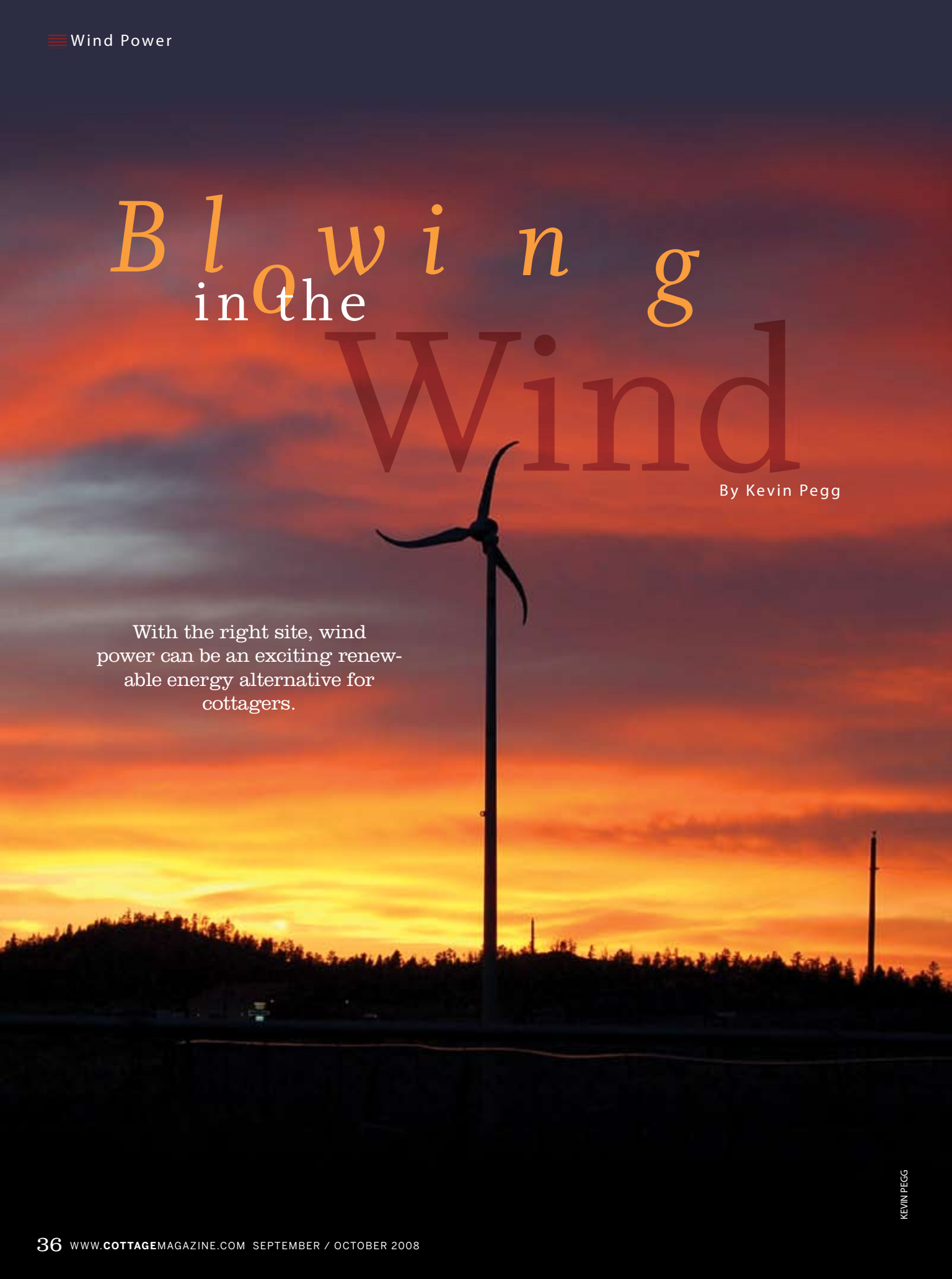
Blowing in the Wind

By Kevin Pegg

With the right site, wind power can be an exciting renewable energy alternative for cottagers.



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Wind energy has been used for centuries for grinding grain, pumping water and generating electricity. Small wind turbines were a significant source of electricity for rural families in the 1920s and '30s, before utility power grids were as prevalent as today. Wind as a source of energy gradually faded into the background due to the rural grid electrification efforts of the '40s and the development of small engines to run generators, offering power on demand instead of at the whims of the weather.

Fast-forward to 2008, and we are once again witnessing wind generation coming into the limelight. European countries have led the way for commercial wind farms while Canada mostly sits on the sidelines and watches. A few large-scale wind farms have come online in Canada (Alberta, Ontario and others) over the last few years. In fact, British Columbia has a wind resource that is well recognized as being amongst the best in the world. However, at this date, there are no commercial-scale wind turbines flying. A combination of a provincial government who does not support the technology and a culture of NIMBY (Not in My Backyard) people who support wind, in concept, as long as it's not near their viewscape, has caused most developers to look elsewhere for communities that embrace the technology. And, the prairies and flatlands of central Canada—Alberta and Saskatchewan in particular—have embraced it. They actually have even more favourable conditions as their winds are more constant and predictable, which are much easier to work with than the sometimes-erratic coastal winds.

Wide open spaces generally provide the best wind conditions, as obstructions cause the wind to slow.

Wind is such a common occurrence that everyone is familiar with it, but how many really understand what wind is, where it comes from and its potential energy? It's quite simple, really: The sun heats the earth's surface at varying intensities depending on the weather, which causes high and low pressure areas. Air will move from high to low pressure areas, and this movement is the wind.

How Wind Power Works

Simply put, when wind blows against the blades of a turbine, similar in design to an aircraft propeller, it causes a shaft in the centre to rotate. This shaft turns a generator, which produces electricity. This electricity can be fed directly into the power grid (grid-intertie); it can be used to power a load directly (as in a water pump); or in an off-grid situation, it can charge batteries. This shaft power can be used for other mechanical operations, however the simplicity of electricity over direct ▸

DO I HAVE A GOOD WIND SITE?

Small-scale wind is not an exact science. While there is sophisticated wind monitoring technology available, it's quite expensive and better suited to larger wind farms that are investing millions. Here are some cheap and easy ways to judge your site:

- Environment Canada has historical wind speeds for hundreds of locations across Canada available at *www.climate.weatheroffice.ec.gc.ca*. It's not perfect data as the sample sites are limited, and it's measured at 10 metres off the ground, which is much lower than a typical wind turbine, but if you are in close proximity and geographically similar to a weather station, this may be a useful resource.
- Retscreen software, *www.retscreen.net,* can be used to predict the power potential and economic return of your site. It's more suited to turbines 10 kW and larger.
- For British Columbians, BC Hydro has released wind data from 18 specific sites measured in 2003/2004 on *www.bchydro.com*. They also have a map of wind in BC. This map indicates general trends in areas, but not the specifics of wind in your piece of paradise.
- If you have a neighbour with a wind turbine, this will be your best bet, as you can learn first-hand from their experience and knowledge.
- If you have an airport or military base nearby, the wind data they collect may offer you some useful information. Personal contacts in these situations are often better than bureaucratic processes.

Visual indicators

- A flagpole can provide great data: if the flag is stiff in the wind for several hours a day, you will likely have a good wind site; if it's torn to shreds in a few months, you have an excellent wind site; and if it never flies, you should invest your money in other technologies.
- Look at the very tops of any trees in the area. If the tips are growing at an angle, that could suggest a good wind site.
- Go fly a kite. This is my favourite. Not only is flying a kite fun, it will give you a wealth of information about the wind at your site. If a kite will fly true and straight, this is a good wind site. If the kite is all over the place and hard to control, it's because of turbulent winds, and your wind turbine will have similar challenges.

WHICH GENERATOR?

VERTICAL AXIS

In the early '70s when wind turbines were being experimented with, many different styles were considered and tested. There's good reason that you just don't see these vertical axis, eggbeater-type of wind turbines anymore. They just didn't work as well as the other types. Some new technology on the market makes some fairly optimistic claims as to their performance. I am not particularly interested if a certain celebrity has one on their garage or not. I want to know the product works like it is claimed to. I've yet to be convinced through actual data that these units perform as well as the manufacturers claim they do.

The units on the market sell for between $5,000 and $50,000 (larger units being more expensive and producing more power).

HORIZONTAL AXIS

These conventional, propeller-type wind turbines are residential-scale units. They can range in size from a few hundred watts (as in the Air series of wind turbines from Southwest Windpower) to a few kW of power (Whisper, Skystream). They can work off-grid or on-grid. If your property is remote and beyond the reach of utility power, this generator can charge up batteries as part of a larger renewable energy system. If you have grid power, a grid-tie wind turbine can feed energy into the power grid, offsetting or eliminating your power bill. Medium-scale units in the area of 10-100 kW are getting into the family of seriously large wind turbines, producing sufficient power to run several homes. Buying a wind turbine is a lot like buying a truck. You can spend $1,000 on a truck or you can spend $100,000 on a truck.

For specific details on pricing and models, visit *www.energyalternatives.ca* where there is a complete selection of wind turbines.

HORIZONTAL AXIS—WIND FARM

Then we get into the commercial, wind farm, MW-sized wind turbines. Like giant mechanical toys, these units feature blades up to 50 metres long, weighing up to 70 tons with capacities up to 3 MW. A unit like this will cost several million dollars and can generate enough power for thousands of homes, depending on the wind resource.

If you really want to get into wind but you just don't have a site, you should look at other projects that are starting up to join in on. There are wind co-ops and new companies sprouting up all over the world.

One of the elegant things about an integrated power is it doesn't actually matter where the electrons are generated, the result will all be the same. It's a similar concept to the Internet: It matters not where you connect from and to, just that you are able to connect. Putting your wind turbine investment into a site that has a fabulous wind resource is your best bet here.

DREAMSTIME

mechanical drive is not to be understated. Mechanical drive is much less efficient, and much higher maintenance.

Considering Wind? Consider This:

- Wind generation is dependent on the quality and quantity of the wind hitting the turbine blades. The stronger and cleaner the wind, the more power you will produce. Your capital costs for a wind turbine are fixed. It costs as much to install a wind turbine in a poor wind site as it does to install in an excellent site.
- A good wind site will have a nice open space—a field ideally, or a location perched on top of a gentle hill—with an average wind speed of 19 kilometres per hour or better.
- Turbulent wind, caused by obstructions such as buildings, geographical features or trees will reduce the power output. When the wind turbine is swinging back and forth hunting for the wind, that's energy that's not being harnessed.
- If the wind speed doubles, the power output increases by a factor of eight. The difference in power output between a 15 km/h and a 18 km/h wind is substantial.
- A wind turbine needs to stand taller than anything nearby. Towers that are 20–40 metres (60–120 feet) tall generally give the best results. A general rule for this is to have a tower that is 10 metres (30') taller than anything within 90 metres (300'). If you have trees that are 12 metres (40') tall, this means your wind tower should be at least 25 metres (80'). (There are some exceptions to this, such as if you have a prevailing wind coming off a body of water.)
- Suitable Zoning. You are generally looking for a half acre or larger lot in a municipality that does not have bylaws prohibiting wind towers. The best thing to do is talk to your neighbours about it. They are the ones who will be most impacted by the installation. If you have the approval of your neighbours, you are unlikely to meet municipal resistance. Wind turbines are really not suited to urban areas, despite what some manufacturers may say.
- The further the wind turbine is from where the electricity needs to be delivered, the more expensive the cable run will be. How far it can be will depend on your needs and site. I've worked with distances of up to one km away for larger wind turbines. It's a balance of picking the best wind site and keeping cable runs manageable. Cable runs of 90 metres (300') to 240 metres (800') are the most common for home-scale wind turbines.
- Accessible site. It's always a lot easier to deliver materials to site and to maintain the unit if you are able to drive right to the base.

As wind speed increases with height, a tall tower is essential for greater wind output.

Tall Enough Towers

Turbulent wind reduces the power output as a turbine swings back and forth searching for wind. The unequal stresses caused by turbulence and the variation in wind speed between the upper and lower blades of a wind turbine installed too close to the ground will reduce power output and wind turbine life.

Wind speed increases rapidly with tower height. Doubling tower height increases the available wind power by about 40 per cent. It is generally more economical to install a higher tower rather than purchase a larger generator.

Self-supporting towers are the least visibly intrusive wind turbine towers. And the most expensive. They can be installed in rough terrain with a minimum of cleared area. Small wind turbines may be installed on shorter, self-supporting tubular towers; larger turbines require a lattice tower. A significantly large concrete anchor is required to support this type of structure. A crane is typically involved in the erection of the turbine, and will be required for most maintenance activities. A tower is generally equal to, or higher than the purchase price of the turbine itself.

Guyed towers are economical and can withstand very high winds if properly installed. They require a fairly large area of cleared land around the tower to facilitate the installation of

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the guy lines. To supply the desired amount of support and keep the stresses on the tower to a minimum, the guy lines should extend as far as possible; typically a radius between 50 and 80 per cent of the tower height. Guyed towers may be either lattice towers or tubular towers. The tubular towers (using standard steel pipe as their mast) are frequently designed for tilt-up installation. They have the advantage of easy material access, transportation and installation. Turbine maintenance is performed on the ground, as a winch or vehicle can lower and raise the tower with minimal efforts once it's all set up.

There is no one easy answer when it comes to predicting the output of a small wind turbine. With some site observations, you can gather information to make some educated predictions as to the viability of its wind. There's an immense personal sense of satisfaction from generating your own power. The gentle whirr in the background from a wind turbine gives you a sense of self-sufficiency. With most of society being totally reliant on others producing electricity for them, it's comforting to see some people can still take care of their own needs. If you have been thinking about wind, there's no time like the present to start looking into further.

WHAT DO I NEED?

1 A good wind site—no matter what brand or type of wind turbine you use. Some unscrupulous manufacturers claim exaggerated power production at low-wind speeds. Check the data. Is it third-party at a reputable test site? If it seems too good to be true, it probably is.

2 A wind turbine that is suitable for your wind profile and your application; i.e. are you selling to the power grid, charging batteries or both?

3 A tower to raise the wind turbine to where the wind is.