

MAKING ELECTRICITY FROM THE SUN WITH PHOTOVOLTAIC PANELS

Photovoltaic solar panels are one of the most fascinating developments in the world of energy because they seem so much like magic. A flat, grey panel sits in the sun and makes electricity. No noise, no exhaust, no moving parts. A growing number of Canadians are wondering how this technology might be incorporated into their homes, and the information you'll find here is the first step towards an answer.

Sunlight shines on photovoltaic (PV) panels and the light energy is converted directly to electricity. That's step one of the process. This electricity is typically stored for future use in a battery. Storage is step two. You can also convert PV electricity into the form that typically comes out of a wall socket. That's optional conversion step number three.

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All photovoltaic panels are rated by how much power flows from them while the sun shines, expressed in watts (W). A panel putting out 500 W, for instance, can power up to five 100 W light bulbs at one time. Panels that generate 1000 watts of power are making one kilowatt.

The electricity that comes directly from PV panels is called direct current (DC).



These rooftop PV panels generate power for a water system and lighting at a lakeside cottage many miles from the power grid.

Photo credit: Steve Maxwell

This is also the kind of energy put out by every battery in the world. The term DC refers to the fact that this electricity flows in one direction only, across the positive and negative poles of a battery or pair of wires. Photovoltaic panels only create direct current, and though this kind of electricity certainly has its uses, it's not the kind of power that most electrical appliances are designed to accept. Typical electrical devices are made to use something called alternating current (AC). The 120 volt AC power that comes out of wall outlets across North America oscillates back and forth from positive to negative polarity 60 times each second. With this basic information in hand, you have what you need to understand the three main photovoltaic options.

SIMPLE DC-ONLY SYSTEMS

An array of PV panels charges batteries that deliver power to items requiring DC current only. This is most often light bulbs,

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but DC water pumps and refrigerated coolers also exist.

DC-AC SYSTEMS

This option also has PV panels and a battery, but they're connected to something called an inverter. This is an electronic device that converts the DC electricity from batteries into the kind of 120-volt AC power that most of our gizmos are designed to use. Inverters are a great thing, though they do introduce some inefficiency into the system. All else being equal, power is lost in the conversion process, so you really want to be sure that you need AC power before you introduce an inverter into the set up.

Unless you're heavily into tinkering, it's best for you to consider a pre-packed PV system where all components are engineered to work together.

DC-AC GRID-CONNECTED SYSTEM

This builds on the DC-AC system, with one important difference. In addition to converting DC power to 120 volts AC, this system is also connected to, and synchronized with, the local utility power grid. When you're making more power than you consume, for instance, it runs your electrical meter backwards, reducing the amount of power you're charged for. Some Canadian provinces offer electricity buy-back rates high enough to make grid-connected PV systems a paying proposition.

These are the fundamental concepts



This 12-volt DC water system delivers pressurized water using power stored in a battery by PV panels.

Photo credit: Steve Maxwell

that apply to the world of photovoltaics, regardless of the state of the technology. At this stage, the best way for most people to make PV part of their lives does not necessarily involve choosing and installing each component from scratch. Unless you're heavily into tinkering, it's best for you to consider a pre-packaged PV system where all components are engineered to work together. At least now you know the basics of the options that are available, and that's a good thing. It's only a matter of time before photovoltaics become mainstream.

Steve Maxwell, syndicated home improvement and woodworking columnist, has shared his DIY tips, how-to videos and product reviews since 1988. Follow "Canada's Handiest Man" at SteveMaxwell.ca, Facebook or @Maxwells_Tips on Twitter.

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