



## Home Battery Backup Systems

### Glossary & Basic Concepts

Battery Energy Storage System (BESS) - Describes all of the components of a battery backup system

Photovoltaic System (PV) - A power system utilizing solar modules and inverters

KiloWatt (kW) - A unit of instantaneous power, equal to 1000 Watts

KiloWatt-hour (kWh) - A unit of energy, the sum of power used over a period of time, for example: An air conditioning unit using 5 kW of power over a period of 1 hour will consume 5 kWh of energy.

Backed Up Loads Panel (BULP) - A dedicated circuit panel for just the circuits that will be backed up during an outage

Automatic Transfer Switch (ATS) - A component that senses power outages and immediately isolates the backup system from the grid

Battery Storage Capacity - The amount of energy a battery can store, (in kWhs)

Nominal Rating - The manufacturer's nominal rating of a battery, usually rounded up

Usable Energy - The amount of energy that can be used without harming the battery, usually the nominal rating less a 10% reserve

Autonomy Period - A measure of how long a Battery Energy Storage System can supply power to the Backed Up Loads Panel (BULP) without being recharged, calculated by dividing the usable energy capacity of the battery by the average power consumption:

$$\text{Battery capacity (kWh)} \div \text{Average load (kW)} = \text{Autonomy period (hours)}$$

Example 1:

A fully charged 10 kWh (9 kWh usable) battery can supply an average load of 100 watts for 90 hours, without being recharged. This is an autonomy period of about four days.

$$(9 \text{ kWh} \div 0.1 \text{ kW} = 90 \text{ hours}).$$

## How Battery Energy Storage Systems Work

The purpose of a BESS is to provide power to designated backed-up loads during a utility outage. The BESS relies on a photovoltaic system (PV) to provide power directly, and to recharge the batteries. It is important to understand the limitations.

Battery Energy Storage Systems do not provide unlimited or uninterrupted power.

The amount of power, (kW), a system can produce at any one time is limited by the maximum output capacity of the PV inverters, which have a finite limit. The amount of energy, (kWh), a BESS can store is limited to the sum of the usable capacity of the batteries.

Installing more solar generation capacity will result in faster battery charging - a plus when solar power is limited, such as during the winter months. Installing more battery storage capacity will increase the amount of reserve energy available - a plus during prolonged outages.

Powering a whole home during an outage is difficult and quite costly to install the required solar and battery capacity to do so. Typically, only the most essential loads are backed up. Prioritize meeting your essential needs, such as life support systems, water systems, internet connectivity, essential lighting, garage doors openers, refrigeration, and cooking appliances. Avoid backing up large loads, such as older HVAC systems, pool equipment, electric heaters, EV chargers. Trying to power these high use items may exceed the power limit and will quickly deplete the batteries, thus shortening your autonomy period to just a few hours.

Homeowners are responsible for managing how long the backup system will provide backup power during an outage. The owner must anticipate solar production, monitor the amount of energy in the batteries and the rate of depletion, and adjust consumption appropriately. Failure to do so will result in running out of backup power prematurely.

It is also important to understand that when the grid power goes out the backup system does not always start up right away. There may be a delay of up to several seconds before the batteries take over. It should not be expected that a seamless transition will happen every time.

Battery systems are complex, emerging technologies and subject to issues just like any other complex technology. Owners should test their system regularly, ideally when there is little risk of an imminent power outage, such as on a normal weekday. This can be accomplished by turning off the main breaker to simulate a power outage. This will familiarize you with how the BESS performs, and help you learn how to monitor and manage usage during an outage. If an outage is likely, due to stormy weather, potential power shutoffs, or anything else, it is prudent to test prior to the expected outage event.

As always, Solar Works is available to assess your specific home and needs.  
Give us a call at (707) 829-8282 or visit us online at [solarworksca.com](http://solarworksca.com) to get started.