Strays – Solar power

Many modern amateurs look to the Sun as a seemingly free, renewable, and limitless energy source. Whether it's by solar panels on our roofs or through a tiny film sheet on a calculator, we're taking advantage of technology that converts ***radiant energy*** into ***electrical energy***. Because of today's availability and relatively low cost, coupled with an increasing energy demand, ***solar power*** is quickly turning from a fad into a necessity.

If you're thinking you might want to join the solar crowd and become one of the cool kids, there are several parts to a solar setup that you'll need to collect. They include, but are not limited to, a solar panel, a solar charge controller, a battery, and possibly an inverter.

Panels

The most obvious component of your solar setup is a solar panel, a device made of many solar cells that convert sunlight into DC (direct current) electricity. Each solar cell is made of tiny semiconductor diodes that generate electric current from absorbed light.

Today, many homes throughout the world have solar panels installed on their roofs, as a means of reducing both their power bills and reliance on an expensive infrastructure.

Charge controller

The sunlight striking the surface of a solar panel can be bright and direct or dim and at an angle, and the output electrical energy can vary by a large amount as a result. This wide range of voltages presented by your panels can fail to power your electrical system or burn it up if the panel output is not regulated. The purpose of a solar charge controller is to maintain as steady a voltage to your devices as possible. It's generally unwise to omit a charge controller from your solar setup.

Charge controllers come in two types, PWM (pulse-width modulation) and MPPT (maximum power point tracking), and each has its advantages. PWM controllers tend to be less expensive but also less efficient. MPPT controllers tend to be bulky and expensive, but are very efficient. For most portable radio and solar station cases, a PWM controller will do the trick. But for a permanent home solution, an MPPT controller is more often the better option.

Battery

As you likely know, batteries are available in numerous types, shapes, capacities, chemistries, and physical sizes. While you can run a solar setup without a battery, I recommend using one for energy storage, especially if you plan to operate your appliances at night. Also, a battery acts as a buffer between the solar panel and the load placed on it.

While most amateur radio equipment require 12 V to the power them, one type of battery might be better suited for your needs than others. For most ham radio setups, a $LiFePO_4$ (lithium-iron-phosphate) battery is highly recommended, because of its light weight and deep-cycle ability, but it is typically more expensive than a SLA (sealed lead-acid) battery.

Inverter

A power inverter is a device that converts DC into AC (alternating current) electricity, for appliances and equipment that need to plug into a wall outlet. This way, you can be far away from civilization and still make use of your laptop or toaster. Then again, if

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you don't plan to use any such appliances in your solar station, you might not need an inverter.

Calculating your solar power needs

Let's take a look at how much power your amateur radio station might need in two separate examples, mobile VHF and portable HF.

Needs common to both

- Laptop (charger, and inverter = 6.6 A -» 6.6 Ah)
- Phone (12 V to USB charger = 3 A -» 3 Ah)
- Lighting (PWRbrite LED light strip = 0.2 A -» 0.2 Ah)

Common hourly energy draw = **9.8 Ah**

Mobile VHF solar solution

- Mobile radio (TYT TH-7800 = 9A, but at 50% duty cycle -» 4.5 Ah)

Total mobile VHF hourly draw = 9.8 Ah + 4.5 Ah = **14.3 Ah**

Portable HF solar solution

- Portable HF radio (Yaesu FT-891 = 23 A, but at 50% duty cycle -» 11.5 Ah)
- Tuner (LDG AT-100Pro II = 0.5 A -» 0.5 Ah)

Total portable HF hourly energy draw = 9.8 Ah + 11.5 Ah + 0.5 Ah = **21.8 Ah**

Therefore, 21.8 Ah x 12 V = 261.6 Wh is the amount of energy you'll need to run your portable HF station. Assuming an 80% efficient PWM charge controller, you'll need 261.6 Wh / 0.80 = 327 W of solar panels charging your battery for an hour, or a 100 W panel for about 3½ hours. A 100 Ah deep-cycle $LiFePO_4$ battery should easily take care of your needs. Keeping your radio transmissions short (say, 25% duty cycle) can help lower those amounts to 2½ hours with the same panel into a 50 Ah battery.

The discussion about solar power is not a trivial one, and involves some understanding of not only how to convert radiant energy into electrical energy, but also how to control it and store it. Similarly, figuring out just what it's going to take to supply your solar needs is also a little involved, but practical if you keep inefficiencies in mind. One final word about charge controllers and inverters: some of them tend to generate radio noise ("hash"), so you might want to keep that in mind too. Read the reviews and ask around, to be sure, or you might end up generating some expensive noise.