

Determining the Appropriate Battery size

The battery bank operates as energy storage in any system, On Grid or Off Grid. In order for the system to meet the customer's needs and expectations, the storage size, as well as numerous and sometime conflicting requirements must be considered.

The continuous power and three times surge performance of the SP PRO is second to none. Impressive, but it is the battery capacity that allows the SP PRO to perform.

The SP PRO can operate on batteries having a large range of capacities, from 100 Ah to 10,000 Ah. The large range gives the SP PRO its flexibility to power a remote sheep station or provide an hour of backup to a suburban dental surgery.

Understanding the customer's needs and expectations will assist in determining what factors must be considered in calculating the battery capacity. Factors to be considered vary depending on the installation. Some of these are:

- Maximum Demand
- Daily Energy Usage
- Renewable Input
- Reliability of Supply
- Cost
- Autonomy
- Site Restrictions
- AC Capacity Limits
- Average Temperature

How Much and How Long?

All individual factors often come down to two questions: "How much?" and "How long?"

Load



Load kW
Daily kWh

Solar Array



Array kW
Sun Hours

Grid Failure



How Often
How Long

Electricity Grid



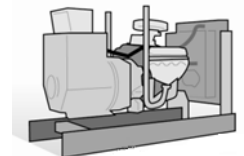
Input kW
Available Hrs

Wind Generator



Output kW
Expected Yield

Generator



Output kW
Run Hrs

Example - Grid Connected

The customer wants to be able to export solar and ride through power outages. The predominant factors that need asking "How much?" and "How long?" are:

"How much"

Load = 1.2 kW largest usual combination

Solar Array = 1kW

Grid Outage = 1 per year

"How long"

Usage = 14kWh

Sun Hours = 4

Outage Duration = 3 hours

From the above information you can see that the system predominately will remain connected to the grid and only occasionally require battery backup. Capacity of array is low compared to usage so array cannot be relied upon to provide power during outage, although what is produced will be used.

Sizing the battery bank then only needs to consider average power consumption, duration of a single blackout and minimum State of Charge (SoC) that you wish to allow.

$$\begin{aligned} \text{Battery Capacity} &= \frac{\text{Load W}}{\text{Battery Voltage}} \times \frac{1}{\text{Inverter Efficiency}} \times \text{Duration} \times \frac{100}{(100-\text{Minimum SoC})} \\ \text{Battery Capacity} &= \frac{1200 \text{ W}}{48 \text{ V}} \times \frac{1}{0.95} \times 3 \text{ hrs} \times \frac{100}{(100-60)} \\ \text{Battery Capacity} &= 197 \text{ Ah} \end{aligned}$$

With small batteries, it is a good idea to add an extra 10 – 20% to allow for load variations.

Example - Off Grid Standalone

The customer wants to run all loads predominantly from solar with low generator run time and be able to ride through five days with no solar input. The predominant factors that need asking "How much?" and "How long?" are:

"How much?"

Load = 2.4 kW largest usual combination

Sun Hours = 4

Generator Size = 4 kW

"How long?"

Usage = 8 kWh

Solar Array = 3.5 kW

Run Hours = little as possible

Capacity of array is significant however given the need for five day autonomy and customers desire for little generator run time, the main factor in determining the battery size becomes the daily expected usage and the five days autonomy.

$$\begin{aligned} \text{Battery Capacity} &= \frac{\text{Usage Wh}}{\text{Battery Voltage}} \times \frac{1}{\text{Inverter Efficiency}} \times \text{Days Autonomy} \times \frac{100}{(100-\text{Minimum SoC})} \\ \text{Battery Capacity} &= \frac{8000 \text{ Wh}}{48 \text{ V}} \times \frac{1}{0.95} \times 5 \text{ Days Autonomy} \times \frac{100}{(100-50)} \\ \text{Battery Capacity} &= 1754 \text{ Ah} \end{aligned}$$

Battery efficiency and temperature effects also need to be allowed for; consult the instructions for your preferred battery type.