



Elements



Photovoltaic 101

Capturing the summer sun for endless electricity

BY KEVIN PEGG

AS WE ARE NOW INTO THE SUNNIEST MONTHS OF THE YEAR, IT'S FITTING to talk about solar photovoltaic (PV) modules — how to site them, care for them, consideration with expansion and other cottage concerns. Solar PV is the most common method of generating power in remote sites. The simplicity and elegance of these modules cannot be underestimated. Aim them at the sun, keep them clean and they will give you up to 50 years of hassle-free electricity (any panel worth buying these days will have a 25-year warranty).

Those are the obvious pros. The largest con is the price; PV is an expensive technology. There's no denying it. If it weren't for the price of metals used in PV manufacturing (aluminum, copper, steel, lead) going through the roof over the last few years, we would see prices dropping — but PV prices have been static for the last couple years. Also, solar requires unobstructed solar exposure for best performance. Any shading whatsoever will drastically reduce output.

Existing Systems

If you have purchased a cottage with an existing solar system, it's important that you verify that the installation was done properly. There is such diversity in the actual knowledge of “experts” out there that you never really know.

The most common mistake, particularly in older systems, is wire sizing; that is, sizing it too small. I've lost track of the number of systems where the customer has saved a few dollars in wire, only to throw away thousands of dollars worth of solar power. And many of these systems appear neat and tidy and professionally done. You must scrutinize the details.

Conventional electrical systems size wire for its carrying capacity. For example, common 14-gauge wire as used in residential circuits will handle up to 15 amps of current. Voltage drop must be the most important design criteria. Lower voltage equals higher resistance. To compensate for this resistance, you can either increase the size of the wire, or increase the voltage. This is why national electricity distribution is done at many thousands of volts. This is also why low voltage systems, such as 12-volt systems, are extremely

With photovoltaic, clear, unobstructed southern exposure is best.

limited in how far the power can be transmitted.

Another common installation mistake relates to orientation. A solar module performs best when facing due south, and at an angle equal to your latitude. For summer operation, when the sun is at its highest, the panels can be latitude minus 15 degrees. In winter, latitude plus 15 degrees is the general rule to follow.

Routine maintenance of your solar PV panels involves generally keeping them clean; washing them with soap and water usually does the trick. Any debris, such as moss, dust or tree slime that falls on solar panels will obstruct the sun's rays from reaching it, reducing the output.

It's a good idea to open up any junction boxes, ensure the connections are all clean, tight and secure. Any corrosion needs to be cleaned, and the connection re-done. Inspect the mounting array for any metal fatigue, ensure fasteners are tight and the material it's affixed to is solid and secure.

Installation of New Systems

The best location for solar modules is either a simple decision (you have a glorious south-facing exposure with no obstructions for 100 km); or one that is considerably more complex (trees, buildings, mountains in the way).

The sun's position in the sky is constantly changing. The good news is it's one of the most predictable aspects of life on this planet. Any solar design professional worth their credentials will use a device such as the solar pathfinder, or its equivalent. These devices will show you, at a glance, where the sun will fall on the site, every hour, every month of the year. It's an essential tool for surveying tricky sites.

When choosing a location, you need to balance the site with the best exposure, and the distance from the batteries, as well as any aesthetic concerns. You want to get the panels in the best possible location for sun exposure as your primary goal.

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Controller Concerns

One of the most significant advances in renewable energy technology is seen in controllers. Modern units such as the Outback MX-60 are capable of operating at a higher voltage for transmission (lowering the wire size) and stepping down to 12-, 24- or 48-volt DC system voltage, saving you from cost-prohibitive system voltage changes.

If you have a very old “on-off” style controller, upgrading to a modern Pulse Width Modulated (PWM) controller will increase the amount of daily power significantly. Even the most basic controller on today’s market will out-perform the most advanced older style units. Not sure what you’re currently using? If your controller is still on the market, good chance it’s a PWM style. (Note to HAM radio operators — PWM controllers will generally interfere with radios. There are some non-PWM controllers on the market to address this issue.)

Mounting Options

Roof-mounted solar modules are the most common approach, as the roof will often offer the best solar exposure, and it’s out of the way. If you are doing new construction, you can save yourself significant expenses by having the roofer install standoffs to connect the solar modules to. It’s a whole lot easier to hit a beam and seal it up perfectly this way. Installing a roof vent pipe with flashing is a good way to run the electrical wires.

If your roof is not a suitable location, ground mounts are common. You have to be mindful of trees, shrubs and so on, which grow over time.

If you need to get some height in a ground-mount situation, a pole is the way to go. Pole mounts are also the most secure method if you are in an area with theft concerns. By using special security hardware you can make it really difficult for anyone to steal them.

Transmission Costs

Here are a few examples, using a 20 amp solar array travelling 30 metres, sized for a three per cent voltage drop, and current prices.

12-volt = 2/0 wire = \$92/metre

24-volt = # 3 wire = \$32/metre

48-volt = # 6 wire = \$21/metre

To Track or Not to Track?

There are mounting systems on the market, which follow the sun across the horizon. Some use the sun’s rays in a passive manner (expansion and contraction of gasses) to rotate. Others use electricity to operate a gear motor to move.

They certainly are sexy contraptions. I talk most people out of trackers for the simple reason that you are introducing moving parts, lots of them and some complicated machinery, to something that is otherwise completely passive.

You need to consider that for the significant extra cost of the tracker, and installation, you may find adding a few more solar panels to your passive rack equates to less money, more power, and a whole lot less hassle. 🌞

Did You Know?

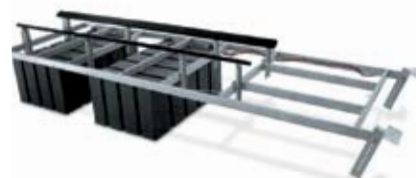
A solar PV module converts the sun’s energy into electrical energy. Solar thermal panels are completely different in design — they produce hot water.



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