

Free Power

Is it really possible to get all the power you need from the sun and wind?
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It looks like a gigantic piece of art,” remarked my Uncle Robert as we drove past the large wind turbine in Toronto. He’s right. Like a piece of art, the turbine is one of a kind—the first large-scale wind turbine in an urban downtown setting in North America. Standing 30 storeys tall, it generates an average of 1,400 megawatt hours of power per year, equivalent to the yearly electricity needs of about 250 homes. It has displaced 815 tonnes of carbon dioxide emissions and generated more than two billion kilowatt hours since 2002—producing zero waste and zero emissions. Even an artist like Michelangelo couldn’t do that.

Visible from across the city, the wind turbine is a daily reminder of renewable energy’s potential and the ever-encroaching energy crisis we face as we burn through remnant fossil fuels. The average Canadian household consumes 700 to 1,500 kilowatts of power a month, and we’re the worst per-capita abusers of energy consumption among G-8 countries, alongside the U.S. “There’s a perception that Canada is an energy superpower,” says Rob McMonagle of the Canadian Solar Industries Association. McMonagle has been working with renewable energy since the 1970s, back when Canada was a world leader in design and application. “We’ve always taken our energy for granted and never focused on replacement sources. Now people are beginning to realize we need to take renewable energy seriously.”

OK, so we know our energy predicament is serious. We’ve found ways to make our homes tighter with energy-efficient furnaces, windows and doors—but what’s the next step? Should I erect a gigantic wind turbine on my front lawn? What about solar power or microhydro systems that generate power from water? What’s realistic?

Exploring Your Options

First the basics. Wind turbines generate power when the blades turn, which cause interior magnets to move and create power. So, the faster the wind, the higher the output.

Like sailboats, wind turbines rely on steady wind and are most effective where there are no obstructions, such as in a farmer’s field free of trees and buildings. “You need a steady wind flow for a turbine to be effective, and you probably have to be on a high piece of land,” says Ontario’s Hydro One spokesman Al Manchee. So, if you live in a subdivision or city, you can rule out this option.

While large turbines might not be suitable, smaller wind generators are still great for running electronics and lights at cottages, usually because you’re situated beside a lake

or river with faster prevailing winds. Canadian Tire sells smaller wind generators (from \$700) that are great for recharging boat batteries and operating other remote structures, such as a beachside sauna.

Another option: installing a micro-hydro system, which generates electricity from falling water—not to be confused with large-scale hydro dams. Here, electricity is produced from the energy in water that’s flowing from a high level down to a lower level; the bigger the drop, the more power to the turbine and the more electricity produced. If you have a small waterfall in your backyard, a microhydro system (costing \$2,000 to \$3,000 from Energy Alternatives in Victoria, see energyalternatives.ca) might be a smart investment. These systems work well in conjunction with a solar system: solar systems generate more energy during the summer months because of the longer days; microhydro systems work best in winter, when water flows fastest.

Luckily, those of us without tumbling waterfalls and vast, windy fields have a third option: solar panels. For regular people, “solar power is the most widely available renewable energy source,” says McMonagle. “Unlike microhydro or wind systems, it’s fairly easy to install a small system on your rooftop, no matter where you live.”

Solar Basics

Solar energy can be divided into three types: passive solar (heat generated when the sun shines on your home’s south-facing windows); solar thermal (mainly used to heat small spaces or outdoor swimming pools); and photovoltaic, or PV (what most people mean by solar electricity).

PV systems are typically mounted on rooftops. When sunlight hits the solar array (a series of connected PV cells), it converts the light into electricity through an inverter. What happens next depends on whether the solar set-up is on or off the grid.

The traditional picture of solar is on a remote cabin in the woods. “In a scenario in which it costs \$35,000 to bring in power lines, it makes sense to install your own system and generate your own power,” says McMonagle. Canadian Tire sells off-grid solar systems for weekend use; the idea is that the system powers up batteries during the week, which you then use during the weekend. These systems cost \$2,500 to \$15,000, depending on the size.

Then there are grid-tied systems. “These work in one of two ways,” says McMonagle. “The first is net metering: you connect your solar system to your hydro meter, and when you generate power, your meter runs backward. During the day, when the sun shines—10 per cent sunlight is sufficient for the panels to work—you run the meter backward. And at night, you use grid power. This is how most grid-tied systems work in North America. There are no subsidies with net metering and you’re not selling electricity to the utility company. You’re only deferring your costs.”

Still, it's quite a treat to see your meter run backward. Toronto resident Dave Ullrich remembers the first day his solar system began operating. "I came home and saw that the meter had run backward—it was pretty cool," says Ullrich, a former musician who now runs an independent music distribution website. His highest daily output: 12 kilowatts. "We've only received a few bills, but the first one was about a third lower than for the same time last year."

Like most of us, Ullrich knew few details about solar-power use. "Then I read a tiny piece in the newspaper about a community group holding a meeting on grid-tied systems," he says. "There were about 200 of us listening to someone explain how they work, how they attach to the roof, the cost—all the usual questions. By the end of the meeting, 75 of us were pretty much convinced it was a great idea."

A few months later, Ullrich installed a two-kilowatt system on his roof. "I have a flat roof, free from obstructions like trees, which is perfect," he says. The inverter is tied into Ullrich's standard electrical panel. "It cost us about \$17,000 with installation, but we got a price break because there were 75 houses in the neighbourhood that signed up." Ullrich's neighbourhood is one of two Toronto communities with a large solar-powered base. Ullrich and crew are so satisfied with the results, they set up a website called Our Power (www.ourpower.ca) so that people can read about solar power from regular people. "Before I went to that meeting, I had no idea this was something a regular person could do—that it was part of the here and now," says Ullrich.

The Our Power website gives examples of two other systems, both one-kilowatt, and both costing about \$10,000 with installation. Again, this is with a group rebate, so a more realistic price is \$12,000. Canadian Tire has a special website set up to give you an idea of cost and return on investment. Using resources on the website (canadiantirepower.ca) you can estimate your power needs and what conversion will likely cost. A two-kilowatt grid-tied solar system will likely cost about \$29,210, with an annual savings of \$1,814 and a return on investment of six per cent. In 16 years, you'll have paid for the system through net metering.

Ullrich uses net metering right now, but he's in the process of applying to the Ontario Power Authority (OPA) to become a generator. Ontario is the first area in North America to provide what it calls the Standard Offer Program. Basically, you fill out a contract to become a power generator, install a solar system and sell your power to the utility company. (To view the contract, visit www.powerauthority.on.ca/sop.) "A feed-in tariff is applied to the amount of kilowatt hours you produce," says McMonagle. "You sell your power at 42¢ a kilowatt, and buy back at 6¢ a kilowatt, which gives you an approximate rate of return of five or six per cent a year." Similar programs are common

in Germany and Japan.

“The Standard Offer Program is a contract between the homeowner and the OPA; we’re just the delivery company,” says Hydro One’s Manchee. “To sell into the grid, you need a four-way meter, which costs about \$4,500, and then there are the installation fees and paperwork needed for any generator. We’ve received more than 500 inquiries about the program.”

The contract comes with a 20-year guarantee, meaning the government can’t come back in a year and change the price structure. But even though you’re selling at 42¢ and buying at 6¢, don’t expect to start receiving cheques from the hydro company. “Most people use more power than they produce,” says Spencer Evans, national sales manager, residential division, for Carmanha, a renewable energy system manufacturer and distributor in Victoria. “But because you’re buying your electricity at a seventh of the cost you’re selling it, you’re still benefiting.”

The benefits will come—in 10 to 20 years. “A regular home can handle a one-, two- or three-kilowatt system,” says Evans. Companies such as Carmanha and Canadian Tire sell solar grid-tied packages (everything you need, plus installation) for about \$10 to \$12 a watt. Evans estimates a three-kilowatt system from Carmanha would cost about \$25,000. A typical warranty covers 25 years and the only maintenance re-quired is removing debris from the array, such as leaves, every once in a while.

The rate of return depends on consumption, so if your home is highly efficient, you will naturally use less electricity. “If you just want to install a solar hot-water heater, you’re probably looking at \$3,500 to \$5,000, which will give you about 50 per cent of your hot water,” says McMonagle. “A solar system to heat your pool will cost about \$4,000, but you get 100 per cent of your water needs. And since a typical pool costs about \$1,000 a year to heat, your payoff comes in just four years.”

Benefit Beyond the Bottom Line

“It’s funny that we don’t ask about payback with our cars or furnaces,” says Evans. “We just accept these costs. And, yet, here we have something that is good for the environment and we’re asking about payback. The fact that there’s a payback is great, but it shouldn’t be the driving force.”

The environmental benefits of a PV system include lessening carbon dioxide emissions, zero waste and reduced dependence on non-renewable energy such as oil and gas. “When you look at the pressure put on the grid in Ontario—all the blackouts and brownouts—we need alternative, renewable energy sources to meet the demand for power,” says Evans.

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Whatever the driving force, the choice is up to you. “The payback is so far off, you have to do it because you want to,” says Ullrich. “Every day, I’m reminded of the savings and environmental benefits. The sun comes up and you see your electricity meter running backwards. It’s hilarious.”