

## Photovoltaic (PV) Systems

### PHOTOVOLTAIC SYSTEM OVERVIEW

Photovoltaic (PV) systems are used to convert sunlight into electricity. They are a safe, reliable, low-maintenance source of solar electricity that produces no on-site pollution or emissions. PV systems incur few operating costs and are easy to install on most Canadian homes. PV systems fall into two main categories—off-grid and grid-connected. The “grid” refers to the local electric utility’s infrastructure that supplies electricity to homes and businesses. Off-grid systems are installed in remote locations where there is no utility grid available.

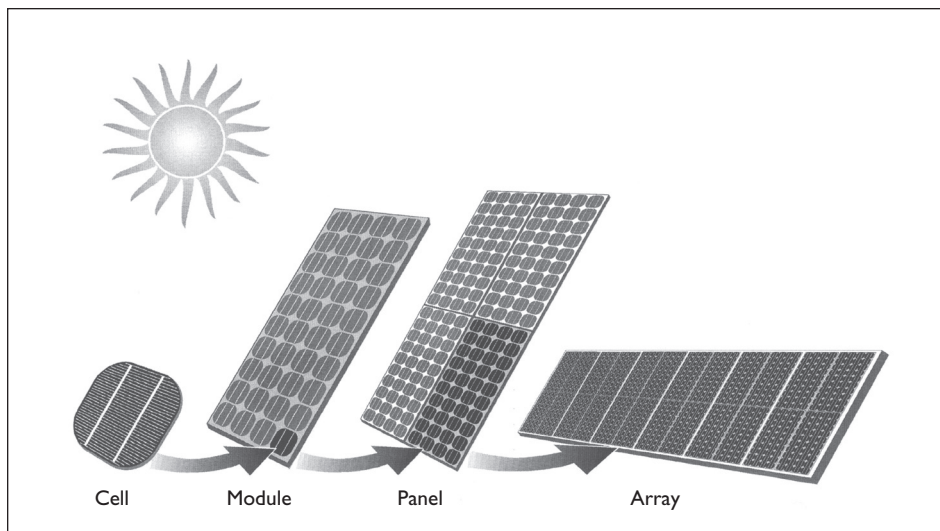
PV systems have been used effectively in Canada to provide power in remote locations for transport route signalling, navigational aids, remote homes, telecommunication, and remote sensing and monitoring. Internationally, utility grid-connected PV systems represent the majority of installations, growing at a rate

of over 30% annually. In Canada, as of 2009, 90% of the capacity is in off-grid applications; however, the number of grid-connected systems continues to grow because many of the barriers to interconnection have been addressed through the adoption of harmonized standards and codes. In addition, provincial policies supporting grid interconnection of PV power have encouraged a number of building-integrated PV applications throughout Canada.

With rising electricity costs, concerns with respect to the reliability of continuous service delivery and increased environmental awareness of homeowners, the demand for residential PV systems is increasing. This *About Your House* aims to inform homeowners of what they need to consider before purchasing a system. The information presented will focus on grid-connected PV systems. To learn more about off-grid applications, consult CMHC’s *Research Highlight* fact sheet *Energy Use Patterns in Off-Grid Houses*.

### PV system components

The most critical component of any PV system is the PV module, which is composed of a number of interconnected solar cells. PV modules are connected together into panels and arrays to meet various energy needs, as shown in Figure 1 on page 2. The solar array is connected to an inverter that converts the Direct Current (DC) generated by the PV array into Alternating Current (AC) compatible with the electricity supplied from the grid. AC output from the inverter is connected to the home’s electrical panel or utility meter, depending on the configuration. Various AC and DC disconnects are installed to ensure safety when working on the systems.



**Figure 1** Components of a PV array

### Metering

There are two different types of metering arrangements that can be used, depending on the local utility. The first is net metering, depicted in Figure 2. In this configuration, the utility charges you for your net consumption of electricity. When you are producing more electricity than you are consuming, your meter will essentially run backwards providing you with a credit. If you have a large system and produce a net surplus of electricity over the course of a year, utilities generally do not currently pay you for the surplus. Instead, accounts are generally reset to zero after a given period, often on a given day every year.

The second metering arrangement is depicted in Figure 3, where the electricity generated by the PV system is measured by a separate utility meter. This metering configuration is used when the utility pays

homeowners a different rate for electricity that is generated than what is taken from the grid. For example, in 2009, the Ontario provincial government started offering 20-year fixed price contracts paying homeowners \$0.802 for every kilowatt-hour produced from rooftop systems of less than 10 kW<sup>1</sup>. These types of contracts, known as feed-in tariffs, are used to accelerate the adoption of renewable energy technologies and are discussed in more detail later.

### Backup power

With systems configured as in Figures 2 and 3, the system shuts down during power outages. In such a case, inverters are designed to sense the outage and automatically disconnect all power going to the utility meter as a safety requirement to protect utility service employees that may be working on the power lines. So even though you have a PV

system, it would not be available during power outages. In order to have backup power, you need to add a battery bank. The whole domestic electrical load is too large to be entirely powered, but some inverters have the capability to continue powering an emergency sub-panel that can be used to provide power to critical loads (e.g. refrigerator, security systems, etc.) in the case of a power outage, as depicted in Figure 4. In addition to a battery bank, this configuration requires a charge controller that is able to effectively manage the batteries charging from the PV system, to ensure their optimal performance and extend their life expectancy. This system is more costly and loses some of the efficiency advantages of a battery-less system.

## SYSTEM DESIGN ISSUES

### Evaluating solar electricity generation potential

It is wise to consult a PV professional at the design stage, as most dealers offer design and consultation services. Ensure that the dealer has proven experience in designing and installing the type of system you want. The Canadian Solar Industries Association (CanSIA) offers a PV Technician certificate program, and graduates have good knowledge of the design, installation and operation of home-sized PV systems. In addition, a number of community colleges across Canada have started to offer programs that cover PV system installations.

<sup>1</sup> Visit <http://fit.powerauthority.on.ca> for more information.

The first step in evaluating the potential of solar electricity for your home is a site assessment. PV modules are extremely sensitive to shading. Cells within a PV module and PV modules within an array are often connected in series. Think of these cells as forming a long chain, and the amount of current flowing through the chain is limited by the weakest link, i.e. the shaded cell or module. The shaded cell or module will act as a resistor. For example, if one PV module in an array of 20 modules is completely shaded, it can reduce the output power of the entire array by 100%. In addition, given that the module will be acting as a resistor stopping the current flow, it will heat up to the point where it can become damaged.

Therefore, when evaluating different locations to mount a PV array, a shading analysis needs to be performed that will identify when and where shading will occur taking into consideration that during the winter months the sun is lower in the sky and tall objects, such as trees and buildings, cast longer shadows. In most cases, the ideal location for a solar array is on the roof of the house. This alleviates most shading concerns, and its large, flat surface makes mounting relatively easy. However, chimneys and other rooftop projections need to be considered in the shading analysis. Also, the future mature height of nearby trees should be used in the evaluation instead of current tree heights.

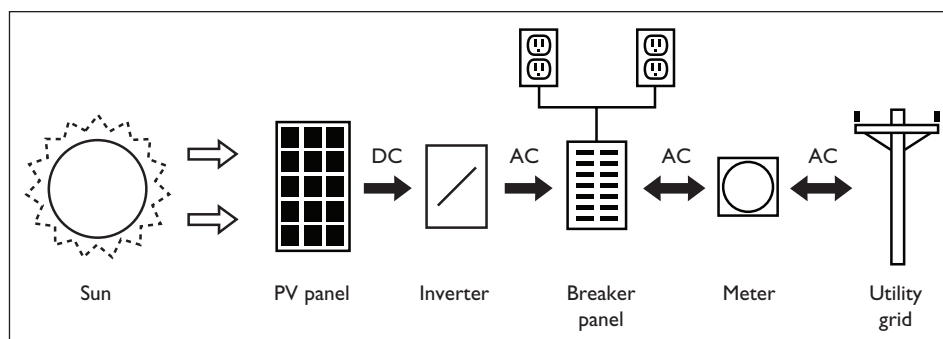


Figure 2 Net-metering PV system configuration

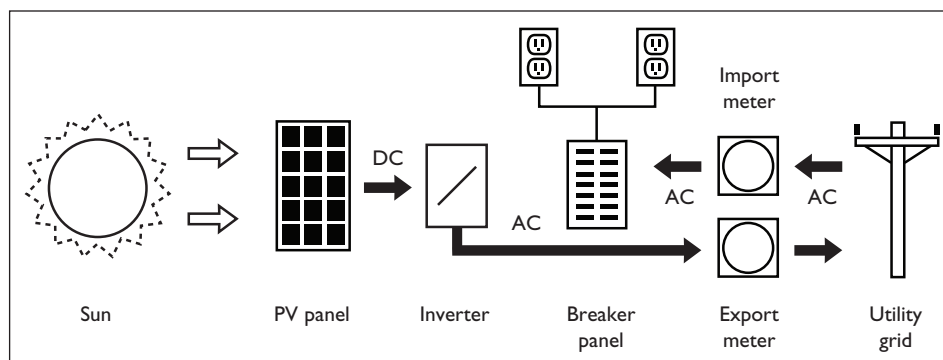


Figure 3 PV generated electricity is individually measured

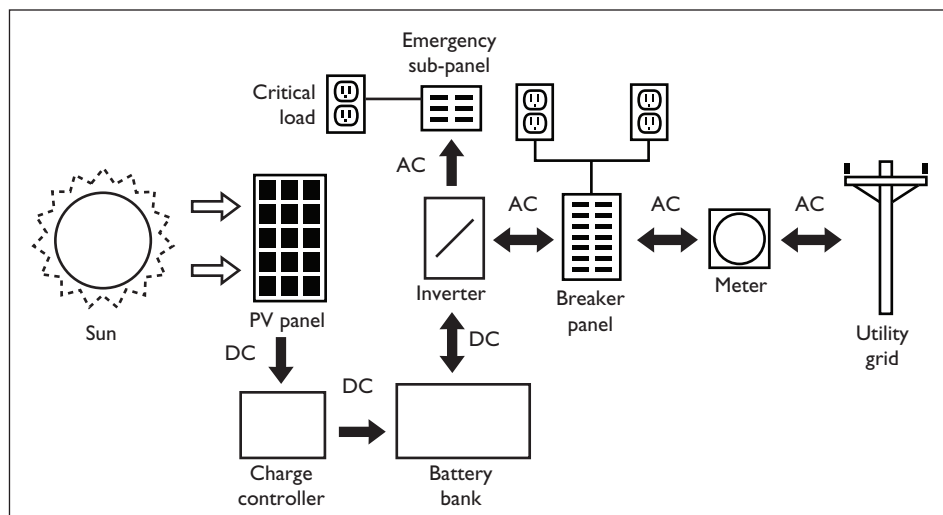


Figure 4 Net-metering PV system configuration with emergency backup

Properly aiming modules due south with an appropriate tilt will maximize the solar energy that the PV array collects; however, small variations of up to 15° in orientation or tilt will not significantly affect performance.

As a general rule, a tilt angle equal to the latitude of the site will maximize yearly performance. Reducing the tilt by 15° does not affect performance significantly (see Table 1); however, a lower tilt will result in more

**Table 1** Yearly PV potential (kWh/kW) at varying tilts

All south facing	Yearly PV potential (kWh/kW)			
	Latitude tilt -15°	Latitude tilt	Latitude tilt +15°	Vertical, 90° tilt
Regina	1355	1361	1295	1055
Toronto	1173	1161	1095	801
Vancouver	1026	1009	939	717
St. John's	946	933	879	686

snow accumulation in the winter. At higher angles, snow generally melts off on its own. At lower angles, snow can accumulate, reducing the power produced in the winter. However, given that most of the yearly output is produced outside winter, snow accumulation will not drastically reduce the annual performance of the system.

In order to assist in assessing the PV generation potential across Canada, Natural Resources Canada developed *Photovoltaic potential and solar resource maps of Canada* that give an estimated PV electricity production for over 3500 Canadian municipalities (see “Additional Resources” on page 12). The maps and tables provided present monthly and annual electricity generation per kilowatt of installed PV. As shown in Table 2, Canadian cities have a good solar potential, compared to many cities worldwide. One of our least sunny locations, St. John's, has more solar potential than cities in Germany and Japan,

which are the world leading countries in solar electricity generation.

### PV system sizing

In off-grid PV system applications, the PV array and associated battery banks must be carefully sized to be able to meet the load demands through periods with the lowest solar availability. In grid-connected applications, the presence of the grid eliminates the need to closely match the system size with the year-round electrical loads. For net-metered systems where the utility does not pay for excess electricity generation, the estimated annual solar electricity generation should be less than or equal to the annual electricity consumption as there is no financial benefit to generating more electricity than you need. For systems with a battery bank serving an emergency sub-panel, the battery bank must be sized factoring in the size of the emergency electrical loads, the PV system size, and how long emergency

backup power is needed (see CMHC's *About Your House: Backup Power for Your House*).

Sizing of grid-connected PV systems can be approached in a number of ways depending on your objectives which could include:

- To maximize PV generation for a given budget;
- To offset your yearly purchased electricity;
- To offset a portion of your family's carbon footprint;
- To completely take advantage of available unshaded south-facing roof area;
- To reshingle a south-facing roof with PV roofing tiles;
- To improve aesthetics; and/or
- To take advantage of a government or utility incentive.

**Table 2** Yearly PV potential of major Canadian cities and major cities worldwide

Major Canadian cities and capitals	Yearly PV potential (kWh/kW)	Major cities worldwide	Yearly PV potential (kWh/kW)
Regina (Saskatchewan)	1361	Cairo, Egypt	1635
Calgary (Alberta)	1292	Capetown, South Africa	1538
Winnipeg (Manitoba)	1277	New Delhi, India	1523
Edmonton (Alberta)	1245	Los Angeles, U.S.A.	1485
Ottawa (Ontario)	1198	Mexico City, Mexico	1425
Montréal (Quebec)	1185	<b>Regina, Canada</b>	<b>1361</b>
Toronto (Ontario)	1161	Sydney, Australia	1343
Fredericton (New Brunswick)	1145	Rome, Italy	1283
Québec (Quebec)	1134	Rio de Janeiro, Brazil	1253
Charlottetown (Prince Edward Island)	1095	Beijing, China	1148
Yellowknife (Northwest Territories)	1094	Washington, D.C., U.S.A.	1133
Victoria (British Columbia)	1091	Paris, France	838
Halifax (Nova Scotia)	1074	<b>St. John's, Canada</b>	<b>933</b>
Iqaluit (Nunavut)	1059	Tokyo, Japan	885
Vancouver (British Columbia)	1009	Berlin, Germany	848
Whitehorse (Yukon)	960	Moscow, Russia	803
St. John's (Newfoundland and Labrador)	933	London, England	728
Source: Natural Resources Canada. (2007). <i>Photovoltaic potential and solar resources maps of Canada</i> . Retrieved February 1, 2010, from <a href="https://glfc.cfsnet.nfis.org/mapserver/pv/rank.php?NEK=e">https://glfc.cfsnet.nfis.org/mapserver/pv/rank.php?NEK=e</a>			



### *PV panels*

The three most common types of solar cells are distinguished by the type of silicon used in them: monocrystalline, polycrystalline and amorphous. Monocrystalline cells produce the most electricity per unit area and amorphous cells the least. If you want to maximize solar electricity generation for a given area, then you should select the most efficient monocrystalline PV panels you can afford. If, on the other hand, your goal is to cover a given area at the lowest cost, then you may wish to buy amorphous panels. If you are concerned with maximizing your solar electricity generation for the lowest cost, then it is best to look at the cost-effectiveness of a panel regardless of its technology by examining its cost per rated production:

$$\frac{\text{PV panel cost}}{\text{Rated PV panel output (watts)}} \Rightarrow \frac{\$}{\text{watt}}$$

For example, you want to compare the cost-effectiveness of a 160-watt PV panel from manufacturer A selling at \$800, to a 60-watt PV panel from manufacturer B selling for \$350. In this case, the more expensive panel from manufacturer A is more cost-effective at \$5/watt compared to \$5.83/watt for the other panel. Other factors should also be considered, such as the quality of the product. Good quality PV panels have 20- to 25-year warranties, have gone through testing evaluations and

bear the appropriate certification labels. Also, some PV panels might be more expensive, but may also be more easily installed and thus less expensive overall. As discussed in the next section, some PV panels are designed to act as roofing tiles or shingles. Although they might be more expensive on a \$/watt basis, you also need to factor in the avoided cost of shingles or other roofing material.

### *Inverter considerations*

Once the PV array is sized, the size of the inverter is determined to maximize the performance of the system. If you plan to expand your PV system in the future, you may wish to oversize the inverter in order to be able to meet the additional demands of the larger system. Adequate wall space to mount the inverter and other associated components is also required in the utility room or next to your electrical panel. Small systems may only require a 0.6 m x 0.9 m (2 ft. x 3 ft.) wall area, while larger systems may require a 1.2 m x 1.2 m (4 ft. x 4 ft.) space. Some inverters are designed to withstand harsh conditions and can be mounted on an exterior wall, therefore not requiring any interior wall space. Alternatively, each PV module can be fitted with its own micro-inverter eliminating the need for one large inverter and minimizing the impacts of shading on the performance of the overall PV array.

### *Battery bank*

If the system has batteries, then a battery enclosure that is vented and protected against freezing will be necessary. Car batteries are not optimal for PV systems as they are designed to deliver a high current for a short period, whereas backup batteries for household applications need to deliver a relatively continuous current over extended periods. Special deep-discharge batteries are best suited. Certain types of deep-discharge batteries release small quantities of hydrogen when being charged and should be kept in a ventilated enclosure, well away from open flames or sparks. Consult your PV or battery dealer to determine the size of battery bank you need, and the installation and venting requirements for your chosen battery system.

### *PV system installation*

When it comes to installing PV panels on your house, there are a number of mounting options available.

### *Building-integrated products*

A number of building-integrated PV (BIPV) products are available, where the PV system essentially becomes an integral part of the building envelope. PV roofing tiles are available and were used on an EQUILIBRIUM™ demonstration home, as shown in Figures 5 and 6.

Another EQUilibrium™ home used a different option where a flexible, thin, amorphous PV panel is applied to a standing-seam metal roof, as shown in Figures 7 and 8. With that system, it is very difficult to distinguish the PV array from the metal roof.

EQUilibrium™ housing strives to achieve a balance between our housing needs and those of our natural environment. To learn more about the CMHC EQUilibrium™ initiative and demonstration homes across Canada, visit [www.cmhc.ca/eqhousing](http://www.cmhc.ca/eqhousing).



**Figures 5 and 6** Avalon Discovery 3, an EQUilibrium™ demonstration home in Red Deer, Alberta uses PV roofing tiles



**Figures 7 and 8** ÉcoTerra™, an EQUilibrium™ demonstration home in Eastman, Quebec uses amorphous PV panels stuck directly on its metal roof



#### *Standard PV panels installed on racking systems*

Standard PV panels can be mounted together on racking systems that fit on a typical roof (see Figure 9). PV systems convert 5% to 20% of the incident solar energy into electricity, a small portion is reflected, and the rest gets converted into heat. Without dissipating this heat, PV panels heat up and their efficiencies start to decrease. To address this, a small air space is typically left between the PV panels and the roof to allow for air circulation to help cool the PV panels.

If you do not have sufficient roof space, a PV racking system can extend beyond your roof, like that on the EQuilibrium™ home shown in Figures 10 and 11. This configuration will experience greater wind loads,

which should be considered when the system is designed.

There are a number of factors that need to be taken into consideration when designing and installing a racking system. You need to ensure that the panels are safely secured to the rack, and that the rack is safely secured to the roof. You may need to get your system certified by a structural engineer. Consult with your installer or your municipality to see what requirements exist in your area.

It is best to select a racking system designed for roofs and to follow the manufacturer's installation specifications. All roof penetrations for both the mounting hardware and electrical equipment need to be carefully sealed to avoid any water penetration in the future. PV systems

can also be mounted vertically on a wall, but will produce less electricity, as shown in Table 1. If you do not have sufficient south-facing roof space but have a large yard, there are a number of pole-mounting options available.

If you are installing a PV system on an existing roof, you may wish to replace the existing shingles, if they have only a few years of life remaining. You do not want to have to take off the PV system shortly after its installation in order to replace the underlying roof. If you are installing a PV system on a new roof that is covered under warranty, you should ensure that adding a racking system with roof penetrations will not void your warranty. Adding a PV system on top of an existing roof can help extend its life, as the PV system will shelter the roof from the elements.



**Figure 9** The Now House®, an EQuilibrium™ demonstration home in Toronto, Ontario has standard PV panels mounted on its roof. Now House® is a registered trademark of the Now House Project Inc. used under license.

## EQUIPMENT SELECTION

While safe installations of electrical systems are covered under the Canadian Electrical Code, the Canadian Standards Association (CSA) governs product safety. CSA has standards for all electrical components, including solar equipment and all electrical equipment must carry an approval label. Products that are purchased outside Canada may not have undergone the testing process that the same product goes through when brought in by a solar product distributor. It is possible to find good quality PV modules that meet testing standards such as IEC 61215 crystalline silicon design qualification





**Figures 10 and 11** The Riverdale NetZero Project, an EQuilibrium™ demonstration duplex in Edmonton, Alberta has a PV racking system that extends beyond the roof

test performance (or the IEC 61646 for thin film modules) and the IEC 61730 (or the equivalent UL 1703) safety test. In addition, inverters have to meet the CSA C22.2 standard no. 107.1-01 to allow their interconnection to the grid. Discuss this with your solar dealer and electrical inspector before proceeding to install these products—often a “special inspection” or extra safety measures will satisfy electrical code requirements.

It is important to remember that PV systems are modular, and can be expanded as energy needs grow or as budgets allow. It is wise to anticipate future needs by purchasing larger or oversized wires, switching gears and controls, so that these components will not have to be replaced to accommodate a larger PV system.

PV components have no moving parts—which keeps maintenance requirements to a minimum.

Good quality PV modules are typically warranted for 20 to 25 years, and have life expectancies exceeding 40 years. PV panel efficiency can degrade over the years and warranties generally cover specific panel performance over the length of the warranty. The majority of the other electronic components, such as charge controls and inverters, will generally last ten or more years, if their ratings are not exceeded. Batteries typically need replacement every five to ten years.

Ask about component warranties and whether the dealer will guarantee the system. Inquire about after-sales service, including where the products need to be sent for warranty service, and who pays for shipping. An inverter that fails and needs to be shipped across the country for repairs could mean that you will be without solar power for a lengthy period—some professional dealers supply “loaners” while equipment is in for repairs.

## ASSURING A SAFE INSTALLATION

The Canadian Electrical Code and its provincial equivalents govern installations of electrical systems. Section 50 of the Canadian Electrical Code describes the special requirements that apply to solar PV systems.

In most cases, equipment must be installed by a provincially certified electrician. However, many electricians are not yet familiar with the design features of solar electrical systems and, while they will be able to install the system to meet the existing codes, they may be unable to maximize the PV system performance. In some jurisdictions, local electrical inspectors will allow non-certified electrical installers to install DC equipment, such as PV modules, charge controls and batteries. To help ensure a safe installation with optimal system performance, check whether the solar dealer has an electrician on staff or access to approved subcontractors.

If contracting electricians directly, ensure that they are familiar with the design issues of PV systems by asking to see solar-related accreditation and/or a list of past PV system projects they installed, along with references.

To ensure that electrical systems, including PV systems, comply with the Electrical Code, the system may need to be inspected by the provincial Electrical Safety Authority (ESA)—your utility can supply local contact information. By having an electrical inspection done, you are ensuring the system is installed properly and is safe. Your local utility might have other requirements before allowing you to connect your PV system to the utility grid.

## INTEGRATING PV INTO NEW HOUSE CONSTRUCTION

If you are in the process of designing a new house or doing major renovations, you may want to consider installing a PV system, or at least preparing your house to be “PV ready.” You have an opportunity to substantially reduce costs and increase system performance. Although you may not yet be ready to invest in a PV system, the fact is that electricity prices will continue to rise while concerns about the reliability of the utility supply and the environment, combined with the decreasing cost of PV systems,

will make solar electricity much more viable in Canada in the future.

While doing this preparation work, you may also wish to consider making your home “solar ready” for both PV and solar domestic hot water systems. Preparing your house to be solar ready now costs approximately \$300 to \$400 but can save thousands of dollars in the future. Natural Resources Canada has identified the following five basic requirements to make a home solar ready:

1. A roof location of suitable size, pitch and orientation;
2. Labelled conduits from the mechanical room to the attic area below the future PV location;
3. Extra plumbing valves and fittings on the water heater (for solar hot water systems);
4. An electrical outlet at the planned solar tank location (for solar hot water systems); and
5. Construction plans that indicate the future component locations.

Orienting the house on the building lot to maximize its solar exposure and installing a roof with the correct solar pitch can maximize the performance of the PV array. Alternatively, if the lot does not permit a house to be oriented south, consider a roof shape that will have a south-facing area. Landscaping

features, such as trees, should be considered when preparing the site—removing trees or moving the house site slightly can make a significant difference in available solar radiation. Remember that trees can grow a couple of feet per year and mature tree heights should be considered when determining shading potential. Although trees can have a detrimental impact on PV system performance, they can offer other benefits such as summer shading, reducing heat island effect, providing a windbreak, adding privacy, improving air quality, providing wildlife habitat that must also be considered. By carefully selecting the variety of trees and their location, you can enjoy the benefits of trees without shading your PV system.

Wires should be installed before interior walls are enclosed, as this will reduce installation time and hide unsightly conduits. Conduit runs through walls, for battery enclosure cables, battery vents, etc., should be done at the time of construction.

It is far less expensive to put conduit runs in place when installing the foundation walls than to have to drill holes later. As solar systems generate low-voltage DC power, the system wires are generally larger than normal house wiring. Minimizing the distances of wire runs is an effective method of reducing costs and increasing system efficiency.

## COMMISSIONING AND CONTRACTING WITH UTILITY

Utilities and their regulators in Canada are only beginning to address the issues of on-site generation, where individual homeowners are their own power suppliers. Discuss the status of regulations in your utility area with your local solar supplier or utility—in some cases, utilities have not yet set up a single point of contact for this new breed of customer, which can lead to delays in obtaining permission to connect to the local utility grid.

A number of currently installed standard electric meters have not been approved for net-metering applications in Canada. A more expensive electronic meter that is approved may need to be purchased. Some utilities cover the meter costs, whereas others charge the customer.

Some utilities in Canada are thinking of moving to “time-of-day” billing, which can be advantageous for homes with net-metered PV systems. This is because most solar systems generate excess electricity during peak-times—when electricity costs can be four or more times the average cost. Times when the PV system is not generating electricity and the homeowner is purchasing more electricity would typically occur more often during off-peak times, when the price of electricity is lower.

Once you obtain approval from your local utility to connect your system to the utility grid, you can turn on your system and start generating electricity. It is a good idea to compare the expected performance of the system with the actual performance, to ensure that all components are operating as expected. Keeping track of your monthly or yearly PV generation over time will help you identify problems with your system. After factoring for annual variations in solar energy, if your system is still underperforming, it may be that one of your PV panels or another component of your system is malfunctioning.

## FINANCING AND INCENTIVE MEASURES

For off-grid applications, PV systems are often cost-effective as they are competing against fuel-powered generators or power line extensions, which typically cost \$5,000 to \$10,000 per kilometre. However, for grid-connected PV systems, it is difficult to justify the installation of PV systems purely on the basis of current economics, given the current relatively low cost of grid electricity in most areas of Canada. However, some people are starting to treat PV systems like any other house upgrade. Instead of deciding whether it is cost-effective at the time of purchase, they are deciding whether they can afford it and considering their future needs along with the associated benefits of reducing one's overall environmental impact.

The current cost of PV systems ranges from \$8,000 to \$10,000 per installed kilowatt, including all system components. In an effort to help accelerate the uptake of PV systems and drive down costs, some provinces and utilities are considering various incentive measures. As mentioned previously, one such measure is a feed-in-tariff (FIT), where a renewable energy generator is offered a premium for electricity produced, for a set term.

The most successful application of a FIT program to help accelerate the adoption of PV systems was seen in Germany, where the program helped the country become the world leader in installed PV capacity, despite its less than favourable solar resource. The first jurisdiction to offer a FIT program in North America was Ontario: it offered \$0.42/kWh of electricity generated from solar energy for 20 years and had 240 contracts for systems under 10 kW at the beginning of 2009. Ontario recently revised its system after the passing of its Green Energy Act and has increased the rate it pays homeowners to \$0.802/kWh for roof-mounted systems under 10 kW for at least 20 years. In 2009, this rate was higher than any other jurisdictions offering similar programs. The \$0.802/kWh tariff was chosen by the Ontario government based on an analysis that found that proponents could generally be expected to recover project costs and earn a reasonable rate of return at that price.



## FINAL THOUGHTS ON PV SYSTEMS

Energy efficiency and conservation are important measures that should be considered in conjunction with PV systems. It is far cheaper to save a kilowatt-hour than to produce one.

Even though PV systems may not be cost-effective in your area now, there is a wide variety of reasons why homeowners are considering generating some portion—if not all—of their energy requirements using PV systems. PV systems provide a buffer against rising energy prices, and the presence of an on-site battery system can supply electricity during utility power outages. Solar power can also help make a difference in the way that we address climate change and our impact on the environment.

## ADDITIONAL RESOURCES

### Websites

#### **Canadian Solar Industries**

**Association** (February 2010)

[www.cansia.ca](http://www.cansia.ca)

#### **Go Solar: Power From Above**

(February 2010)

[www.gosolarontario.ca](http://www.gosolarontario.ca)

#### **Natural Resources Canada—**

#### **Introduction to Solar Ready**

**New Homes** (February 2010)

<http://oee.nrcan.gc.ca/residential/personal/new-homes/solar-homeowner.cfm>

#### **Natural Resources Canada—**

#### **Photovoltaic potential and solar resource maps of Canada**

(February 2010)

[https://glfc.cfsnet.nfis.org/mapserver/pv/index\\_e.php](https://glfc.cfsnet.nfis.org/mapserver/pv/index_e.php)

#### **Ontario Power Authority**

#### **Renewable Energy Feed-in**

**Tariff Program** (February 2010)

<http://fit.powerauthority.on.ca>

#### **Solar Energy Society of Canada Inc.**

(February 2010)

[www.sesci.ca](http://www.sesci.ca)

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*Order No. 65548*

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*Order No. 62669*

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