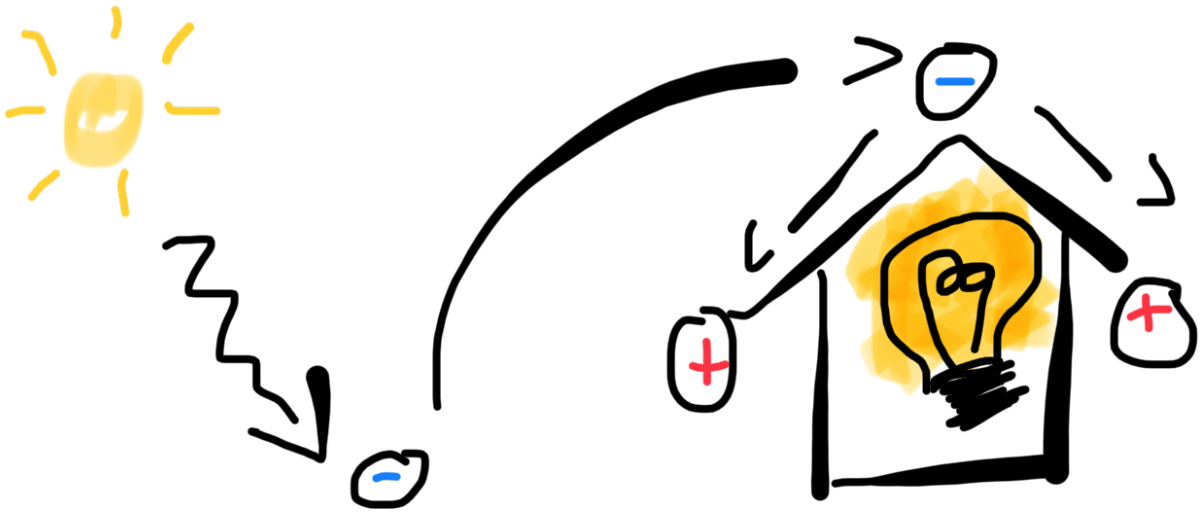
Solar 101 & Monitoring Platform Guide - Solarman & Soliscloud

Solar panels are fascinating devices. Photons, light from the sun, incident on the surface of a panel, are able to boost electrons on the surface of the panel into a higher energy state, allowing them to freely “roll” towards a zone of the panel which has fewer electrons, generating a moving charge which is the definition of a current.

Think about it like kicking a football onto a neighbours roof. Your excellent and powerful kick is the light from the sun, the electron is the ball, and that ball rolling down the neighbours roof is a generated current. A moving charge.



The silicon is designed in such a way that all the electrons roughly flow in the same direction, therefor giving us a continuous, direct, current (DC). Accordingly, out the back of each panel are two wires, and electron dense negative and an electron poor positive. We simply wire the panels together, + - + - + -, as far as needed and extend the end cables, and route them into the loft of your house.

You could imagine what might happen if we connected these two terminals at this point - under strong enough sunlight, the current passing through the closed circuit would cause the wires to heat up - fire!

DC fires are no joke. If you need to perform works on your roof and this will involve your solar system, you absolutely must ensure that you employ an MCS certified team to do the work.

So we have one positive wire, and one negative wire. The inverter, which is the big white metallic box we've put into your property, has corresponding ports for the DC power on its underside.

The inverter's role is to take this variable (sunshine dependent) current, and transform it into something usable. Either AC power for your homes consumption via your fuse box, or possibly a standardised DC current to charge a battery.

The inverter will automatically prioritise sending power to your property to meet its demands.

If you are demanding more than you are generating, and your batteries if you have them are flat (or discharging as fast as they can) - then the grid will step in to cover the difference and you will have to pay for that.

If you are demanding less than you are generating, the power will be diverted to charge a battery system (if one is installed), if you don't have a battery, but do have a power diverter, you will start heating your water. If the battery is full and you don't have a power diverter, or if the battery is full and your water is already as hot as it can get, then you will start exporting to the grid. Fig 1. Explains the priority.

Fig 1. Power Priority

In the UK, you can be compensated for the export. Granted, its not much, you'll be paid about a tenth of what you will pay per unit of power. If you want to set this up, you'll need to contact your (prospective) utility provider, who will be able to set you up with a smart meter and get you on the appropriate tariff. You will need paperwork from us to complete the process, documenting the system and its owner.

Backup

Some people have a requirement or a desire for a backup system with their solar. By law, if there is a blackout, the inverter must disconnect itself from your properties fusebox in order to prevent dangerous domestic electrical conditions.

To work around this, inverters come installed with two AC outputs, one for the property's fusebox, and one for backup.

The backup port can be wired up separately, and regular double sockets can be run off that, bypassing the property's main fusebox. If batteries are installed, the sockets will run off those, and if the sun is shining, the batteries can charge and you can effectively use your solar power, although possibly not all of it, depending on system size.

The upshot is that if you have a few appliances that would benefit from this additional layer of redundancy in the case of a blackout, it may be worth enquiring about our EPS system.

Monitoring

Here at homesmart energy we install Solar & Storage systems that come equipped with their own Wi-Fi devices, just like those found embedded in smart phones, tablets and laptops. Therefor they can join your home's Wi-Fi network and transmit data to the internet! (We have a separate guide to perform this configuration - accessible via our website FAQ page)

A caveat, data is only parsed at best once every 5 minutes, what data the inverter chooses to upload is often the maximum value, per parameter, received across that period. This is crucial to understand.

For example, inverters hooked up to batteries will often discharge a short sharp burst of (grid) power into them, particularly in the morning hours after the batteries have run flat overnight, in order to prevent them going into sleep mode, which can cause inverters to trigger NO-BATTERY alarms, at which point you would otherwise have to manually reset the battery to wake it up. However, due to the fact data is only transmitted at 5 minute intervals, it can appear that this spike is sustained, when in reality, it is likely to run for a second or two at most.

There are two platforms, two apps, that we recommend our customers install (in 99% of cases); Solarman and Soliscloud. Both of them piggyback off the Solarman platform. Some parameters have slightly different names, but these will be highlighted as we go.

Overview Pages

The Overview pages, shown below (Figures 1 & 2) are the bane of my life. Reason being, as

described above, the data is transmitted once every five minutes, but, particularly on Solis systems, the overview is presented as though it is a live feed. It is not, and therefor, it can indicate bizarre things like, pulling from the battery to discharge to the grid, or pulling directly from the grid to feed the battery when more than enough sun is being produced!

These figures do not reflect reality, they must be disregarded!

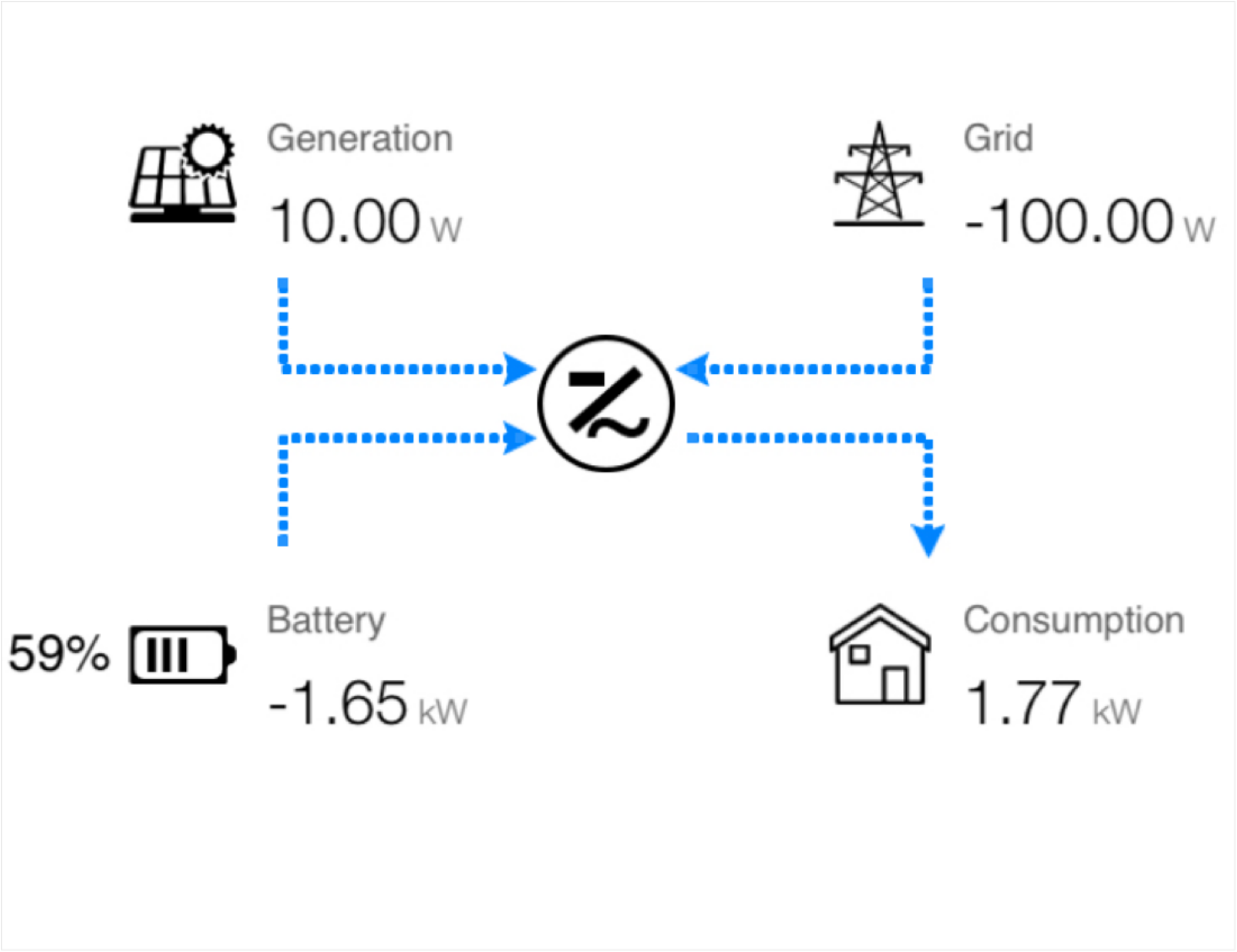


Fig 1. Solarman Overview

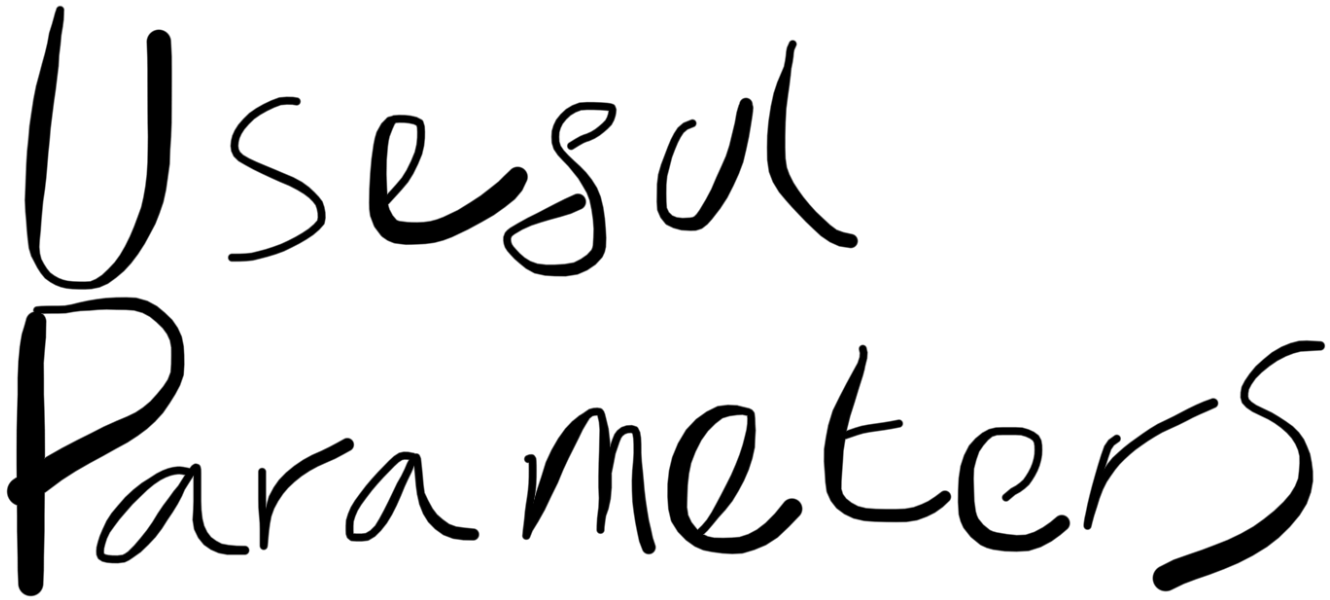
Fig 2. Soliscloud Overview

It is therefor useful for only two things.

To tell whether or not the system is connected to the internet.

An admittedly helpful diagram loosely showing us how an inverter system works.

If we want to know more about how our system is performing, whether we are curious about how much we are generating, how much we are consuming, the difference between the two and how much power is going where, and when, we have to look a little deeper.



There are a number of useful parameters at our disposal for the above purposes, but these are meaningless without a decent understanding of what they are and what they mean. Once that is established, the patterns can be interpreted to describe a systems behaviour accurately.

Power. Watts (W).

Power, for our purposes, is the measurement of electrical work. For example, a kettle rated at 3kW uses 3000 Watts of electricity to heat water rapidly for your cuppa. A single LED lightbulb may use about 20 Watts, which is also on the order of the power consumption of your inverter required for its operation.

Capacity. Watt hours.

Capacity is a measurement of either electrical work done, or electrical work that can be done. Take our kettle. If we run our kettle flat out for an hour, we will have run a 3kW (3000W) device, non stop, for an hour. Thus your home has discharged 3kWh (kW hours) through the kettle, and into the water.

The logic also works for a battery. We install 3.2kWh batteries, which means a single one of our battery modules, from fully charged, would be able to run our kettle for just over an hour. It doesn't sound like a lot, but kettles are a highly energetically intense appliances. Very, very, efficient, but all the same, water is a tough mother to heat.

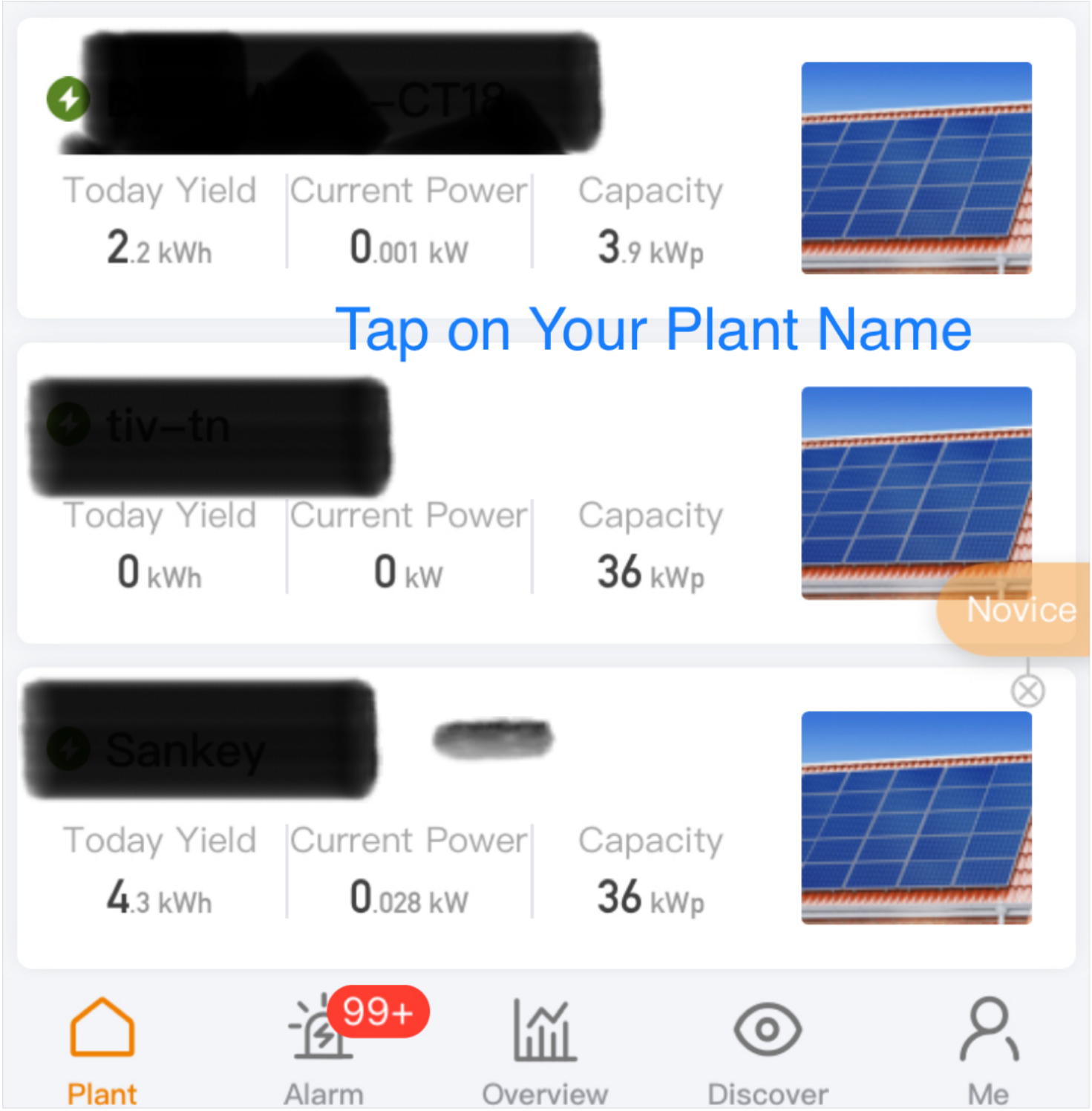
These are the only two units you need to understand to interpret all the useful information from your system.

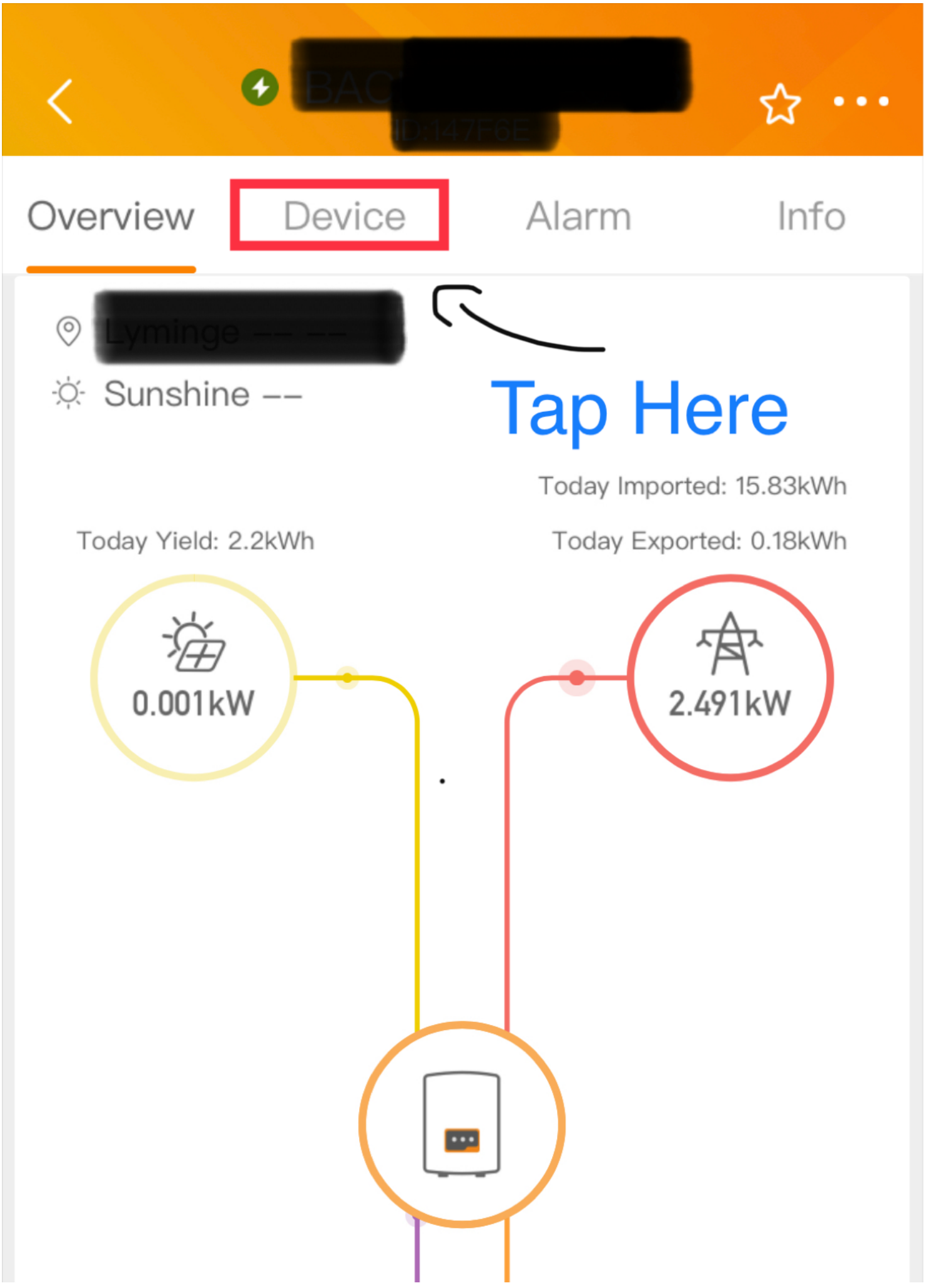
An understanding of Voltage and Amperage is useful if you want to dive into the

parameters, particularly battery parameters, in more detail. But this is outside the scope of this guide. If we receive enough demand I'll write another guide just for those.

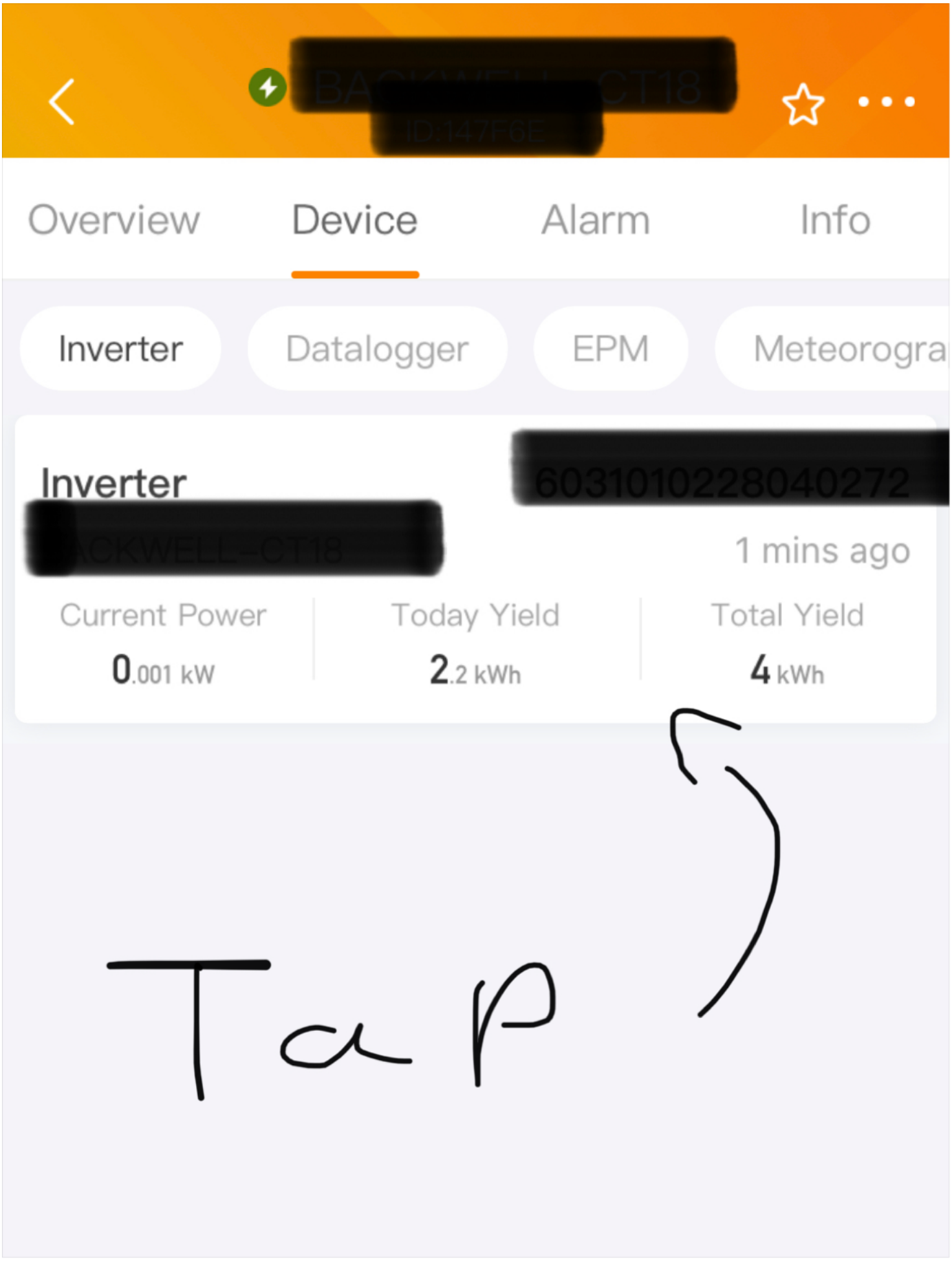
Posted below are two visual guides to help you navigate to the useful pages on both the apps & the web platform, for either a Soliscloud or Solarman setup.

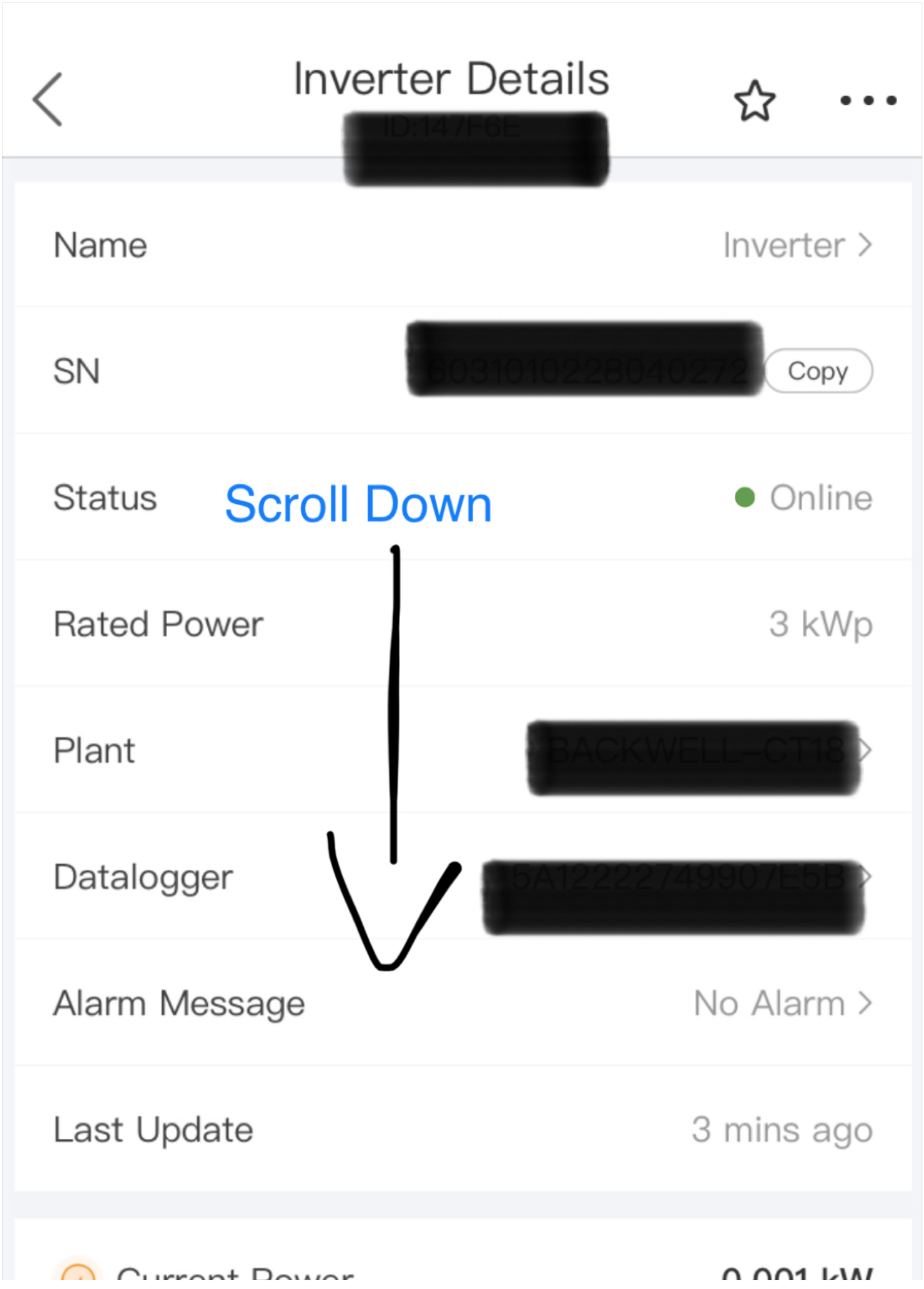
Soliscloud Navigation - App




Overview
Device
Alarm
Info
Lyminge -- --
Sunshine --
Tap Here
Today Imported: 15.83kWh
Today Yield: 2.2kWh
Today Exported: 0.18kWh
0.001kW
2.491kW


18%
0.039kW
2.531kW


[redacted]
ID:147F6E
Overview
Device
Alarm
Info
Inverter
Datalogger
EPM
Meteorogra
Inverter
6031010228040272
[redacted]CKWELL-CT18
1 mins ago
Current Power
0.001 kW
Today Yield
2.2 kWh
Total Yield
4 kWh
Tap


Inverter Details
[redacted]
Name
Inverter
SN
[redacted]
Copy
Status
Online
Scroll Down
Rated Power
3 kWp
Plant
[redacted]
Datalogger
[redacted]
Alarm Message
No Alarm
Last Update
3 mins ago

Current Power 0.001 kW

Today Yield	Monthly Yield	Total Yield
2.2 kWh	4 kWh	4 kWh

Day Month Year Total

Inverter Details

[redacted]

Today Yield	Monthly Yield	Total Yield
2.2 kWh	4 kWh	4 kWh

Day | Month | Year | Total

2022-11-11

Parameter

DC Info

	Voltage (V)	Current (A)	Power (W)
PV1	75	0	0
PV2	0	0	0

W
(A)

Grid Power

Total Grid Active Power
(kW)

Total Grid Reactive Power
(Var)

Total Grid Apparent Power

Grid Energy

Today Imported
(kWh)

Total Imported
(kWh)

Today Exported
(kWh)

Total Exported
(kWh)

Grid Other Parameters

Grid Power Factor

Frequency
(Hz)

Battery (1 selected)

Basic Battery Parameters

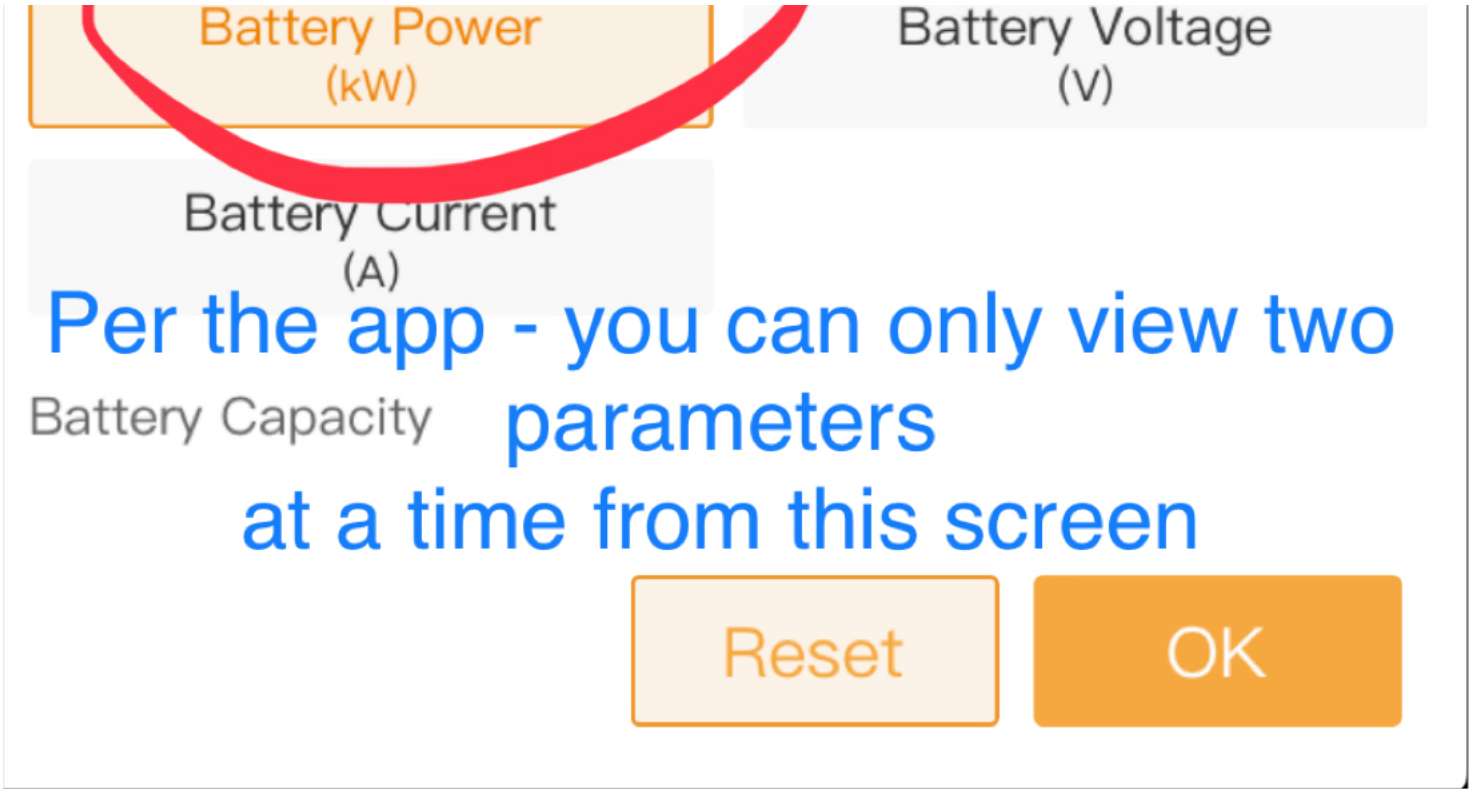
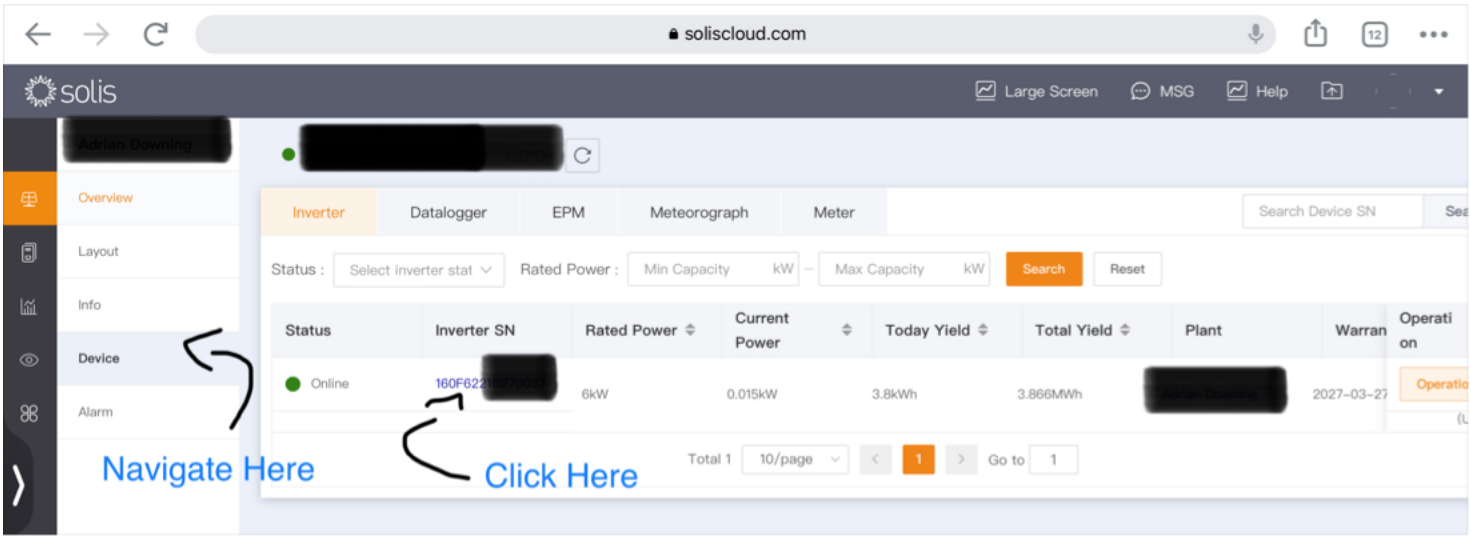


Fig 5. Soliscloud App Navigation

From this overlay you can view just about every metric the inverter itself is reporting.

Soliscloud Navigation - Desktop (logging onto www.soliscloud.com)



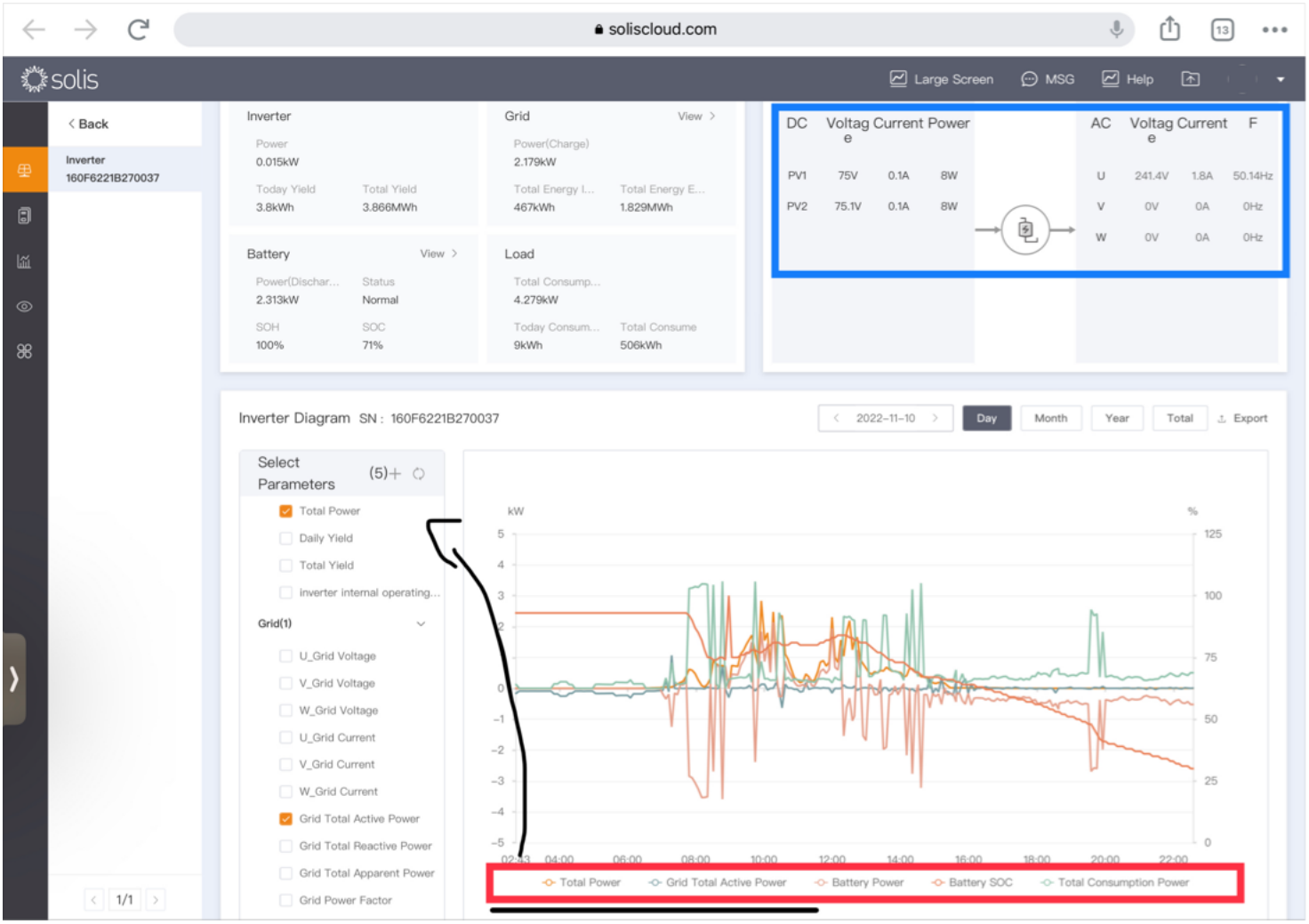


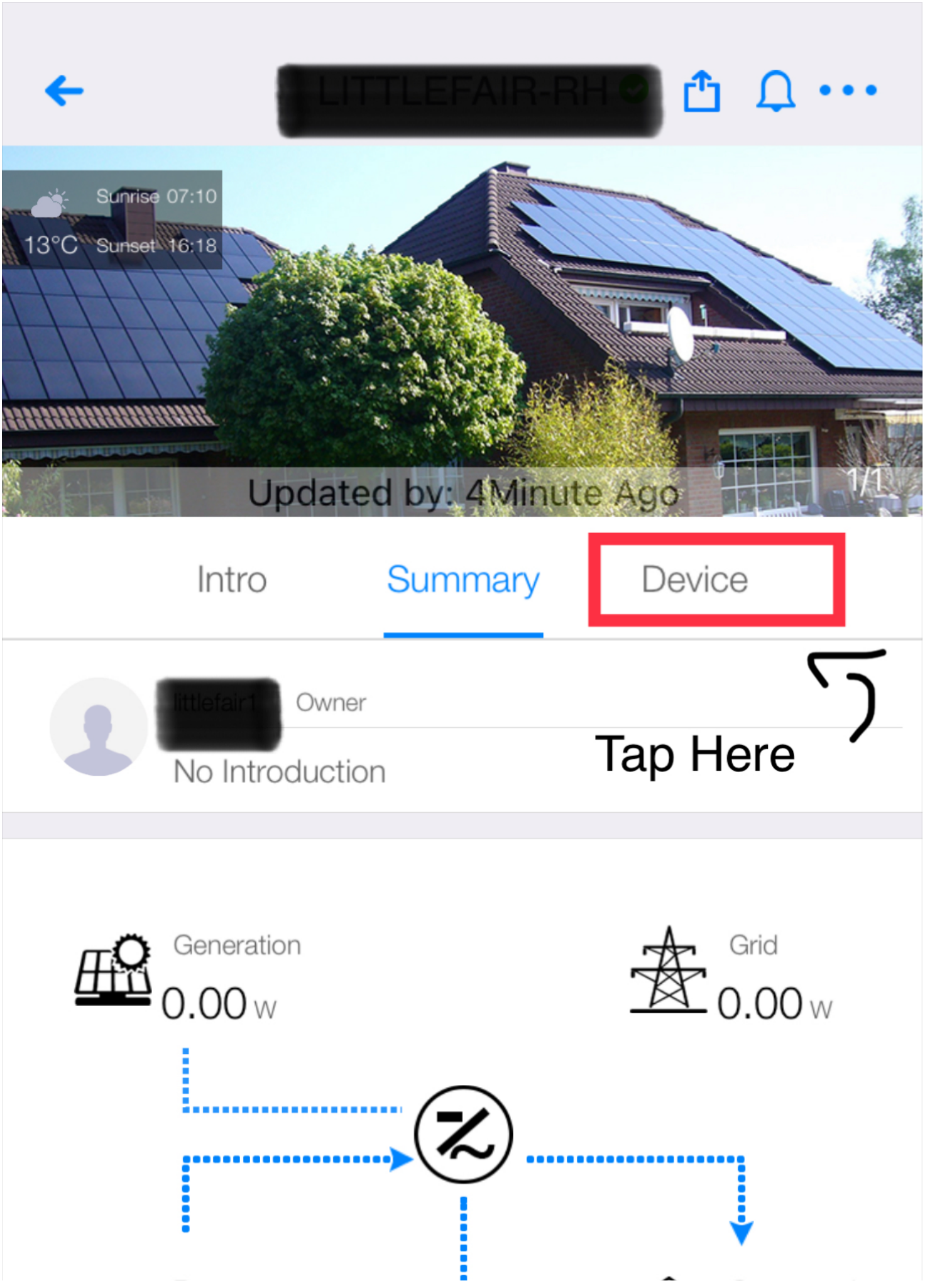
Fig 6. Soliscloud Desktop Website Navigation

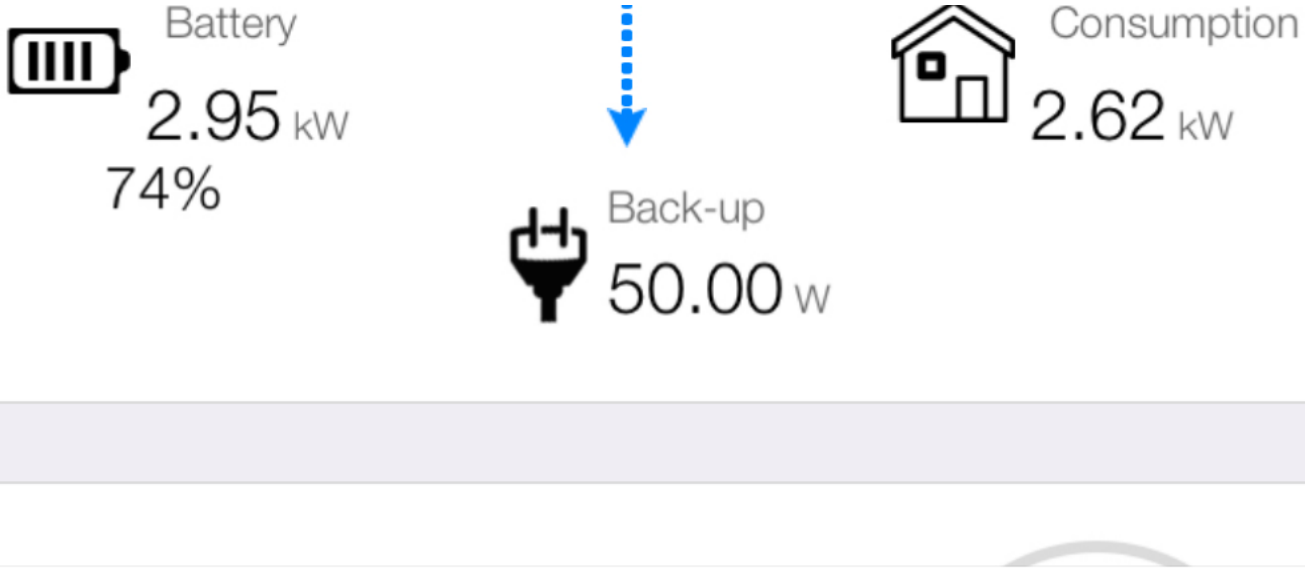
Highlighted in Blue: Power from your PV input(s). This example has a total of four DC power input cables, two for PV1 & two for PV2.

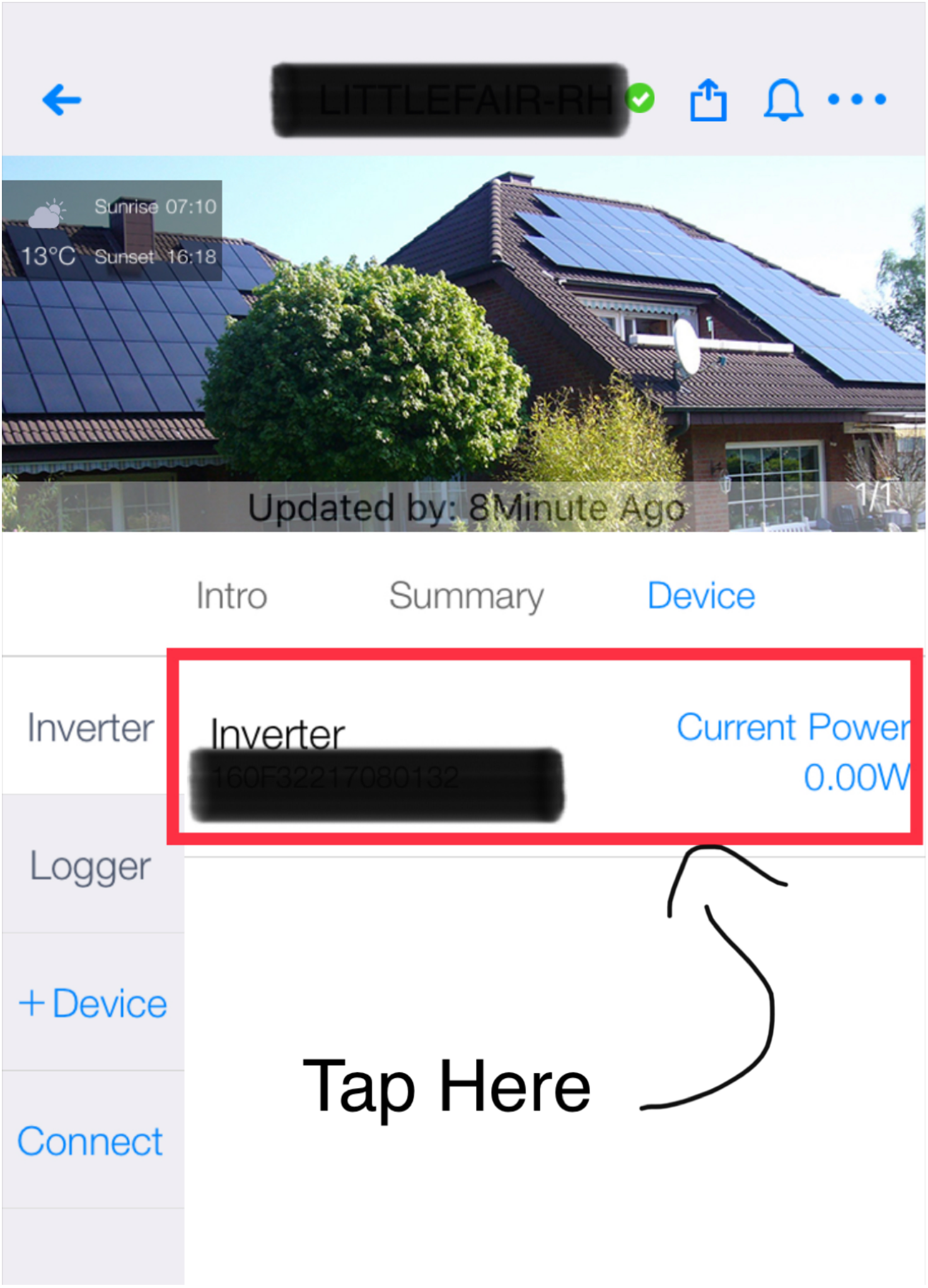
***Important note: If nothing is connected to PV1 or to PV2, or any possible PV inputs - the inverter will fill the fields with dummy figures, usually very small ones. Same applies for Solarman.**

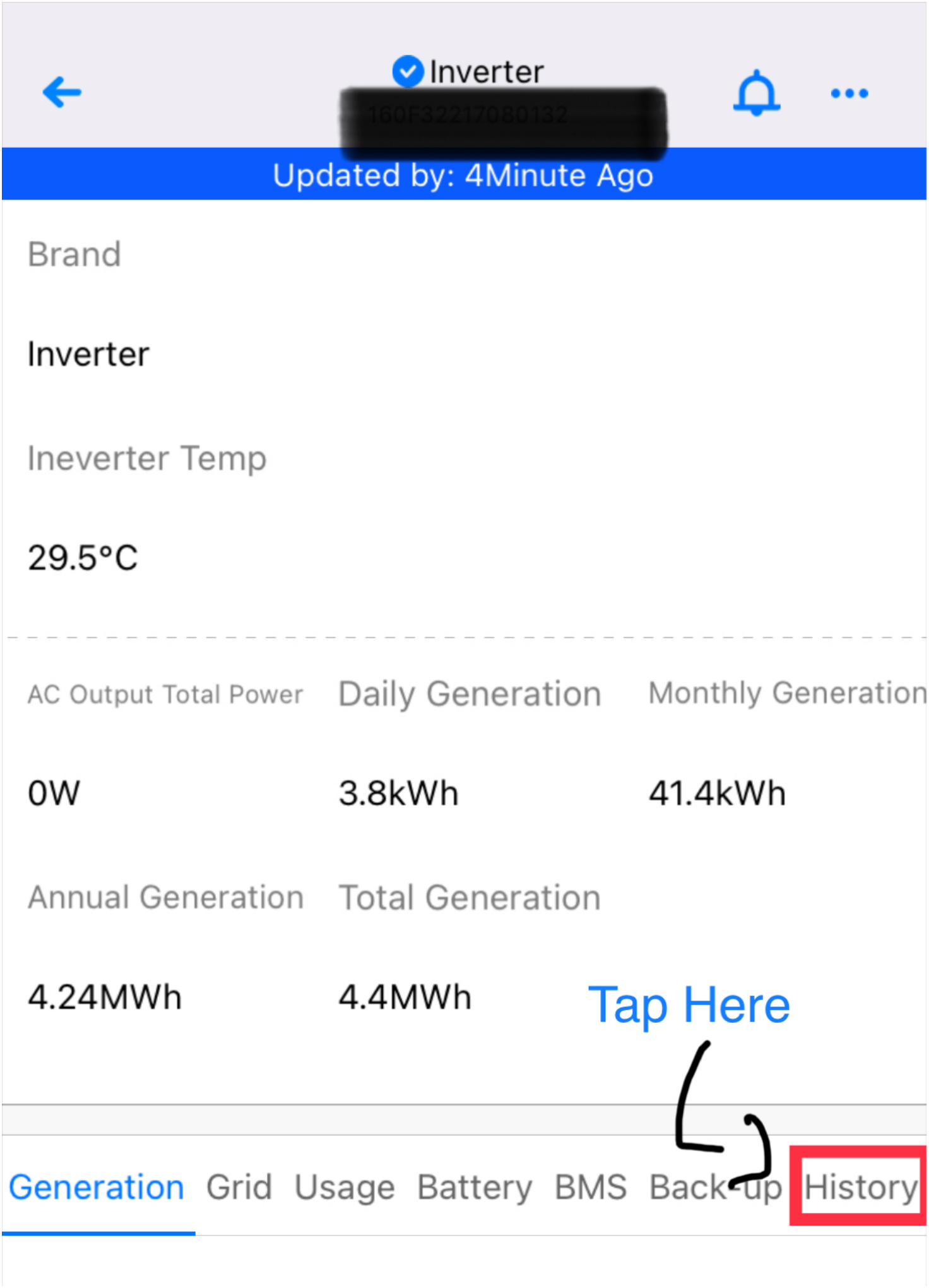
Highlighted in Red: The parameters needed for system monitoring.

Solarman Navigation


LITTLEFAIR-RH
Sunrise 07:10
13°C Sunset 16:18
Updated by: 4Minute Ago
1/1
Intro
Summary
Device
littlefair1
Owner
No Introduction
Tap Here
Generation
0.00 w
Grid
0.00 w


Battery
2.95 kW
74%
Back-up
50.00 W
Consumption
2.62 kW


LITTLEFAIR-RH
Sunrise 07:10
13°C Sunset 16:18
Updated by: 8Minute Ago
1/1
Intro
Summary
Device
Inverter
Inverter
160F32217080132
Current Power
0.00W
Logger
+ Device
Connect
Tap Here


Inverter
[redacted]
Updated by: 4Minute Ago
Brand
Inverter
Ineverter Temp
29.5°C
AC Output Total Power
Daily Generation
Monthly Generation
0W
3.8kWh
41.4kWh
Annual Generation
Total Generation
4.24MWh
4.4MWh
Tap Here
Generation
Grid
Usage
Battery
BMS
Back-up
History

	Voltage	Current	Power
PV1	113.60V	0A	0W
PV2	128.70V	0A	0W

Generation Grid Usage Battery BMS Back-up History

Day | Week

2022/11/11

Energy generated last month

Energy generated today

Cumulative energy generated

Total power-Consumption side

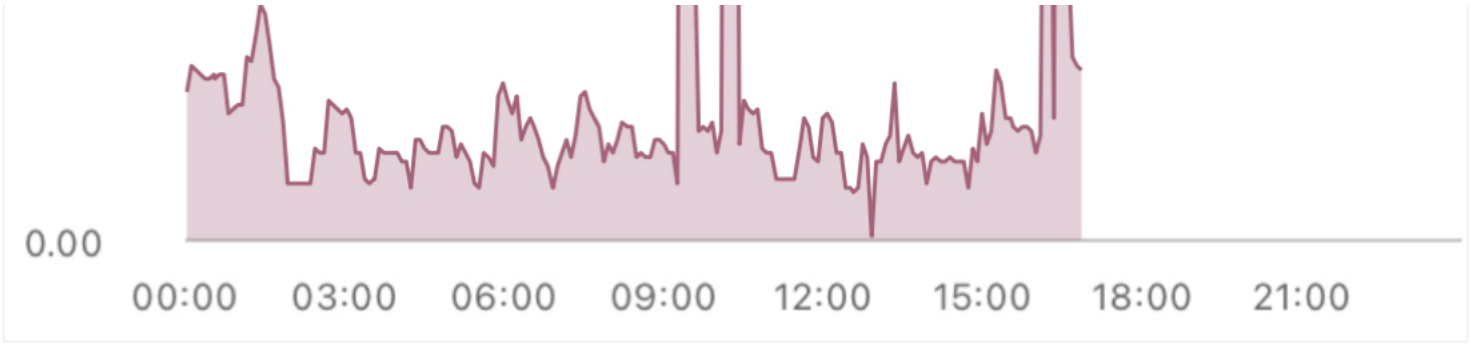
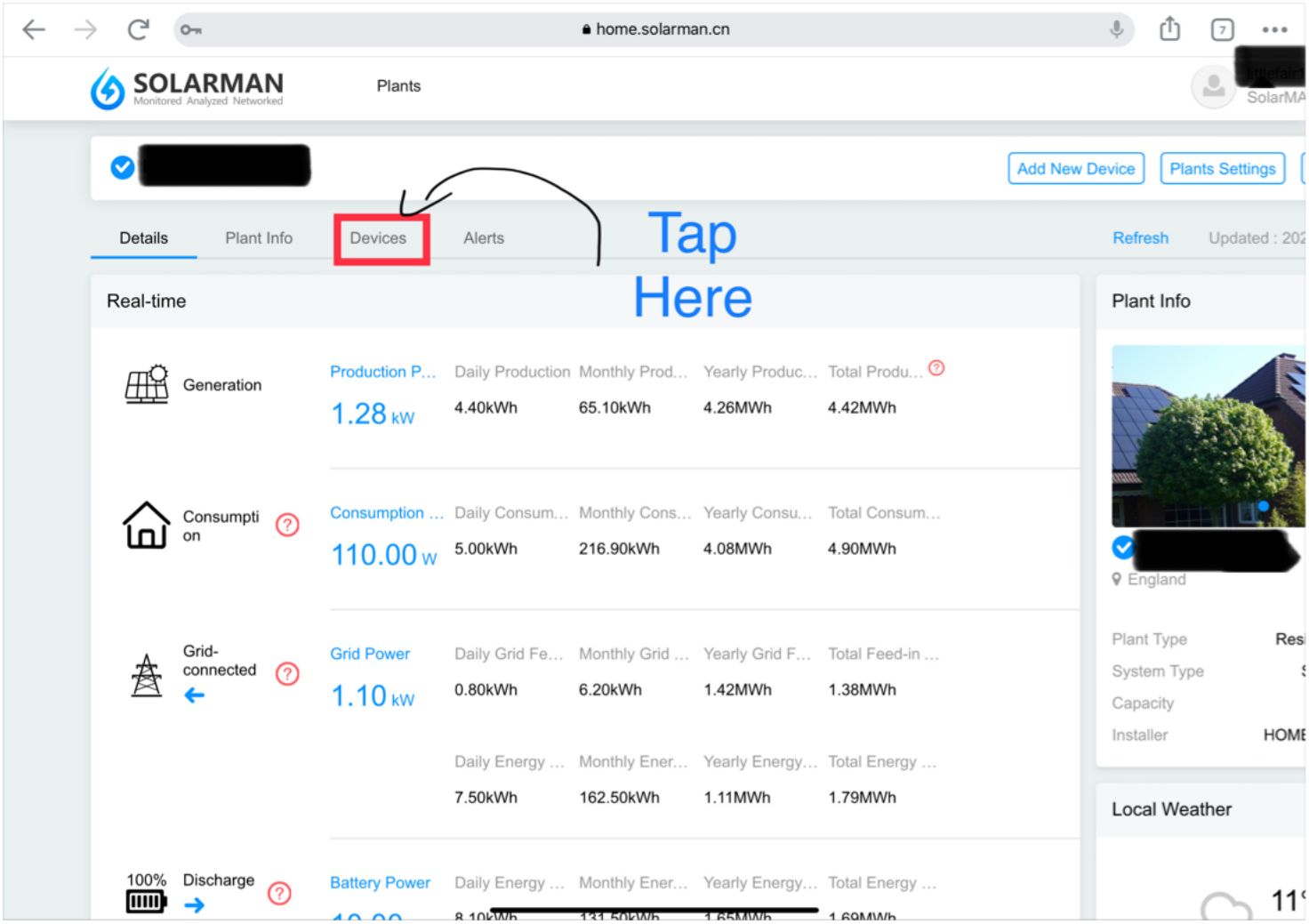
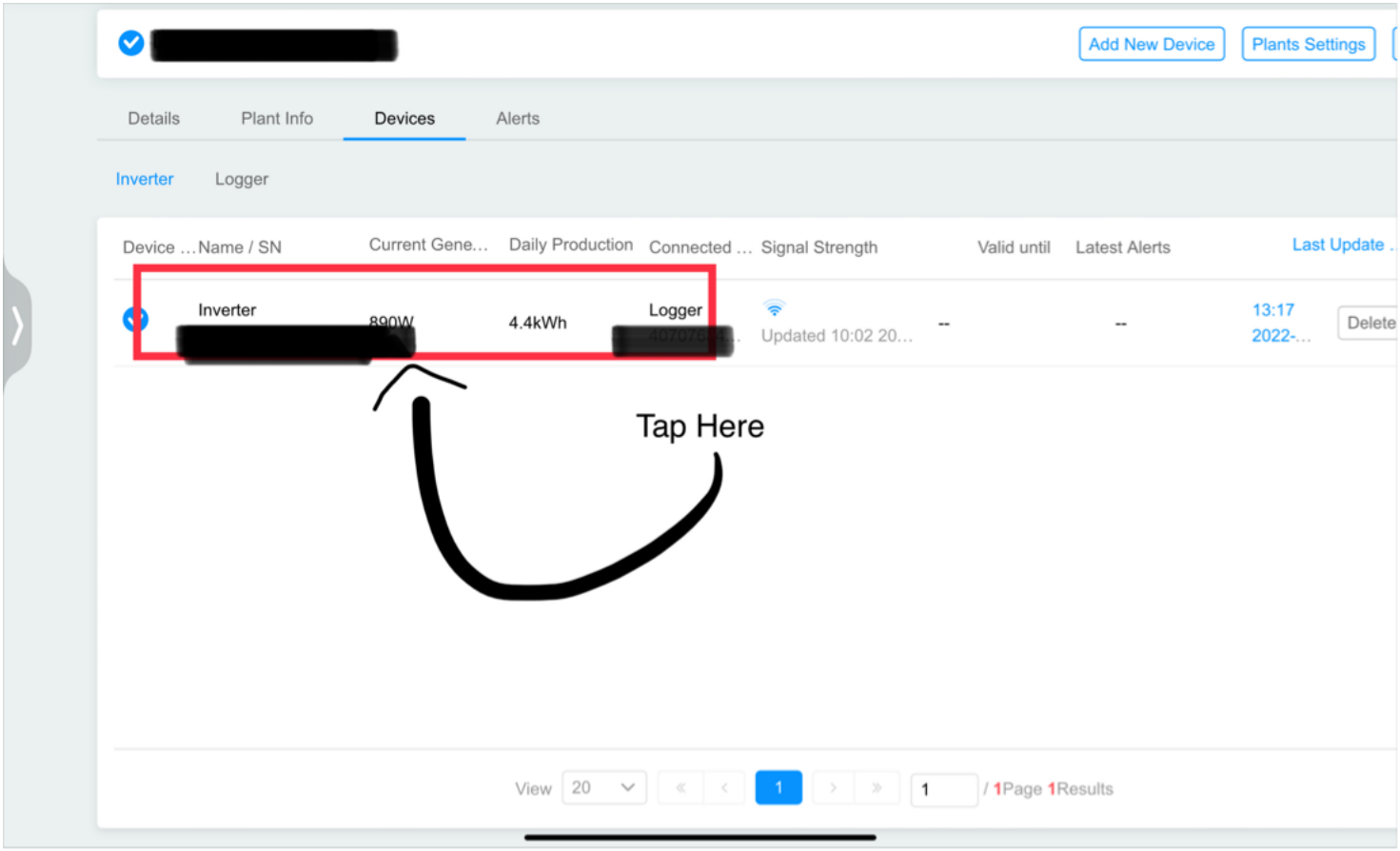
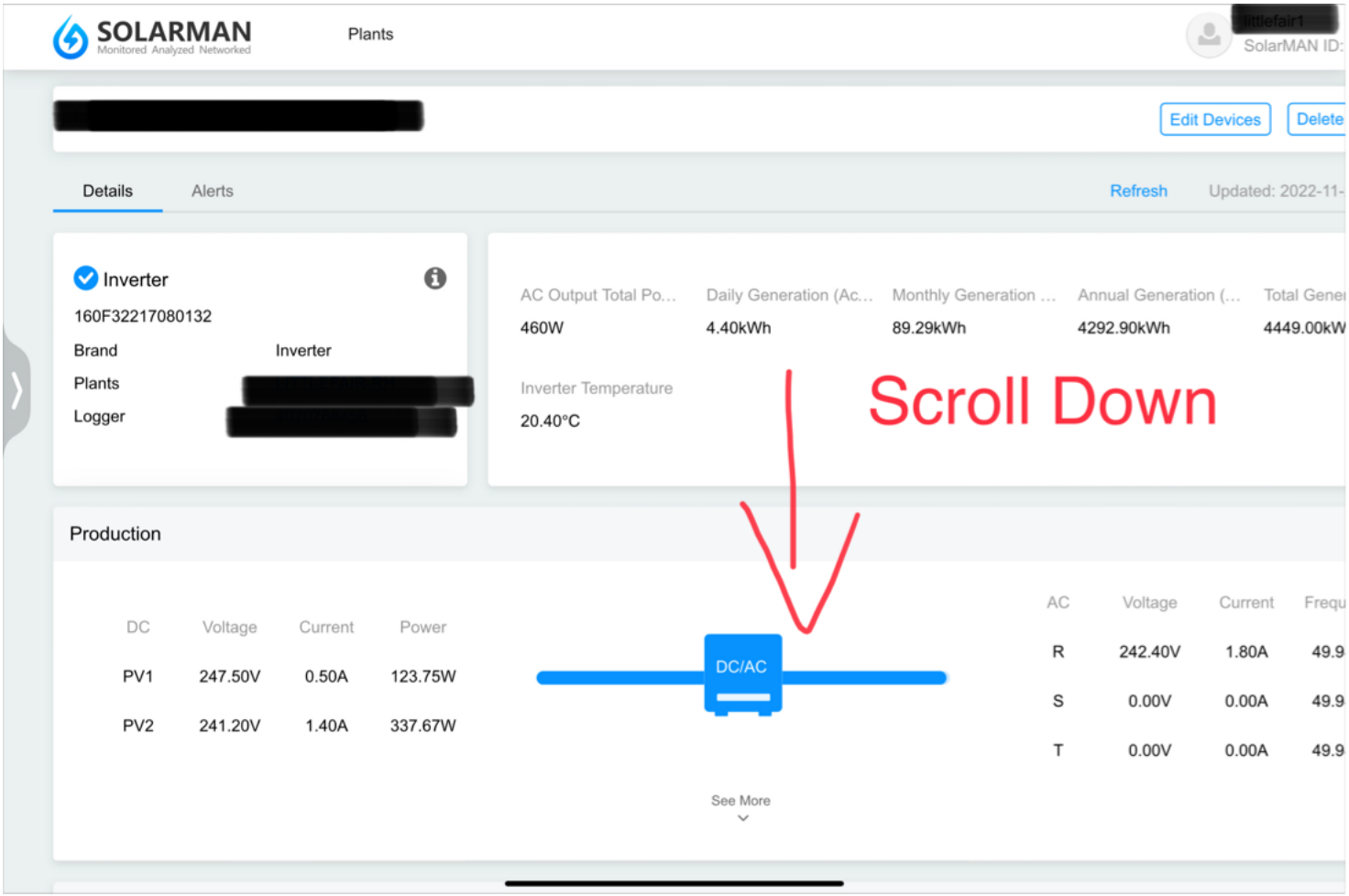


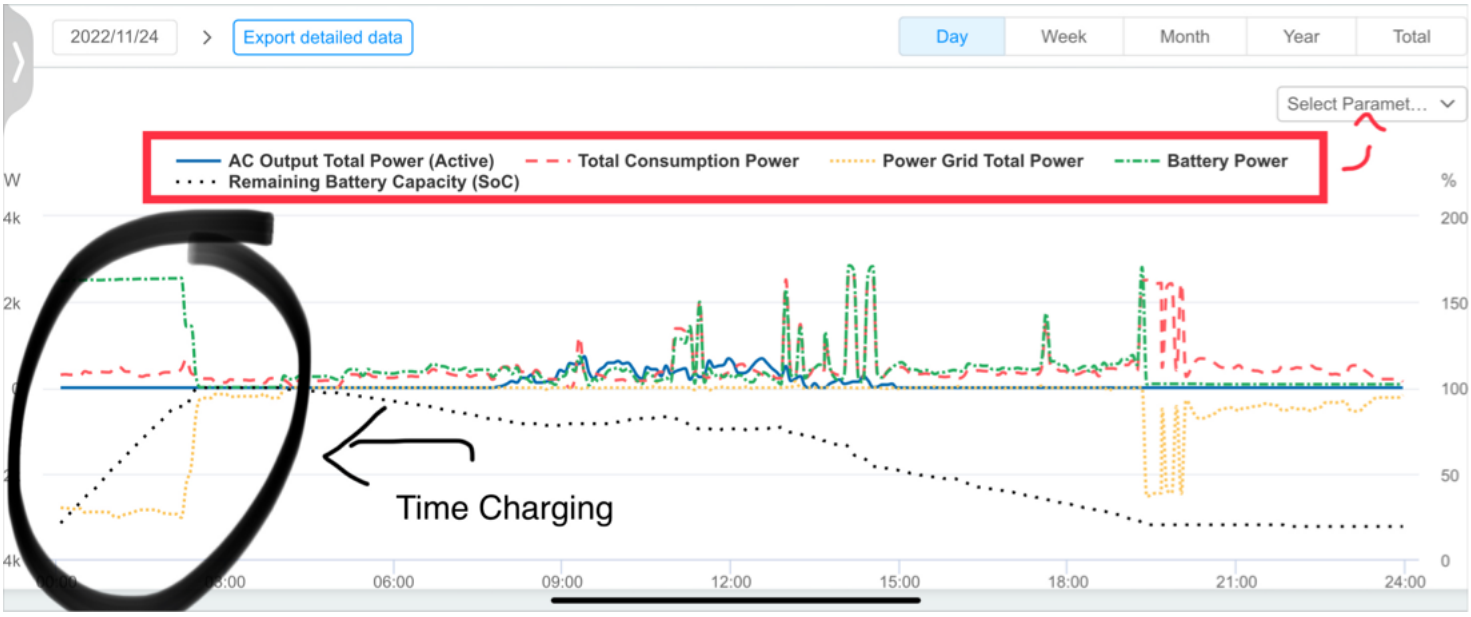
Fig 7. Solarman App Navigation

Solarman Desktop Navigation




Add New Device
Plants Settings
Details
Plant Info
Devices
Alerts
Inverter
Logger
Device ...
Name / SN
Current Gene...
Daily Production
Connected ...
Signal Strength
Valid until
Latest Alerts
Last Update
Inverter
890W
4.4kWh
Logger
Updated 10:02 20...
--
--
13:17
2022-...
Delete
Tap Here
View
20
1
/ 1Page 1Results


SOLARMAN
Monitored Analyzed Networked
Plants
littlefair1
SolarMAN ID:
Edit Devices
Delete
Details
Alerts
Refresh
Updated: 2022-11-
Inverter
160F32217080132
Brand
Inverter
Plants
Logger
AC Output Total Po...
460W
Daily Generation (Ac...
4.40kWh
Monthly Generation ...
89.29kWh
Annual Generation (...
4292.90kWh
Total Gener
4449.00kW
Inverter Temperature
20.40°C
Scroll Down
Production
DC
Voltage
Current
Power
PV1
247.50V
0.50A
123.75W
PV2
241.20V
1.40A
337.67W
DC/AC
AC
Voltage
Current
Frequ
R
242.40V
1.80A
49.9
S
0.00V
0.00A
49.9
T
0.00V
0.00A
49.9
See More



So, with all of that out of the way - let's look at some graphs!

Generation can be described as either Total DC Input, or Total AC output, or simply Total Power for Solis. A typical summers day of generation is shown below. As below, you can see how much power is generated at any instant, and by taking the area under the graph, or letting the platform do it for you, you can tell how much you've generated in total. Again, this is where we must be exceptionally careful, and this same note will apply to every figure we look at:

Because the total generation and consumption data sets are calculated off the back of what the inverter has relayed to the cloud platforms, they are susceptible to error as they are calculating results of an incomplete dataset. The truest measure of your generation and consumption are without a doubt your home smart meter and installed generation meter. Do not be alarmed if there is a discrepancy between real readings from your provider and the app. The app is vanishingly unlikely to be more accurate than what your utility provider is able to measure.

Self use (using the power from the sun to directly power home appliances) can be helpfully described with two further sets of data. Total consumption (the power consumption of your home), and Grid Total Active Power (GRTAP) (Solis) or Power Grid Total Active Power (Solarman), GRTAP is the measure of your activity on the national grid, whether you are selling to or buying from, and how much. Positive means selling and negative means purchasing.

An ideally optimised solar + storage system will neither buy nor sell power to or from the grid - we are looking to capture and use everything we can!

First, a system without any storage:

Because there is no battery, there is no reason for the inverter to need to know whether it should pull power to or from the grid, it is in a state of always pushing, it will push through your house first (to power any appliances that may be on) and then out to the grid. If your system is PV only you will only see your generation.

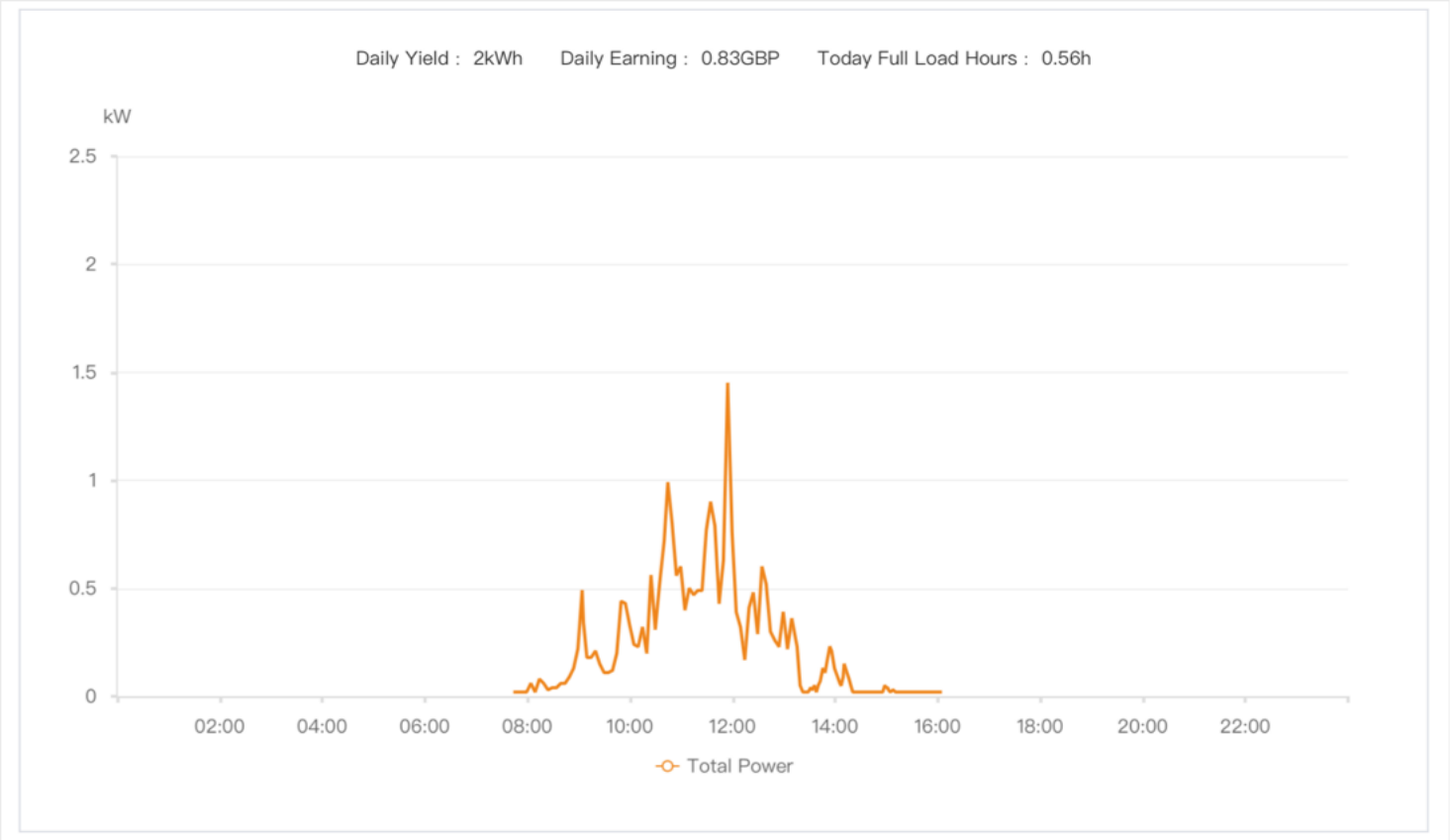


Fig 8. PV Only System

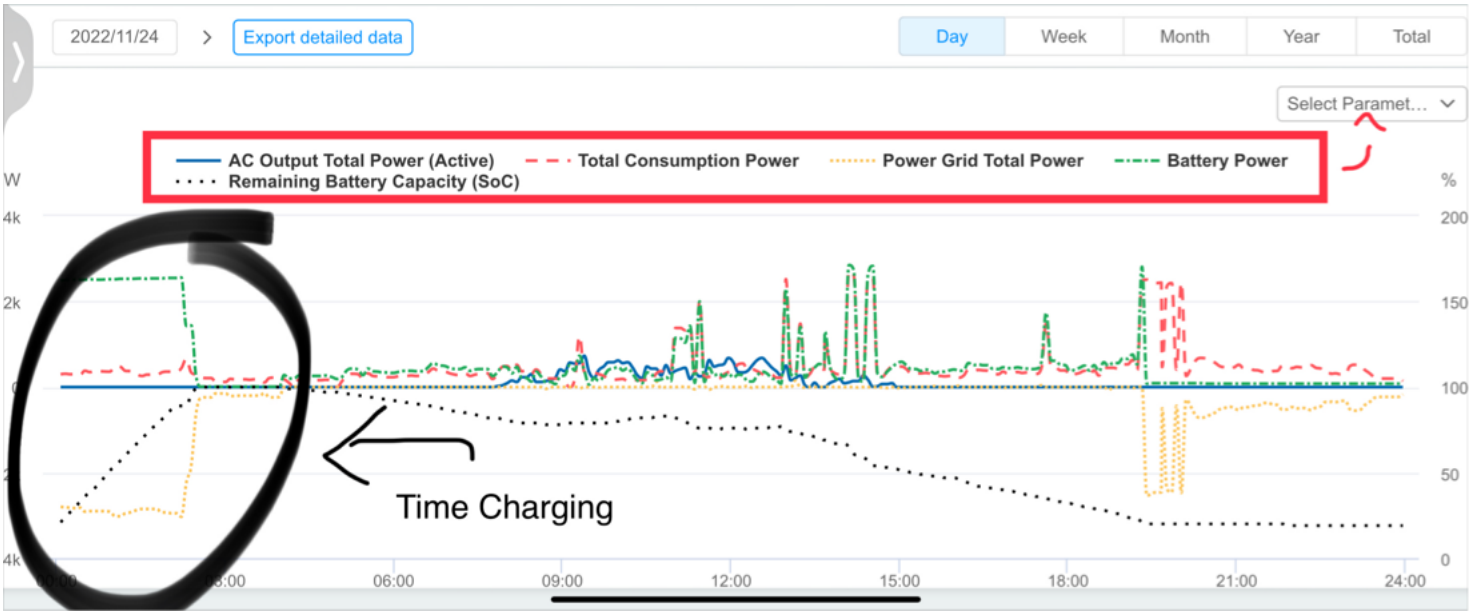
Let us consider a system with a battery.

We can add more parameters to the graph now. Battery Power which depending on your platform will either be positive and negative to reflect discharge and charge respectively, or simply positive to reflect either condition, showing the power ramping up either to discharge or to charge. We should also overlay the Battery SOC (Solis) or Remaining Battery Capacity (Solarman) - just to tell us in % how much charge is in the battery, so we can see it respond to excess generation or power demands in near real time.

Then Fig 8. shows how a battery can further minimise grid impact, by instead of selling power to the grid through the day, it can ‘catch’ the excess generation, and discharge it to meet domestic demand when demand exceeds generation, often overnight.

In the figure below, you can see the yellow line is totally neutral except for first thing in the morning where the customer elected to implement time charging, and after about 20:00 when

the battery ran totally flat.



And for most systems, that's it!

If you have multiple inverters, particularly secondary PV inverters, your charts just will look weird. Unfortunately, no mechanism exists presently to correlate multiple PV inverter and Hybrid inverter and/or a battery charging inverter such that all the figures line up into one homogeneous usable graph. You will have to track data from each one and play mental gymnastics to figure out (using the same methods described above) the daily performance of your device. However, rest assured, if a piece of equipment stops functioning it will be blatantly obvious. The best metric of a fully operational system is the depression in electricity bills!

If the above case describes you and you need further support understanding what's going on, we are happy to help. Just write into the office asking for an interpretation and we will do what we can to help.

Thank you for reading this guide and I hope you found it helpful. We are always pushing the limits of what solar can do here and if there's anything that I've missed that you would like to see some detail on, let us know through Rex (the friendly chatbot, available at www.homesmartenergy.co.uk).

Best Wishes

Home Smart Energy Technical