solis seminars

Episode 45

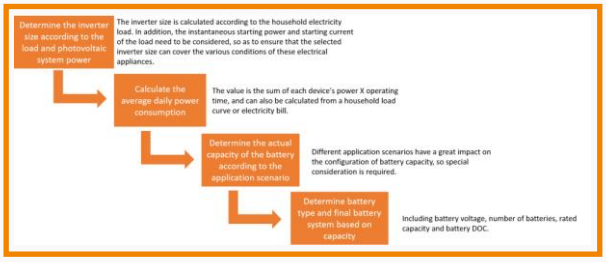
Battery Capacity Selection Criteria for Solar PV Energy Storage Systems

Background

In a solar PV energy storage system, battery capacity calculation can be a complex process and should be completed accurately. In addition to the loads (annual energy consumption), many other factors need to be considered such as: battery charge and discharge capacity, the maximum power of the inverter, the distribution time of the loads, and the maximum SOC of the battery, specifics of the installation location etc., Carefully considering all these factors will help enable an accurate selection of the required battery capacity.

This Solis seminar will share with you how to select the correct battery capacity for solar energy plus storage systems.

The Basic Logical Decision Sequence of Battery Capacity Selection in Solar Energy & Storage Systems



In a solar energy storage system, we first need to understand the household loads and consumption. This should include the average power and instantaneous power of all loads, to ensure that the selected inverter power and battery capacity can fully meet all household needs. To find a formula, add up the wattages of all appliances in your home, from computers and refrigerators to microwaves and computers. The result of the calculation will determine the size of the inverter you use.

Example: A room with two 50-Watt fans and a 500-Watt microwave. Inverter size is 50 x 2 + 500 = 600 Watts. Do this for each room in the house and total everything up.

Average Daily Energy Consumption

The power consumption of appliances and devices is usually measured in Watts. To calculate the total energy consumption, multiply the watts by the hours of use.

Example: A 40W bulb consumes 200 Watt hours for 5 hours of operation and a 50W fan on for 6 hours consumes 300Wh.

Continue adding up all the Watt-hours for each appliance in the property to get how much energy the home uses each day.

(Note: We need to account for the initial startup process of some devices which often consumes more energy. Multiply the result by 1.5 to cover this. If we take a fan as an example, the fan runs 6 hours a day. 50 x 6 = 300 Watt hours. 300 x 1.5 = 450 Watt hours)

Of course, you can also use a monthly electricity bill to estimate the daily energy consumption.

Autonomous Days

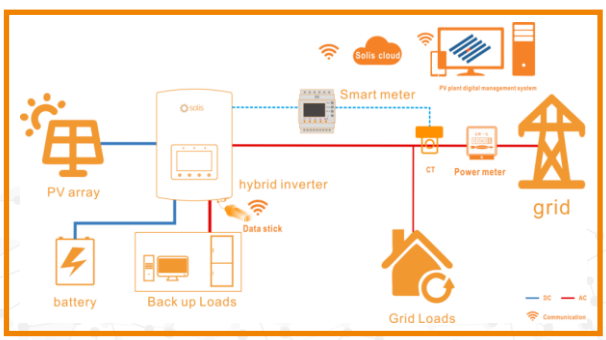
This determines how many days the battery will power you. Generally, autonomy will maintain power for two to five days. This has a lot to do with the amount of sunshine in your area. For example, it is better to use a larger battery capacity in areas with more cloudy days and a smaller battery pack capacity in sunny areas.

Application Scenarios

Different application scenarios also have an impact on the battery capacity chosen. Self-consumption, peak-valley electricity price balance, backup power (unstable power grid or critical loads), pure off-grid applications, etc. will all play a factor in battery matching. Each scenario should be considered and analyzed with the customer in different situations. They will have a direct impact on the resulting battery capacities.

Good Public Power Grid, but the Electricity Price is Relatively High

The installation of a solar energy storage system is mainly to reduce the electricity consumption from the grid and reduce the electricity bill.



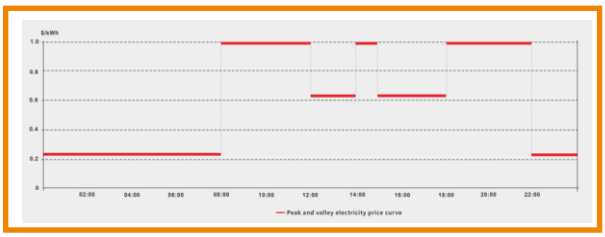
Application scenario features:

a. Grid stability

b. Solar is only to reduce the electricity consumption from the grid (the electricity cost is higher)

c. There is sufficient sunlight during the day

Take into consideration the electricity cost from the grid and electricity consumption. You can then determine the battery capacity according to the PV energy storage system + grid power supply ratio or the peak and valley electricity prices. You can even use the average daily electricity consumption (kWh) of the household to simply select the battery capacity.

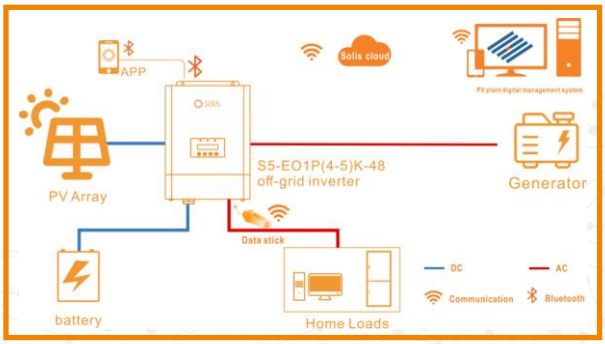


Capacity Design Logic

This is an estimated method. As long as the power supply capacity of solar + energy storage ≥ the power consumption of the load.

Uninterrupted Power Supply (UPS) Application Scenarios,

These are mainly used in areas with unstable power grids or situations with critical loads.



Application scenario features:

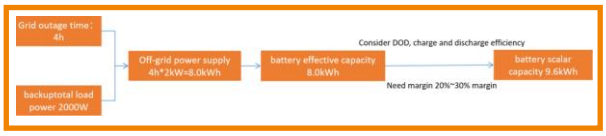
a. The grid is unstable

b. There are important equipment that cannot be powered off

c. Understand the power consumption and off-grid time of the device when off-grid

For example, there is a small hospital in an area with an unstable power grid, and there is an important oxygen supply machine that needs to work 24 hours a day. The power of the oxygen supply machine is 2.0kW, but the power grid in this area is out of power for an average of 4 hours a day. In this scenario, the oxygen supply machine is a critical load, and the total power consumption when off-grid and the estimated off-grid time become the most critical parameters.

Calculated based on the estimated maximum time of power outage of 4 hours, the design can be referred to like this:



Battery Characteristics

This aspect mainly focuses on the battery material (lead-acid, lithium or lithium iron phosphate, etc.). Different materials have different charging and discharging characteristics. In addition, it is about the voltage of the battery pack, which needs to match the charging voltage of the inverter. Depth of discharge (DOD) of any battery is also an important factor to consider. You can also refer to Solis' comprehensive battery compatibility list to simplify battery selection and ensure you only select a compatible battery model according to the required capacity.

Summary

The selection of battery type and capacity is related to the power supply capacity and economic benefits of the system. The choice of battery capacity needs to consider the different demands of specific application scenarios.

It is necessary to conduct analysis on specific application scenarios such as battery charging and discharging capacity, maximum power of the energy storage inverter, power consumption period of the loads, and actual maximum discharge capacity of the battery.

To ensure peak performance from any solar + battery energy storage system it is critical to select compatible equipment. Solis offers one of the widest choices of compatible batteries to fit alongside its hybrid, AC coupled and off grid inverters.

For further information and to understand more about the products Solis offers you can go to www.solisinverters.com