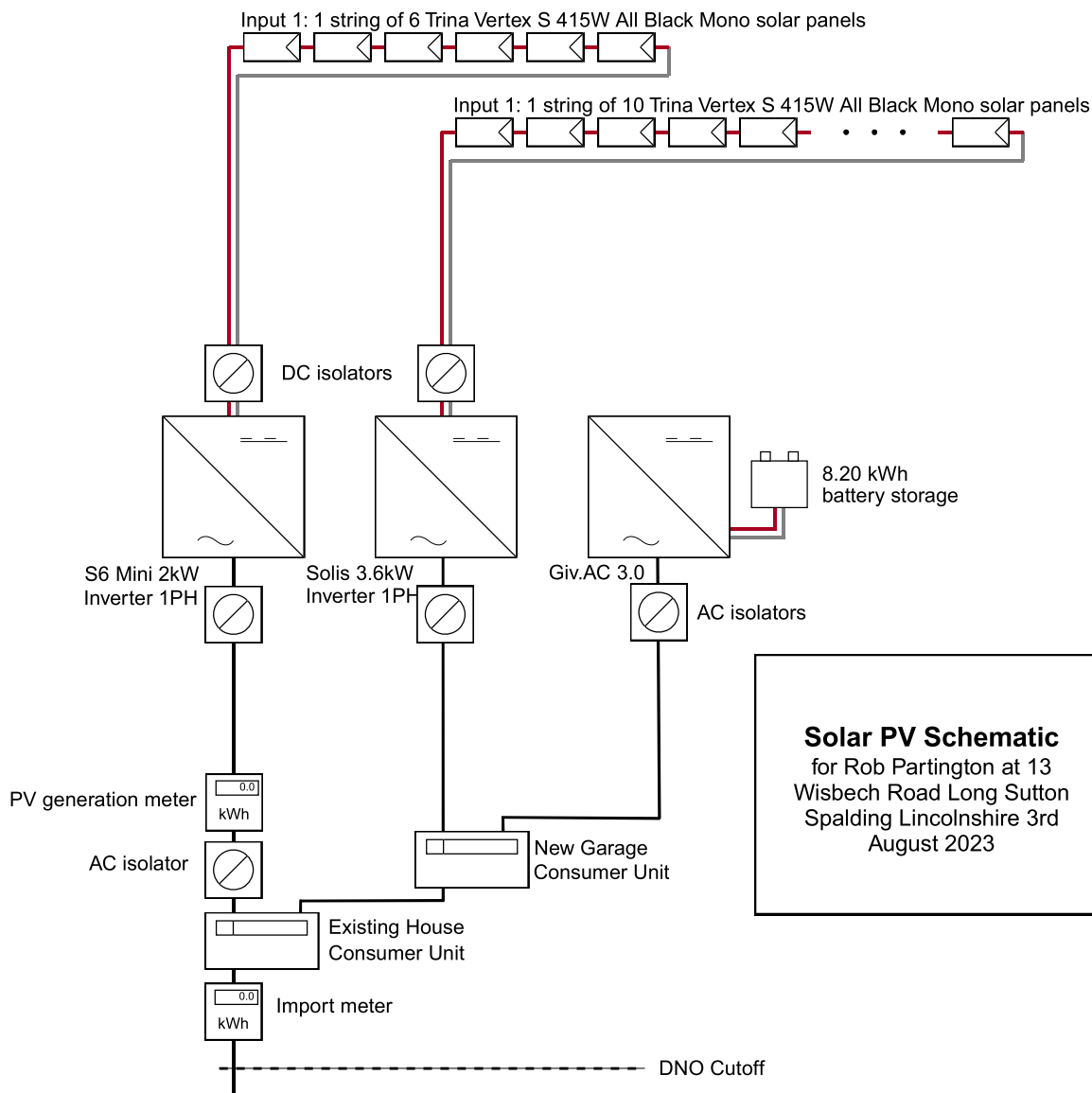
Voltage drop at maximum power point at 40°C will be around
0.85 V (0.22 percent)

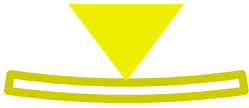


Input 2: No panels



Schematic diagram





Structural calculations

Weight loading calculations

Roof 1

Weight of solar panels and mounting	256.5 kg
Area of solar array	20 m ²
Loading imposed by solar array	0.13 kN/m ²
Dead load from roof covering	0.45 kN/m ²
Total dead load of solar array, mounting and roof covering	0.58 kN/m²
Permitted dead load	0.785 kN/m²

The solar array, mounting system, and roof covering are expected to impose a total dead load on the roof of **0.58kN/m²**. This is less than the permitted dead load for the roof of **0.785kN/m²**.



Roof 2

Weight of solar panels and mounting	159.2 kg
Area of solar array	12 m ²
Loading imposed by solar array	0.13 kN/m ²
Dead load from roof covering	0.45 kN/m ²
Total dead load of solar array, mounting and roof covering	0.58 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 **0.58kN/m²**. This is less than the permitted dead load for the roof of **0.785kN/m²**.



Wind loading calculations

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

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

Roof 1

Q_p	783 Pa	
From Fig 34 in Guide to the Installation of Photovoltaic Systems for a building 5 m high, in windzone 1, in country terrain, at a distance of between 2km and 20km from the sea		
$C_{p \text{ net}}$	Roof Centre	Roof edge
Uplift	-1.3	-2.2
Pressure	1	1.1
C_a	1	
At an altitude of 12m		
C_t	1	
When there is no significant topography		
A_{ref}	19.98m ²	
F	Roof Centre	Roof edge
Uplift	-20339N	-34419N
Pressure	15645N	17210N

With 24 roof hooks we should allow for an uplift force per hook in the central zone of **847N**, rising to **1434N** at the edges. If 2 screws are used per roof hook, this equates to **424N** per fixing in the central zone, and **717N** at the edges.

Concrete 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:

$$17.3 \times 1.25 \times 65 = 1406N$$

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.



Roof 2

Q_p 783 Pa

From Fig 34 in Guide to the Installation of Photovoltaic Systems for a building 5 m high, in windzone 1, in country terrain, at a distance of between 2km and 20km from the sea

$C_{p \text{ net}}$	Roof Centre	Roof edge
Uplift	-1.3	-2.2
Pressure	1	1.1

C_a 1

At an altitude of 12m

C_t 1

When there is no significant topography

A_{ref} 11.99m²

F	Roof Centre	Roof edge
Uplift	-12203N	-20652N
Pressure	9387N	10326N

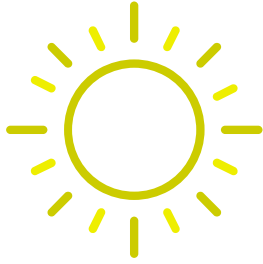
With 18 roof hooks we should allow for an uplift force per hook in the central zone of **678N**, rising to **1147N** at the edges. If 2 screws are used per roof hook, this equates to **339N** per fixing in the central zone, and **574N** at the edges.

Concrete 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:

$$17.3 \times 1.25 \times 65 = 1406N$$

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

Rob Partington

Address

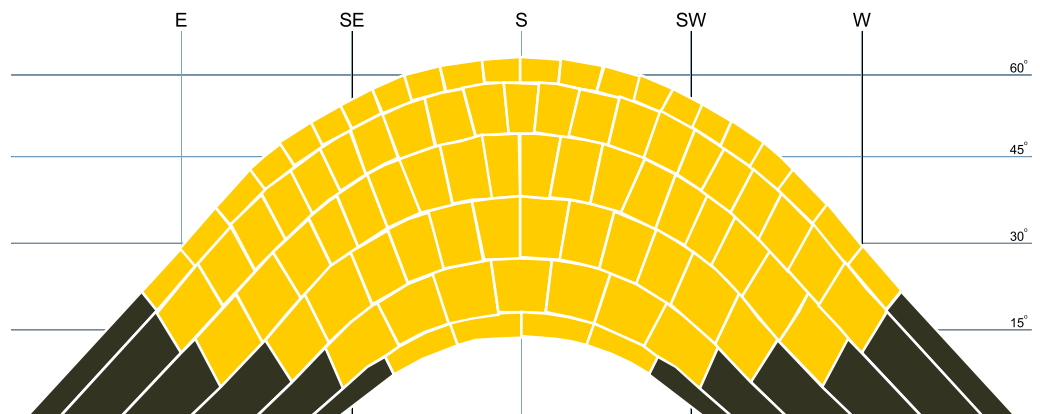
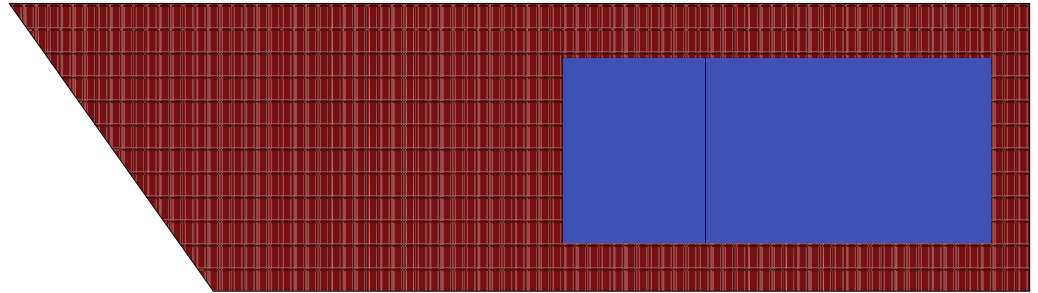
13 Wisbech Road Long Sutton Spalding Lincolnshire

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

S6 Mini 2kW 1MPPT 1PH Inverter

Input 1



A. Installation data

Installed capacity of PV system - kWp (stc)	2.490	kWp
Orientation of the PV system - degrees from South	-49	°
Inclination of system - degrees from horizontal	40	°
Postcode region	11	



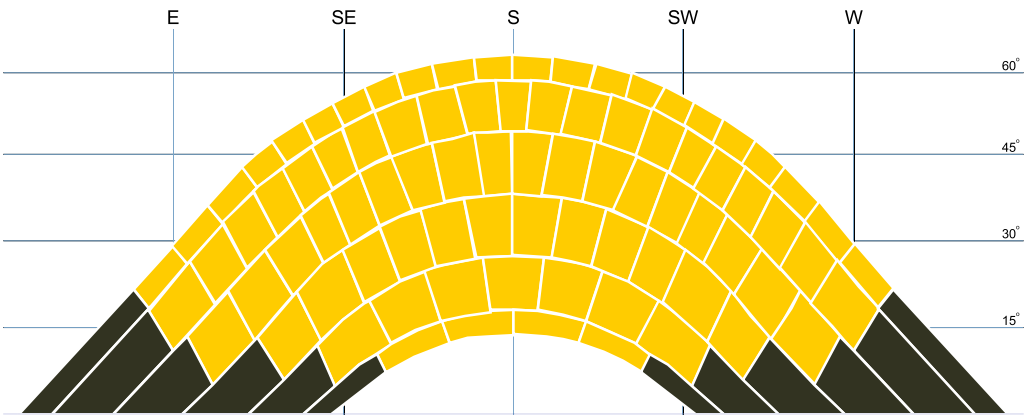
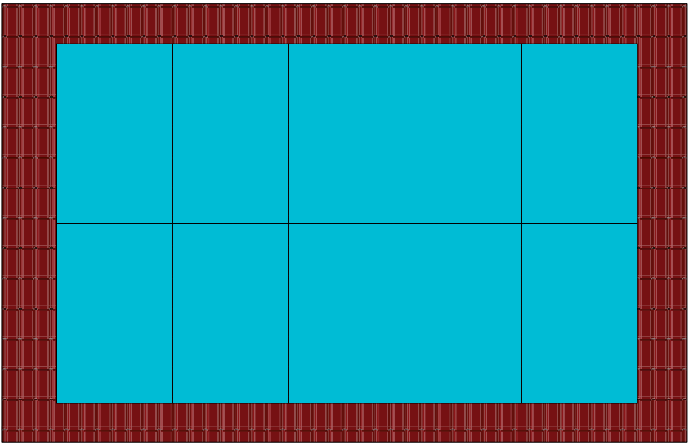
B. Performance calculations

kWh/kWp (Kk)	825	kWh/kWp
Shade factor (SF)	1.00	
Estimated output (kWp x Kk x SF)	2054	kWh

Inverter 2

Solis 3.6kW S6 Dual MPPT - Single Phase

Input 1



A. Installation data

Installed capacity of PV system - kWp (stc)	4.150	kWp
Orientation of the PV system - degrees from South	35	°
Inclination of system - degrees from horizontal	40	°
Postcode region	11	



B. Performance calculations

kWh/kWp (Kk)	859	kWh/kWp
Shade factor (SF)	1.00	
Estimated output (kWp x Kk x SF)	3565	kWh

Performance Summary

A. Installation data		
Installed capacity of PV system - kWp (stc)	6.6400000000000001	kWp
Orientation of the PV system - degrees from South	See individual inputs	
Inclination of system - degrees from horizontal	See individual inputs	
Postcode region	11	
B. Performance calculations		
kWh/kWp (Kk)	See individual inputs	
Shade factor (SF)	See individual inputs	
Estimated output (kWp x Kk x SF)	5619	kWh
C. Estimated PV self-consumption - PV Only		
Assumed occupancy archetype	home all day	
Assumed annual electricity consumption, kWh	5475	kWh
Assumed annual electricity generation from solar PV system, kWh	5619	kWh
Expected solar PV self-consumption (PV Only)	1854.27	kWh
Grid electricity independence / Self-sufficiency (PV Only)	33.87	%
D. Estimated PV self-consumption - with EESS		
Assumed usable capacity of electrical energy storage device, which is used for self-consumption, kWh	8.2	kWh
Expected solar PV self-consumption (with EESS)	3933.3	kWh
Grid electricity independence / Self-sufficiency (with EESS)	71.84	%

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 guidance only for the first year of generation. It should not be considered as a guarantee of performance.

The solar PV self-consumption has been calculated in accordance with the most relevant methodology for your system. There are a number of external factors that can have a significant effect on the amount of energy that is self-consumed so this figure should not be considered as a guarantee of the amount of energy that will be self-consumed