



An Introduction to

# Photovoltaic Systems

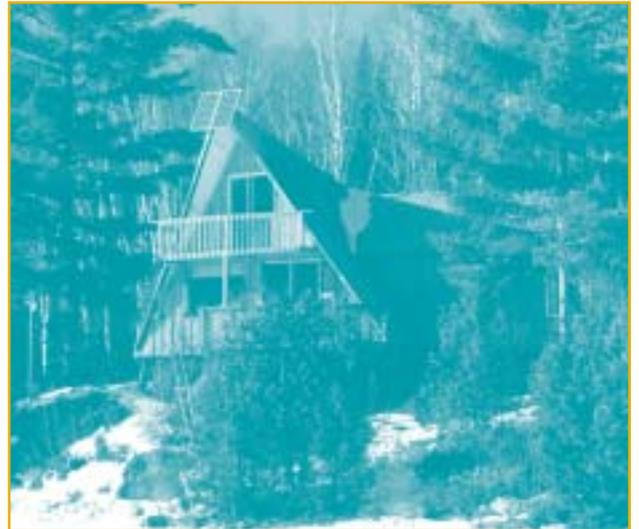


## Photovoltaic or Solar Electric Systems

Every day, the sun delivers energy to the earth free of charge. Canadians can use this free energy thanks to a technology called photovoltaics, which converts the sun's energy into electricity.

Photovoltaic modules or panels are made of semiconductors that allow sunlight to be converted directly into electricity. These modules can provide you with a safe, reliable, maintenance-free and environmentally friendly source of power for a very long time. Most modules on the market today come with warranties exceeding 20 years, and will perform much longer.

Millions of systems have been installed worldwide, in sizes ranging from a fraction of a watt to multi-megawatts. For many applications, solar electric systems are not only cost-effective, they may also be the least expensive option.



▲ *PV systems are an economical option for remote cottages.  
Picture is a courtesy of Cimat Power Systems Inc.*



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Canada

## Uses of Photovoltaic (PV) Systems

Thousands of PV systems are used in Canada today for a variety of applications. Here are a few examples:

### PV for Cottages and Residences

In general, PV systems are an economical option for remote cottages and residences. In most remote areas, it is impossible to connect to the electrical grid and, in many cases, expensive fossil fuel is brought in to generate electricity. If your residence is tied to the existing grid, PV will give you the autonomous source of electricity you might need during a power outage.

### PV for Mobile and Recreational Applications

Recreational vehicles, boats and expeditions can also benefit from the clean and quiet operation of portable PV systems to recharge batteries.

### PV in Agriculture

PV systems are used effectively worldwide to pump water for livestock, plants or humans. Since the need for water is greatest on hot sunny days, PV is a perfect fit for pumping applications. PV is also used to power remote electric fences on farms.

### PV for Other Applications

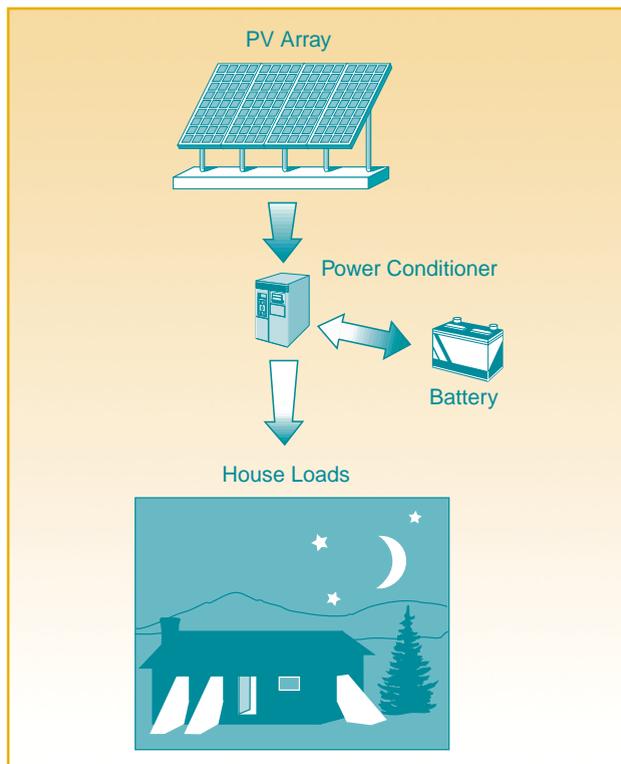
PV systems can be adapted to suit any requirement, small or large. For instance, PV cells are used in calculators and watches. As well, telecommunications equipment, highway construction signs, parking lights and navigational warning signals are excellent applications for PV.

## The Right System

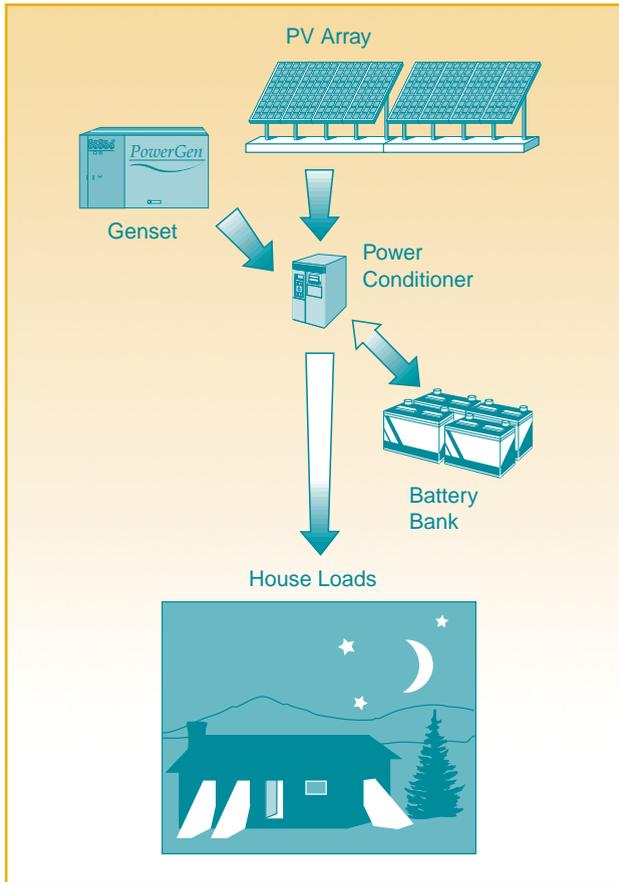
PV systems are categorized into three types: autonomous, hybrid and grid-connected. The type you choose will depend on your needs, location and budget.

**Autonomous systems** are completely independent of other power sources. They are usually used to power remote homes, cottages or lodges as well as in applications such as remote monitoring and water pumping. In most cases, an autonomous system will require batteries for storage.

Such systems are particularly useful and cost-effective for summer applications, when access to a site is difficult or costly, or when maintenance needs to be minimized.



▲ Autonomous PV system with batteries.



▲ PV hybrid system.

**Hybrid systems** receive a portion of their power from one or more additional sources. In practice, PV modules are often paired with a wind generator or a fuel-fired generator. Such systems usually require batteries for storage.

They are most appropriate when energy demand is high (in the winter or year-round), when power must be available on demand, or if your budget is limited.



▲ Grid-connected PV system.

**Grid-connected** systems allow you to reduce your consumption from the electricity grid and, in some instances, to feed the surplus energy back into the grid. In some cases, your utility may give you credit for the energy returned to the grid. Since power is normally stored in the grid itself, batteries are not necessary unless you want some form of autonomous power during outages.

These systems are used in buildings, homes or cottages already hooked up to the electrical grid.

## Photovoltaic Systems: Benefits and Limitations

### Benefits

Solar electric systems offer many advantages, including the following:

- They are safe, clean and quiet to operate;
- They are highly reliable;
- They require virtually no maintenance;
- They operate cost-effectively in remote areas and for many residential and commercial applications;
- They are flexible and can be expanded at any time to meet your electrical needs; and

- They give you increased autonomy – independence from the grid or backup during outages.

## Limitations

You should also be aware of the practical limitations of PV systems:

- PV systems are not well suited for highly energy-intensive uses such as heating. If you wish to use solar energy for this purpose, consider other alternatives such as a solar water heater, which produces heat much more efficiently.
- Grid-connected systems are rarely economical, primarily because the current cost of the PV technology is much higher than the cost of conventional energy in Canada. Since these systems can be expensive, choosing a solar electric power system often comes down to a personal lifestyle decision – just like the type of house or car you might own.

## Summary

Photovoltaic power systems allow you to harness the sun's energy for many purposes. These systems are a very reliable and clean source of electricity that can suit a wide range of applications.

## For Further Information

If you would like more information on photovoltaic systems, or are interested in purchasing a system, obtain a copy of Natural Resources Canada's (NRCan's) *Photovoltaic Systems: A Buyer's Guide*. The Guide is a useful source of information you can use when approaching a qualified PV dealer. It will also help you to become knowledgeable enough to benefit further from the expertise of a qualified dealer.

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To order a copy of *Photovoltaic Systems: A Buyer's Guide* or other publications on renewable energy technologies, please call NRCan's toll-free line at 1 800 387-2000. You can also get a copy of this publication, and others, by visiting the Canadian Renewable Energy Network (CanREN) Web site at <http://www.canren.gc.ca>

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Aussi disponible en français sous le titre : *Introduction aux systèmes photovoltaïques*