

Residential Solar Electricity in Canada

The Solar Wave is Coming!

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Introduction

Solar Electricity, or photovoltaics (PV), is the conversion of light energy into electricity. This fast moving technology started on satellites in the 60s, and moved to terrestrial applications like floating buoys and cottages in the 90s. More recently it has become part of the mainstream energy mix. For example, Germany received 5% of its electricity from PV in 2012. California has over 150,000 homes with solar.

PV on rooftops in Canada has evolved over the past decade. Since 2009 installed costs on residences have dropped by 60%. This has been driven by increases of solar module efficiencies, which have improved by 2%, or by 5 watts extra per year for a typical 250 watt product. Solar systems today cost one half of what they did in 2010.



The result, and the well-kept secret is that PV installations in Canada are now an attractive investment and well worth considering on homes with well exposed roof spaces. Reducing a typical home's electrical consumption by 2000+ kWh per year for the next 30 years for under \$10,000 is now a possibility. Since your average Canadian home consumes around 10,000 kWh per year, that's equal to a 20% reduction in electrical costs – for life essentially.

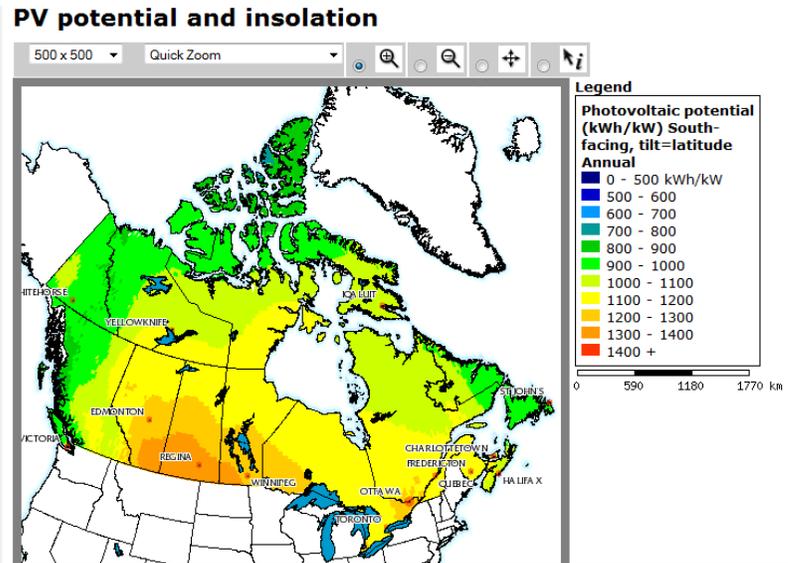
2kW Solar Electric System will produce 20% of the electricity the Croy's use in their Victoria home for the next 30 years.

Solar in Canada? Are you kidding?

This is a common reaction to solar discussions in Canada. The common myth is that there's too little sunshine, too much rain and grey skies. And then, of course, there's the famous Canadian winter.

However, Canada’s solar climate is the sum of 12 months of weather. Since PV panels are merely conversion devices, they take whatever incident energy is available, and with approximately 15% conversion efficiency, turn this into electricity. Of course more solar energy is available on sunny days than cloudy days, but a supplemental rather than a primary energy source, the key is how much energy generation is possible over 365 days.

On that account Vancouver outshines Berlin by 15%. We have the advantage of long summer days. Southern Ontario’s PV resource may not be Saskatchewan’s, but Ottawa is within 16% of Regina – Canada’s solar capital. The Canadian solar resource is not to be dismissed – the potential is very good.

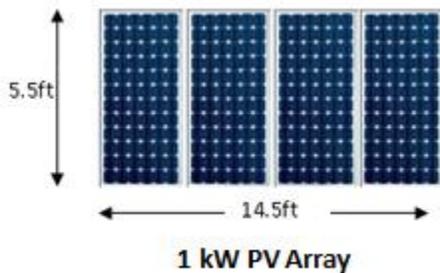


PV Production Map for Canada showing kWh of electricity per kW of PV installed. From NRCAN PV Maps

What Can Solar Do on a Canadian Home?

Solar systems sizes are measured in kilowatts (1000W). Each kilowatt of PV panels require about 80 square feet of roof space.

On a 4/12 pitch roof facing from south with good solar exposure, each kilowatt of PV panels installed will deliver the following annually:



| City | Electrical Production/kW |
|-----------------|--------------------------|
| Vancouver (YVR) | 1090 kWh per year |
| Kelowna | 1268 kWh per year |
| Calgary | 1363 kWh per year |
| Regina | 1434 kWh per year |
| Thunder Bay | 1335 kWh per year |
| Toronto | 1204 kWh per year |
| Ottawa | 1205 kWh per year |
| Montreal | 1180 kWh per year |
| Halifax | 1151 kWh per year |
| St. John's | 1033 kWh per year |

- Predicted output by Retscreen (www.etscreen.net) for south facing array at 20 degree tilt, assuming 10% performance losses due to age and 5% efficiency losses.

What Does a Solar Electric System Cost?

A rooftop solar installation involves:

- Site inspection for measurements and to determine location of the components
- Obtain electrical permit (and a building permit in some jurisdictions)
- Equipment delivery to site
- Installation of the solar racking and panels by qualified rooftop crew
- Installation of the inverter (which converts solar DC power to synchronous AC power)
- Electrical connection of the rooftop solar array power to AC load centres
- Installation of an exterior AC disconnect per utility connection rules
- Labeling, inspection, Net Metering Application

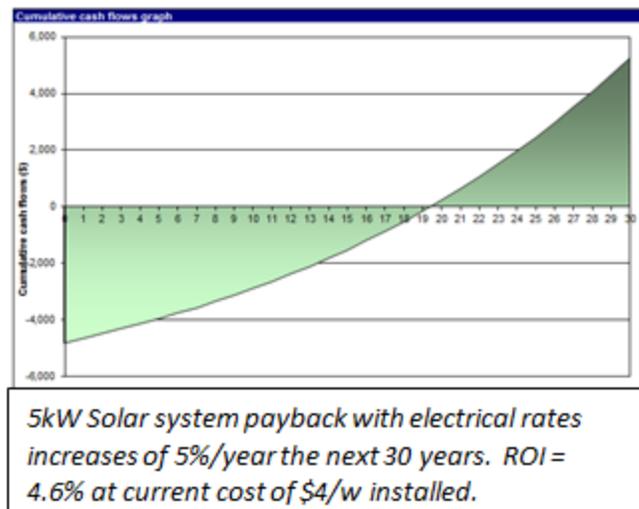
A qualified Solar Professional will typically charge around \$9000 for a 2kW solar array, and less per watt for a larger system. The variables are time and travel, the difficulty to access the roof, and the relative location of the solar panels and the AC equipment. Flat roofs are more difficult as they require different types of attachment.

How Does Solar Pay for Itself?

When you install a solar system, you buy 25 to 30+ years of electricity as you write the cheque. Since electrical rates are not static, but increasing, the value of the electricity increases every year. Rates are forecasted to increase by significantly in most provinces to cover aging infrastructure and the replacement of polluting electrical plants. BC Hydro expects annual rates increase of 5%, and much higher in Ontario.

A 2kW system installed on a well exposed SE to SW facing roof in Victoria has a payback of 20 years, assuming electrical rates only rise at 6.4% per year. This equates to investing cash at a rate of 4.2% for 30 years. The same 2kW system in Calgary offers 6.3% on a cash investment, assuming the solar displaces \$0.12 kilowatt hours today, and rates increase by 6.5% per year. This is due to the current higher costs of electric power, and a better solar climate.

A 5kW system installed on this same roof would yield a rate of return as the costs for larger systems get cheaper by the watt. A 10kW system, needing 1800 square feet of roof space would yield 5.8% in Victoria, and 8% in Calgary when the costs are amortized over 30 years of production – quite an attractive investment. For an installed cost of \$35,000, 10kW of PV would deliver over 400MWh over its 30 year life – a cost of 8.7¢ per kWh.



How Reliable are PV Systems?

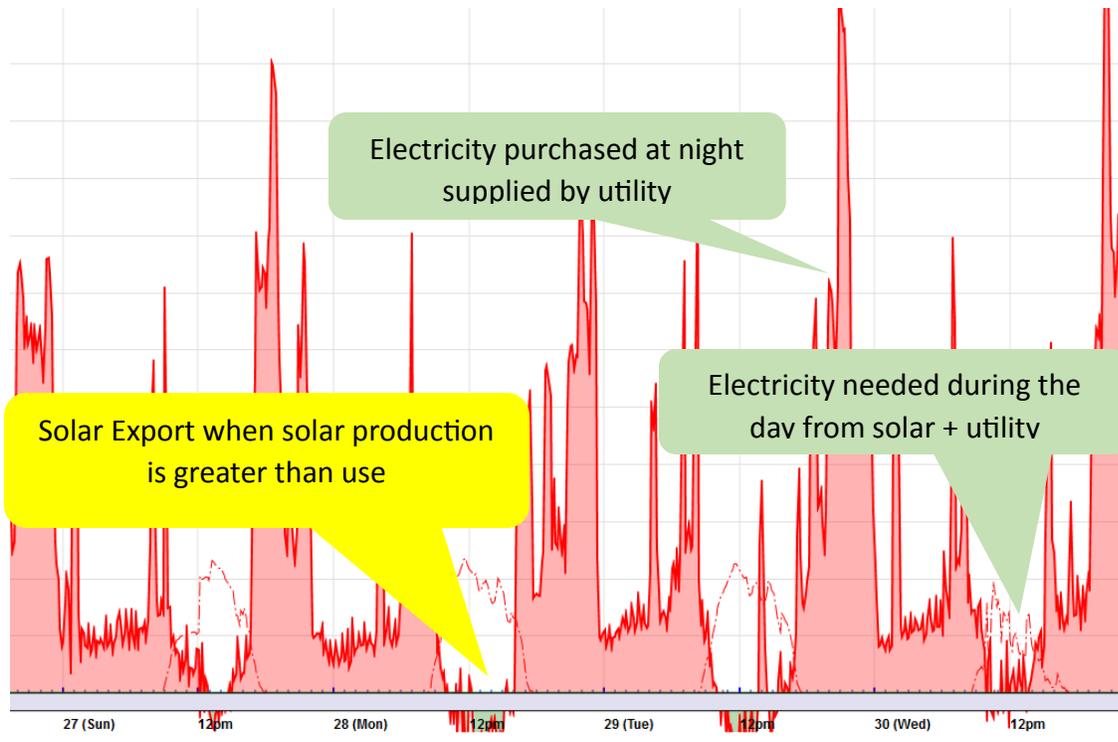
One of the key features of solar electrical panels is that they are simply solid state conversion devices, made of refined silicon. Nothing is consumed in the process of converting light energy to electricity. For that reason solar panels have a long life – there are panels that have been in operation for 30 years. Manufacturers of both PV modules and the power conversion electronics offer 25 year power output warranties. This offers system owners the expectation of a 30 year solar system life.

Virtually no maintenance is required. In some areas of the province people clean their solar panels if bird droppings or dirt become an issue – but in practice rain usually does this for the owners.

What Do Utilities Think About Solar?

Most utilities have programs called Net Metering, which simplifies the way PV systems can connect to the province's grid. The Net Metering program allows solar owners to sell their excess electricity back to the utility for a full credit at the retail rate.

How does this work? If during the day, a home does not need the solar production, the power is sent back up the lines to the street. The utility uses a special two way meter that registers both production and consumption. The monthly bill is the net of the two – and the customer gets reimbursed for all electricity it produced but did not need.



Sample Net Metered house electricity flow for 4 days. The dotted red line is solar generation. The house has exported power to the street (negative consumption) for several hours each day.

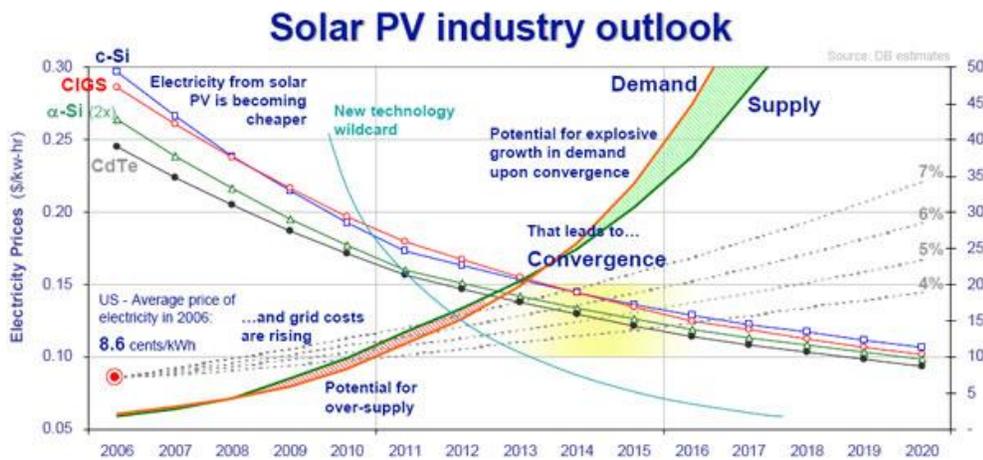
Conclusion – Approaching Grid-Parity

Grid parity, from the solar sense, is when a consumer pays the same for their solar electricity as they do when buying from a utility. Hydro rate increases, higher rates for top tier consumption, more expensive power during the peak hours are all in the future rate plans.

At the same time solar electricity has become cheaper. The cross-over point has already happened now in many jurisdictions – especially where utilities are deregulated and responsible for profitable operations.

Solar grid-parity in Canada is essentially there now if we consider the retail cost projections. For cash in the bank, a rate of return of 5% might represent an attractive investment.

In the not so far future, when installed solar cost decline to \$3/watt, and electricity rates reach 15 cents, solar systems will deliver at 9 cents per kWh. This offers homeowners a 12 year payback, and a 10% rate of return. That's when the solar wave will hit – consumer choice will drive it.



Grid parity for PV power in Canada is imminent. A 10kW PV system today installed at \$3.5/w would deliver electricity at 10.7¢ per kWh in Victoria, and 8.7¢ per kWh in Calgary over the 30 year lifetime of the system.