How Do I…

An occasional series

This week: Let's Build a Solar Power System

Editor's Note: Thank you to William Wagaman, N3GTY for sharing this article. Originally written to support the Cumberland Amateur Radio Club Field Day 2024 Educational Activity, he and I are pleased to present the information here in the Know-How Resources page of the club website. Please enjoy.

Let us start with some very basic theory on solar panels.

Solar panels use the sun's energy to generate electricity through the process known as the "photovoltaic effect". Solar panels are made of silicon or other semiconductor material, glass, and metal. When sunlight hits the panels, the material releases electrons and creates an electric charge. This charge creates an electric current, specifically direct current (DC), which is captured by plates and wires and sent to your home and appliances.

The rate at which solar panels generate electricity varies depending on the amount of direct sunlight and the quality, size, number, and location of panels in use.

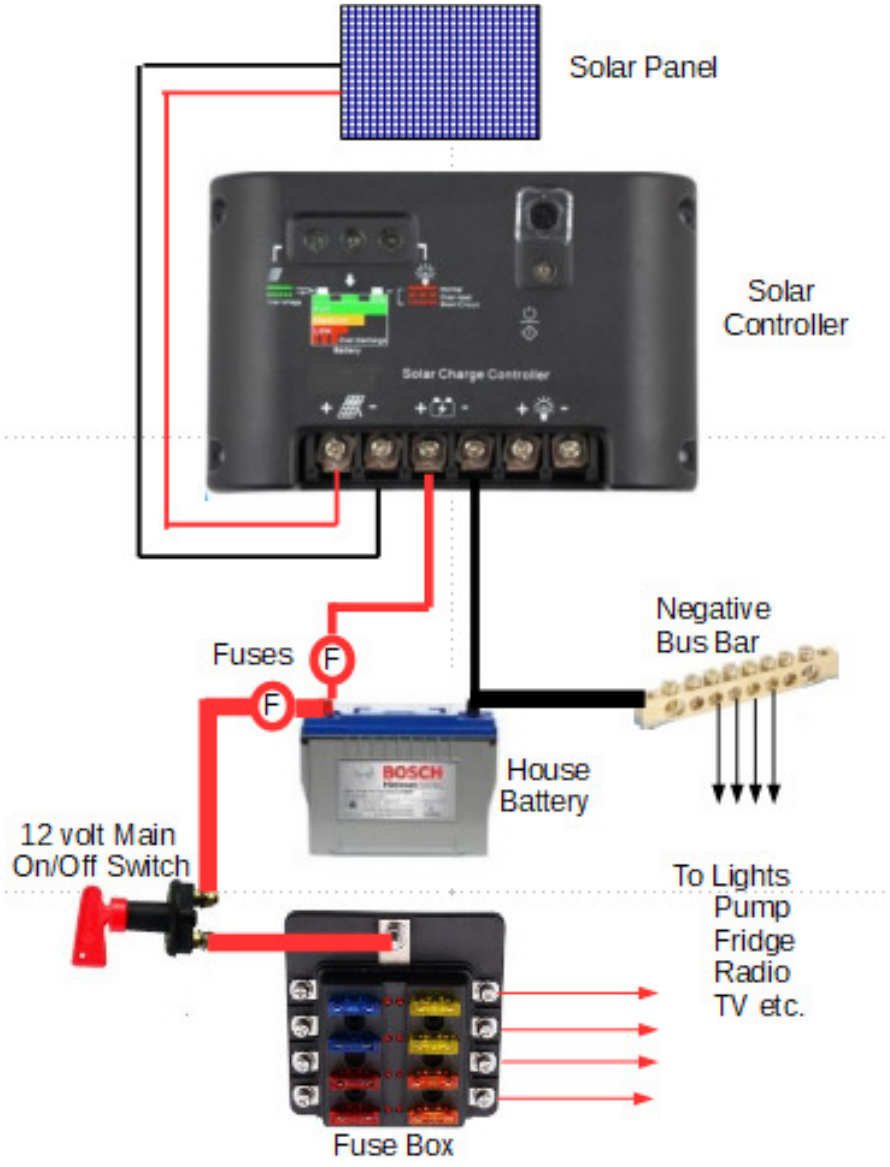
Manufacturers rate solar panels by their efficiency, which ranges from around 15% to 20% of conversion of the sun's energy transformed into usable electricity. However, researchers have developed Photo-Voltaic cells with efficiencies approaching 50%.

Basically the process works like this:

1. Sunlight hits a solar panel on the roof or solar farm
2. The panels convert the energy to DC current, which flows to a controller and an inverter.
3. The inverter converts the electricity from DC to AC, which you can then use to power your home.

Solar energy comes from the sun's rays, a renewable source that will never run out. In contrast, traditional energy is primarily derived from finite fossil fuels, such as coal, oil, and natural gas, which will eventually be depleted.

Here is a basic depiction of a Solar Installation:



Add a DC Voltage Regulator and a DC-to-AC Inverter to complete the installation.

The installation I am demonstrating today has all this along with a DC Voltage Regulator and Inverter.

The regulator makes sure that we will always have a constant voltage to our radio. We all know that we have cloudy days, and of course night, where no power is generated by our solar panels. When this happens, and the stored DC Current in our batteries drops below what is needed, the regulators kick-in and make sure that we have our needed 12 volts. The regulators can boost the lower voltage anywhere from a low of 8 volts to the needed 12V DC as the batteries run low.

So, the more battery capacity that we have, the more electricity we can store for those days that the panels do not generate the needed current.

The inverter we have here is taking the 12V DC from the storage battery and converting it to 120V AC and passes the 120V AC out the long extension cord to be used where needed.

In this setup I am using a Deep Cycle battery which is older technology, but still OK. Newer battery technologies (Lithium Ion and Lithium Iron Phosphate batteries) work a bit better due to their lighter weight and the fact that they give a constant voltage until they run out of charge and volts drop to zero.

Now let us start to assemble this solar power plant and capture some photons so that we can make some power from the sun and earn some Bonus Points here at Field Day.

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