

Harnessing the wind

Using modern technology to create efficient, economical and emission-free electricity

By Rachel Philippe, AMM Senior Policy Analyst



Seeking a cleaner environment often leads to a consideration of energy resources and the potential for more environmentally responsible alternatives. In 2002, the majority of energy produced in Canada was generated from large hydroelectric facilities. However coal, nuclear power, natural gas and oil still accounted for 38% of Canada's energy production. Advancing technology has created new opportunities to supplement existing energy sources with cleaner generation methods. Wind energy is a prime example of this trend. With its increasing usage, the costs of generating wind power are steadily declining, making it one of the most effective ways to generate emission-free electricity.

The basic concept of generating energy from the wind is hardly new. The fundamental principle remains the same as wind currents are harnessed to rotate the turbine's blades and capture energy. Advancing technology allows the motion of the blades to turn a generator and produce electricity that can ultimately be transferred to the electricity utility's transmission grid. Today's wind energy generation relies on modern technology that allows manufacturers to design and produce machines larger in capacity and higher in efficiency than ever before. Taller towers and more efficient turbines are now possible because of lighter blades as well as improved towers and foundations. Taking advantage of this technology allows more energy to be created by less wind at a lower per kilowatt hour cost. The Canadian Wind Energy Association (CanWEA) indicates that wind energy is one of the most economical sources of new large-scale electricity generation.

Sophisticated technology is also required for the operation of wind farms. Remote computer monitoring systems are commonly used to control the angle of each rotor blade and to ensure that the rotor blades face into the wind. The ongoing operation of the turbines is also monitored in a similar fashion.

Utility-scale land-based turbines range in size from less than one megawatt to more than three megawatts (MW). A one MW turbine with a 30% capacity factor¹ produces about 2,600 megawatt hours (MWh) per year; enough to power about 320 homes. Since winds fluctuate on a daily basis, turbines typically begin to operate when wind speeds are approximately 8-13 km/h and maximum power is reached with wind speeds ranging from 30-40 km/h. To determine the generation potential of a particular site, technicians will study

long-term historical wind patterns. These and other site-specific measurements are used to forecast average monthly and annual potential energy production that will inform the site assessment. Such calculations have estimated a significant potential for wind power development in Canada and Manitoba.

Canada is predicted to be among the countries with the fastest growth rates for wind energy capacity. Many Federal and Provincial incentives are now available and CanWEA estimates that these measures could lead to the installation of at least 8,000 MW of wind energy in Canada by 2015 – a significant increase of Canada's April 2006 capacity of 944 MW. Estimates suggest Canada could eventually meet 20% of its total electricity needs with wind power (50,000 MW).

Opportunities for wind energy development in Canada offer key environmental benefits. Using wind to power over 200 homes instead of burning coal has the same positive impact as taking 417 cars off the road or planting 10,000 trees. Wind energy generation

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avoids the production of harmful substances such as greenhouse gases, heavy metals and particulate matter. Using wind energy in place of conventional energy reduces the generation of smog and acid rain. As one of the cleanest generation methods available, wind energy will help meet environmental objectives across Manitoba and Canada.

With the majority of wind energy projects being located in rural areas, there are substantial economic benefits available at the local level. Rural landowners can profit from lease payments and rural municipalities will experience increased tax revenues. (For a Manitoba example visit www.canwea.ca/en/CanadianResources.html). Tourism and employment benefits can also have a significant impact on rural community economic development. Such benefits are already apparent in Manitoba's own St. Leon wind farm.

So what's happening in Manitoba?

Earlier this year, construction was completed on Manitoba's first wind farm. The community of St. Leon is home to the 63 turbines that make up this 99 MW project. The energy generated from St. Leon is enough to power approximately 41,000 homes. Local landowners will benefit from \$9 million in revenue over the next 25 years and the project is expected to generate 300 direct or indirect jobs and \$100 million in operating expenditures.

Manitoba is well-positioned to further capitalize on its wind generation potential. In order to stimulate development of wind farms, the Province of Manitoba announced its intention to procure 1,000 MW of wind energy by 2014. To meet this mandate, the Province conducted an Expression of Interest process and received 36 submissions from 43 proponents including wind developers, First Nations, communities, turbine manufacturers and consultants. Combined, these projects proposed more than 10,000 MW of wind energy projects and identified 75 sites for wind farms in Manitoba. The next step in developing additional wind farms is for the Province to issue a Request For Proposals related to specific wind generation projects. Their intention is to develop 1,000 MW of wind energy generation in Manitoba over the next eight years.

There is a tremendous opportunity for wind power to contribute to Manitoba's energy resources and provide environmental and economic benefits. The advantages of using wind energy will certainly make this technology more prevalent in the near future. ♻

Sources:

- AirSource Power: www.airsourcepower.com
- Canadian Wind Energy Association: www.canwea.ca
- Canadian Wind Energy Atlas: www.windatlas.ca
- Manitoba Energy, Science & Technology, Energy Development Initiative: www.gov.mb.ca/est/energy/initiatives/index.html
- Taxing Wind in Canada – Property Tax Assessment Policies and Practices in Canada: www.canwea.ca/en/CanadianResources.html
- Windustry: www.windustry.org

¹Capacity factor is defined as the percentage of electricity that the wind turbines are expected to produce relative to a maximum theoretical production in given period of time (based on the amount of time the wind is actually blowing).

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