Setting up a basic, one Lead-Acid battery system with a generic controller and a single 100 watt solar panel.

Bill of Materials:

Item	Description
1	100 W Solar Panel, HF # 57325, modified, w/20' cord & APP Connectors
2	Solar Controller, MPPT, generic, 12 or 12/24 Volts, 10 Amp.
3	Battery, Lead Acid, Marine Type, 12 V 80-105 AH
4	Inverter, generic, True Sine Wave, 300-400 watt, 12 VDC to 115 VAC 60 Hz
5	Power Monitor, Kill-A Watt, # P4400

The four major components of a basic system (Kill-A-Watt not pictured).

-Inverter and Kill-A-Watt not needed if you are only running items that use 12 VDC.

-If you substitute a LiFePO4 battery, use a controller that specifically charges it!

1: Choose a convenient site close enough to where you are that gives you as much unobstructed sunlight as possible:

-The best sunlight is from mid morning to late afternoon.

-Any shading on a panel can drastically reduce or stop its output current.

2: Set up the solar panel:

-Set up the panel at an angle so that the sun shines face to it. Flat on the ground works, but reduces the amount of power generated.

-If you can, move the panel every 3 or so hours to face the sun.
-If you can't move the panel, set it up to get the best amount of sunlight that you can.

3: Set up the battery:

-Site the battery near the solar panel, but not so that it shades the panel.

-Check battery voltage before you connect up: You want a reasonably charged battery (over 12.2 Volts for Lead/Acid, 13.4 Volts minimum for LiFePO4). The battery in the picture is essentially a fully charged battery!

- If you have low voltage, use a more fully charged battery unless this is all you have. It's also a good idea that if you use multiple batteries, that the voltages are fairly close to each other. You don't want to connect fully charged batteries to exhausted ones (like in the next picture), unless you have no choice.

This is NOT what you want to see! At 10.65 Volts, this battery is fully discharged. It didn't recover after being charged. Subsequent testing showed it had no capacity, and is junk.

A good but discharged battery will take a long time to charge fully, but a bad battery will jump quickly from low voltage to full regulated voltage, and drop quickly again with a load put on it.

-Check the battery terminals for corrosion. If there is ANY, use a metal bristle brush, terminal cleaner, or sand paper to remove it. Corrosion is your enemy, doubly so if you need a lot of current to power a large load!

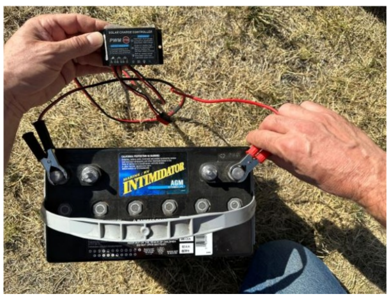
4: Set up the solar controller and inverter (Connect to battery FIRST!):

-Verify that the controller you have is compatible with the battery: Same voltage and battery chemistry, and has enough current rating to handle the current from the solar panel. Make sure the inverter is the same input voltage as your battery.

The controller on the left is a generic 12 or 24 Volt automatic unit capable of 10 Amps, with an SLA battery. It's waterproof and simple, and will

handle a single solar panel. It will regulate a 12 Volt SLA to about 13.5-13.6 Volts. This was an Ebay purchase, about $12 delivered. I Haven't had any problems with them (I bought 6!), we use them quite often.

-Connect the controller to the battery FIRST. Do NOT connect the controller to the solar panel until AFTER the battery has been connected!



-Connect the controller and inverter (if using an inverter) "-" leads to the battery "-" terminal, and the controller and inverter "+" leads to the battery "+" terminal.

This is the generic controller being attached to the battery with clip leads. They work fine for low current work, but if you are going to draw significant current (such as with a heavy charging current or pulling a large load on an inverter), you'll want to use ring terminals for better connections.

This is the battery with both the solar controller and a small generic inverter clipped on.

5: Connecting the solar panel:

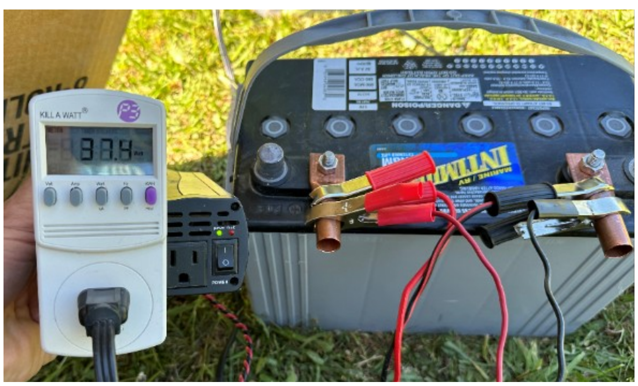
-Plug the panel directly to the controller.

6: Hooking to the inverter:

-Plug a Kill-A-Watt P3 4400 power monitor into the inverter output: Use it as a Volt meter to measure AC Voltage. A good range is up to 125 Volts no load, and as low as 110 VAC full load. You can also use the Kill-A-Watt as a frequency meter, to measure current drawn, as a real time wattmeter (as shown here), and as a KWH meter to track total power consumed.

For less than $30, the P-4400 is a bargain for all that it does!

-Plug either an outlet strip or heavy duty extension cord into the Kill-A-Watt to distribute power.



This is a setup using alligator clips and optional terminal extenders with both the solar controller and low power inverter (ca. 400 watts). It's shown delivering 37.4 watts to a soldering iron. That's just a little more than a CPAP machine uses with the heater tube turned on in cold weather.

Here's the inverter output voltage (112.6 VAC) with a 1500 watt rated unit delivering 800 watts to a coffee pot (about 7.0 Amps). This is on the low end of the output voltage, but there is quite a bit of sag due to the high current voltage drop in the DC cables going to the inverter (3 SLA's in parallel for 12 Volts at roughly 300 AH capacity).

Plug either an outlet strip or heavy duty extension cord into the Kill-A-Watt to distribute power (6.98 Amps AC to power the coffee pot).

This is reading the real time power delivered to the coffee pot: 785 Watts (112.6 Volts times 6.98 Amps).

7: Testing the system, DC side (AC already mentioned above):

-Check the battery for voltage again once you have the solar panel connected: If it is short of full voltage (13.5-14.2 V for Lead Acid, 14.4 V for LiFePO4), you should see the voltage rise slowly if the panel has good sunlight, and the controller is working.

At 12.73 Volts, this battery is essentially fully charged. It's a perfect candidate to be put into service, either by itself or together with several other similar high charge state batteries.

-Recheck the battery periodically to verify that the controller cuts off charging voltage at the right point: From 13.4 to 14.2 V for Lead Acid, 14.4-ish V for

LiFePO4. If the batteries go higher than that, the controller may be defective. Lead Acid batteries will gas above 14.4 Volts, the BMS in LiFePO4 batteries will disconnect them above 14.6 volts.

This battery is sitting fully charged at 13.56 Volts. This is the high voltage set point for the regulator in this generic controller.

Note 1: The “basic” will produce at least 400 watt hours (0.4 kWH) per day in good sunlight, and significantly more during the height of summer.

Note 2: The “basic” can safely power 2-3 CPAP machines in full sunlight, warm weather, and 2 CPAP machines in cold weather (heater tubes on). Power draw approximately 0.15 kWH warm, 0.2 kWH cold per unit.