How to Size Off-Grid Solar Batteries

Step 1: Calculating Your Amp-hour Needs

1. Inverter size

To determine the inverter size we must find the peak load or maximum wattage of your home. This is found by adding up the wattage of the appliances and devices that could be run at the same time. Include everything from microwaves and lights to computers and clocks. The sum will tell you which inverter size you need.

Example: A room has two 60 watt light bulb and a 300 watt desktop computer. The inverter size is 60 x 2 + 300 = 420 watts

2. Daily Energy Use

Next find the energy used in a day. Figure out how long each electronic device will be run in hours during a day. Multiply the wattage of each device by its run-time to get the energy in watt-hours per day. Add up all the watt-hour values to get a total for your home. This estimate is likely too low as there will be efficiency loses. To get a very rough idea of the real value with system loses, multiply by 1.5. This will help account for decreasing performance when temperature increases.

Example: Light bulbs run for 5 hours a day. Computer runs for 2 hours a day. 120 x 5 + 300 x 2 = 1200 watt-hours. 1200 x 1.5 = 1800 watt-hours

3. Days of autonomy

Now decide how many days worth of energy you want to store in your battery bank. Generally this is any[1]where from two to five.

4. Battery bank capacity

Finally we can calculate the minimum battery AH capacity. Take the watt-hours per day and multiply them by the number you decided upon in 3. This should represent a 50% depth of discharge on your batteries. Therefore multiply by 2 and convert the kwh result into amp hours (AH). This is done by dividing by the battery voltage.

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[1] Information from: http://www.instructables.com/id/How-to-Size-Your-Off-Grid-Solar-Batteries-1/

Example: You want the battery bank to last three days without recharging and that you use 1.8 kwh per day. As 1.8 x 3 x 2 = 10.8kwh, this is the energy we need from the batteries. Converting this to AH we have to divide by the voltage of your system. This can be 12, 24 or 48 for commercial application. If we choose to use 48V, the minimum AH capacity is then 10 800/48 = 225 AH. Now if you divide by your battery's rating you find the number of batteries you must use.

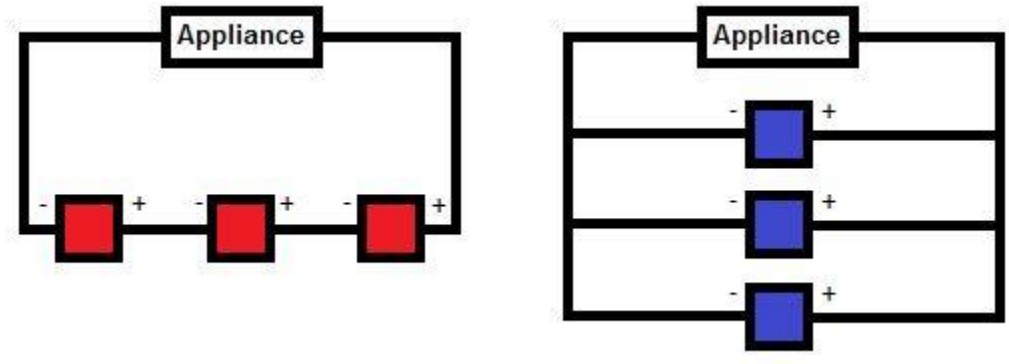
Step 2: Don't overcharge your batteries

Once you have sized your battery bank and solar panel array, determining which charge controller to use is comparatively straight forward. All we have to do is find the current through the controller by using power = voltage x current. Take the power produced by the solar panels and divide by the voltage of the batteries.

Example: A solar array is producing 1 kw and charging a battery bank of 24V. The controller size is then 1000/24 = 41.67 amps. Now introduce a safety factor. Multiply the value you have found by 1.25 to account for variable power outputs: 41.67 x 1.25 = 52.09 amps

In our example we would need at least a 52 amp controller. The Flex Max 60 MPPT Charge Controller would fit our specifications.

Step 3: Battery Wiring – Putting it all Together



Series Wiring | **Parallel Wiring**

Before buying your batteries you need to figure out how many you need. Wiring is going to play a major role in determining this number. The goal is to find a configuration that produces target AH and voltage. There are two methods of wiring components in a circuit: parallel and series. In a series configuration the battery voltages add up while in parallel, current adds up.
Series and parallel connections can be combined to produce the voltage and AH that you require. Just remember:

Series → voltage adds, current does not
Parallel → current adds, voltage does not

Previously we claimed that you could find the number of batteries you would need by dividing the AH capacity of your system by the AH rating of your batteries. This actually depends on how you wire together your system. Also remember that if a used battery is connected in parallel to a new one, it will degrade the fresher battery decreasing the lifespan of the whole system. Some people say that ideally you should just use a long line of batteries connected in series for your battery bank. Unfortunately, this is not always possible due to voltage and AH requirements.

You've now gone through all the steps necessary to size your off-grid battery bank system.