DIY Guide to Installing a Solar Power System

Photo Voltaic Panels (PV)

The first step is to mount the photovoltaic panels (ex. Kyocera KC130). These can be bolted to a roof or wall, or mounted on a frame in the yard. The ideal mount will point the panels at true south, not magnetic south, and titled at an angle similar to your latitude. In winter, you will get more gain if you tilt latitude +15 degree (ex. 44+15=59 degrees), in summer, latitude -15 degrees (ex. 44-15=29 degrees). Spring and fall will use straight latitude as the angle (ex. 44 degrees).

See http://www.zipinfo.com/search/zipcode.htm to find your latitude and longitude (ex. N44.7476, W74.8044).

Then go to http://www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html to convert the decimal notation to Degrees/Minutes/Seconds (ex. Lat. 44° 44' 51.3594", Long. 74° 48' 15.84").

Then take the result to http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html to find Solar Noon (ex. 12:05:20).

Once you know Solar Noon, Put a stick in the ground at Solar Noon, and the shadow will run true north and south. Watch your panels, and make sure there are no shadows during the prime generation times of 9am to 3pm.

You want to keep airflow underneath the panels for cooling. If, by mounting the panels, your access to the wiring box underneath is restricted, you will want to wire them first. There is typically a waterproof box on the back where you make your connections. We caulk the connectors on the box to prevent water infiltration.

*NOTE - This is the dc side of the system, there is a positive (red, or white wire) and a negative (black wire). Make sure these always match up. The exception is series wiring, where the negative of one panel connects to the positive of the next panel.

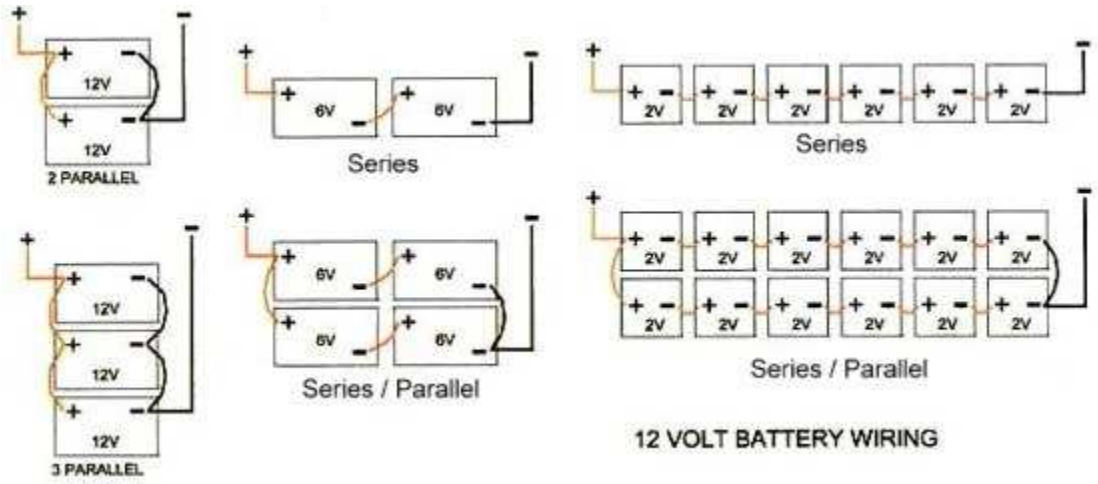
If you have a 12v system, then your panels will be wired in parallel. If a 24v system, then 2 panels in series gives you 24v, and every set of two in series would be paralleled. If a 48v system, then sets of 4 in series would be paralleled. With the advent of MPPT Charge Controllers, it's common to wire up to 5 panels in series (100v open circuit) before connecting the charge controller. Check with your panel manufacturer for the open circuit voltage, and your charge controller manufacturer for maximum voltage input. Our Outback MX-60 can take a 150v input max.

Charge Controller

The wiring from the PV panels into the house, where the charge controller (Xantrex C-35, white box in picture above) is located, needs to be of a sufficient size to handle the current with minimal voltage loss. A 12v 130 watt panel, 100' from the charge controller, should have a 3 awg wire connecting it. At 100v (five panels in series), a 12awg wire would be sufficient. The goal is a 3% or less voltage drop. See the wire size calculator at http://www.powerstream.com/Wire_Size.htm

A fused disconnect is recommended before and after each component in the system. This makes it easier for maintenance, and protects the wiring and components. The fuse size is determined by the power potential of the device. A 35 amp charge controller might need a 50 amp fuse between it and the battery, and make sure the wire can handle 50 amps of current. A Lightning Surge Protector may be advisable between the PV panels and the charge controller.

From the charge controller it's a straight run to the battery bank, through a fused disconnect. When using multiple batteries, connect the charge controller to opposite corners of the battery bank. See http://www.solarseller.com/battery_bank_wiring_diagram.htm



Battery

For stationary use, we like the Trojan T-105 (225ah, 6v), or the Trojan L16 (420ah, 6v). For mobile use, or for folks not able to maintain a battery bank, we recommend a deep cycle AGM battery like the Concorde (ex. 70ah, 12v) series. Do not do a battery equalization on a AGM battery. On the Trojans, do it monthly, and add distilled water as necessary. Read http://www.batteryfaq.org/ for more info on caring for your battery.

Battery Monitor

We like to use a Bogart Engineering Tri-Metric battery meter (blue box in above picture) to monitor the effectiveness of our system. This is like a check register, monitoring deposits and withdrawals, and telling you the balance. There is a shunt that installs on the negative line from the battery, and all connections to the battery bank go through this shunt. The 4 wires from the trimetric meter are G1 & G2 (black), that connect to the system side of the shunt, S (white) that connects to the battery side of the shunt, and M+ (red) that connects to battery positive. This meter reads battery voltage, amps, and amp-hours.

Inverter:

Now on to the inverter (center black box in above picture). This is where your big cables get used. Typically 2AWG or something similar, depending on inverter size. You want the inverter close to the batteries to keep the length and size of this cable manageable. A 12v, 200 amp possible load (2400 watt inverter) would need a 6' 2AWG set of battery cables, connected to opposite ends of the battery pack, as seen above. Put a 400 amp fuse between them on the positive wire to prevent short circuit issues. This allows for momentary starting surges. The output of the inverter may have 120v outlets (cheap) or hardwire terminals (better). The cheap ones cannot be wired to a AC Panel without some care, as AC Panels typically bond the neutral (white) and ground (copper) wires, blowing the inverter. The better inverters handle this just fine. Check with your inverter manufacturer. The 2 types of inverters are a Modified Sine Wave or a Sine Wave. AC Motors and Microwaves work better with a SW Inverter and Laser Printers pretty much demand one. Everything else should work fine with a MSW inverter, which are less expensive, and more efficient. Our example above is a Morningstar 300 watt SW inverter. If you get a Charge controller and Inverter from the same manufacturer, you may be able to monitor both with the same display (ex. Outback MX controller and FX inverter).

Photo's of this installation are at http://www.green-trust.org/Anguilla%20Solar/

To size a system for your needs, see http://www.green-trust.org/2003/pvsizing/default.htm

All these components, and a fully designed system can be obtained from:

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