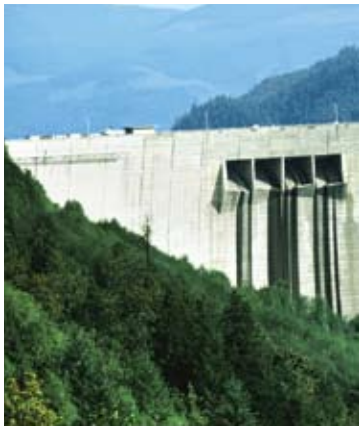
Wind power is here.

Wind power is determined by more than just how and when the wind blows. Wind energy is the culmination of years of studying the wind and perfecting the technology that harnesses it.

Wind is reliable and has the power to make a significant contribution to Canada's energy needs. In Denmark, 20% of electricity demand is currently met by wind energy. With our abundant resource, there's no reason why we couldn't follow their lead – and the Canadian wind energy industry is here to capture that potential.

photo courtesy of Vision Quest

"Wind has an availability factor of 98% – much higher than conventional forms of energy production."[1]



As long as there is wind, there will be wind power.

Changing winds.

Everyone knows that the wind is variable. Sometimes it blows, other times it doesn't. So how can wind power be a reliable source of energy? The answer to that lies in how we plan for variability.

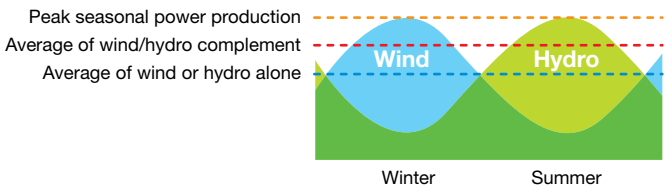
Most turbines are located in sites where there's enough wind to produce electricity 70-80% of the time. Naturally, the amount of electricity produced varies with the wind. The way we manage for this variability is to locate wind farms in different geographical areas so that turbines can take advantage of different prevailing winds. The fact is, the wind will never stop blowing everywhere at once – even within a single wind farm, it's unlikely that all the turbines stop spinning at one time. With Canada's large and varied wind resource, there's no doubt that the wind can power us well into the future.

The power of two.

In Canada, we would never rely on wind turbines alone to meet the entire country's electricity needs. Instead, we use wind in conjunction with other forms of compatible energy production.

One example is wind and hydro-electric. These two sources of energy are a natural fit. In the winter, wind is at its peak, allowing hydro to store energy for use when wind productivity is lower. Hydro dams can be closed relatively quickly allowing water reserves to build when peak wind is in full swing.

In the spring and fall, hydro is at its peak production and wind energy serves as its supplement. It's interesting to note how wind energy can help us better manage our precious water resources.



WIND POWER IS RELIABLE

photo courtesy of Vision Quest

"The variability of wind matches the variability of demand. Generally wind is strongest in cold-weather months when our demand for electricity is highest." [2]

Capturing the energy of wind.

Estimating energy productivity is done through a calculation called capacity factor. If a power plant produced at full capacity 100% of the time, it would have a capacity factor of 100%. Of course, wind is variable, so it doesn't have a 100% capacity factor – but neither does any other form of energy. No energy source, conventional or otherwise, works 100% of the time. It's simply impossible.

There are periods when power plants shut down for maintenance and repairs. There are times when resources run low or when unexpected outages occur.

One of the greatest attributes of wind is that it blows hardest – and therefore generates more electricity – in the winter. Wind power offers an opportunity to add more green energy to the grid and to add it during the coldest months of the year, when demand is heavy.

Wind turbines are reliable.

Wind-generated power is a reliable source of electricity. Wind turbines have one of the highest availability factors – a term that refers to the reliability of the turbines and the percentage of time that a plant is ready to generate energy. Wind has an availability factor of 98% – much higher than conventional forms of energy production.

Maintenance issues are also much smaller on a wind farm. At some conventional power plants, the entire plant may have to be shut down for repairs whereas at a wind farm maintenance takes place one turbine at a time.

Enhanced technology and design improvements have also played a part in increasing the reliability of wind power allowing turbines to generate electricity in all but the most extreme weather conditions. Plus wind forecasting technology has the potential to make wind energy more predictable and more reliable than ever before.

Yes, it's true; the wind blows some of the places all of the time, and all of the places some of the time – but it can't blow everywhere at once.

Wind is variable, but with good site selection, wind farms have access to strong and steady winds.

As of June, 2006, Canada's installed capacity was 1,049 MW – enough to power about 315,000 Canadian homes.

CASE STUDY

North Cape Wind Farm, PEI

Owner/operator:
PEI Energy Corporation

photo courtesy of PEI Energy Corporation

On line since 2001, PEI Energy Corporation's North Cape Wind Farm – sited in one of Canada's windiest locations – has an installed capacity of 10.56 MW. With a capacity factor of 40%, it generates about 35,000 MWh annually – enough to supply 3% of PEI's electricity requirements, or about 5,000 PEI homes.

Together, with other wind farms, PEI will have 52 MW of installed wind capacity by mid 2007.

It's estimated that PEI could develop 200 MW of wind energy by 2015. PEI currently imports over 90% of its electricity from New Brunswick. By exporting excess wind energy during periods when production exceeds demand, it's feasible that PEI could net out as an energy self-sufficient province.

Purchasing agreement: North Cape Wind Farm's power is sold to Maritime Electric Company Limited for distribution. Maritime Electric can sell the power through their Green Power Program, which allows customers to purchase it at a premium price. This green power premium is passed along to PEI Energy Corporation. If the electricity available under this program becomes fully subscribed, then additional wind powered generators may be installed on PEI.

Canadian Wind Energy Association
Powering Canada's future naturally
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Natural Resources Canada | Ressources naturelles Canada

CanWEA acknowledges the contribution of Natural Resources Canada.

1: Source: http://www.awea.org/faq/tutorial/wwt_basics.html
2: Source: http://www.windpower.org/en/tour/grid/season.htm

ABOUT STRAY VOLTAGE

STRAY VOLTAGE FACT SHEET

WHAT IS STRAY VOLTAGE?

Stray – or 'tingle' voltage – is a low-level electrical current or shock (typically under 10 volts) that results primarily from an improperly grounded or, in some cases an ungrounded, electrical distribution system.

Stray voltage can be found in any electrical system and is strictly a power distribution issue – improper grounding causes low voltage current to travel along a neutral wire. An electrical wiring system is grounded in order to keep voltage potential differences between the neutral wire and the ground, below levels that could be considered harmful.

While potential exists for stray voltage in residential areas, it is most commonly found at agricultural operations and is often attributed to poor grounding of the neutral wiring system in an environment where the presence of water increases conductivity between points of contact.

Stray voltage is unwanted electricity that in some cases can pose a safety risk to animals – and to lesser degree, humans – that come in contact with it.

Farming operations are especially susceptible to incidences of stray voltage for two key reasons:

1) Many working farms have electrical systems and wiring that have not been fully updated to current electrical codes and standards

2) Farms have a higher number of potential contact points (e.g., metal), water and wet conditions, i.e. feed bowls and wet concrete floors

WHAT'S IN A TERM?

The term 'stray voltage' is often misused due to poor understanding of its cause.

Stray voltage has incorrectly been called 'dirty electricity', implying that some forms of electricity are better or cleaner than others. Electricity from all sources is equally 'clean'. Stray voltage has also been confused with electricomagnetic fields (EMF), grounding systems or even naturally-occurring current found in the earth.

ANIMAL REACTION TO STRAY VOLTAGE

Stray voltage may affect farm animals through nerve stimulation, causing a 'tingling' effect.

This so-called 'tingle' can occur when the animal comes in contact with two points that have a voltage potential – such as a metal dish filled with water and a wet concrete floor - creating a path for current (electricity) to flow through the animal.

This nerve stimulation may have an effect on an animal's behaviour directly – in the form of involuntary muscle contractions and/or pain; or indirectly in the form of behavioral responses such as reduced food and water intake, or proving difficult to handle.

All electrical current must be respected as potentially harmful and stray voltage, although present in low amounts, is no different. Based on research, levels below 1 V are considered to be inconsequential, and generally not believed to cause behavioral changes in farm animals.

DETECTING AND REPAIRING INCIDENCES OF STRAY VOLTAGE

In most cases the source of stray voltage can be identified, allowing it to be either mitigated or eliminated.

Suspected cases of stray voltage should be investigated by an inspector from a local utility operator such as Hydro One, Toronto Hydro, etc., as it is a common distribution issue for farm operators as a result of inconsistent wiring quality. A utility inspector will investigate the farm's existing wiring system to ensure proper installation, wire condition and code compliance. An inspector will seek to isolate the source of neutral-to-earth (ground) voltage through measurement of voltage at various points within the electrical system. This helps to determine whether the issue is related to on-farm wiring and distribution or whether the issue is related to the electrical distribution system off the farm.

COUNTERING INCIDENCES OF STRAY VOLTAGE IN ONTARIO

In 2007, the province of Ontario began an extensive research and consultation process into the phenomenon of stray voltage and its effects on the farm sector. In 2009, the Ontario Energy Board (OEB) enacted code amendments detailing procedures and methodology for dealing with incidences of stray voltage.

As part of its two-year research and consultation process, the OEB employed Dr. Douglas J. Reinemann, a Professor of Biological Systems Engineering and a leading authority on stray voltage to review studies and literature on the subject.

Recognizing stray voltage's connection to farming operations, Dr. Reinemann sought to further clarify the term 'stray voltage' by further defining it as "…a low-level electrical shock that can produce sensation or annoyance in farm animals". He also further specifies the term as "a special case of voltage developed on the grounded neutral system of a farm".

STRAY VOLTAGE AND WIND ENERGY

There has been much confusion on the topic of stray voltage, and wind turbines have at times been inappropriately linked as direct sources of stray voltage.

Stray voltage is a potential symptom in *any* system of electrical distribution, regardless of source and is especially prevalent on working farms. Wind turbines are often located in agricultural areas, connecting to the provincial electricity grid with farm operators leasing the land on which the turbines sit. Through improved regulation and electrical code enforcement, incidences of stray voltage will be increasingly detected and eliminated.

WIND FACTS

WIND BY THE NUMBERS: **ECONOMIC BENEFITS OF WIND ENERGY**

Wind energy is generating affordable, clean electricity while creating new jobs and economic development opportunities in communities across the country. Here are some of the economic benefits being realized today – and opportunities for tomorrow.

- Canada is now the ninth largest producer of wind energy in the world with current installed capacity at **5,403 MW** – representing about **2.3 per cent** of Canada's total electricity demand.
- Canada enjoyed a record year in 2011 the addition of **1,267 MW** of new wind energy capacity to provincial grids, representing an investment of **$3.1 billion** and creating **13,000 person-years** of employment.
- 2011 was also a record year for new wind energy installations in Ontario with more than **500 MW** installed by the end of year.
- More than **6,000 MW** of wind energy projects are already contracted to be built in Canada over the next five years.
- Ontario is expected to install more than **5,600 MW** of new wind energy capacity by 2018, creating **80,000 person-years** of employment, attracting **$16.4 billion of private investments** (with more than half of that invested in the province), and contributing more than **$1.1 billion of revenue to municipalities** and landowners in the form of taxes and lease payments over the 20-year lifespan of the projects.[1]
- Wind energy drives jobs and local benefits at prices that are competitive with other new sources of electricity. According to new research from Bloomberg New Energy Finance: "The cost of electricity from onshore wind turbines will **drop 12 per cent in the next five years** thanks to a mix of lower-cost equipment and gains in output efficiency."
- CanWEA believes that wind energy can satisfy **20 per cent** of Canada's electricity demand **by 2025**. The benefits of achieving this vision are many:
  - $79 billion in new investment
  - 52,000 new high quality jobs
  - $165 million in annual revenues for municipalities
  - Reducing Canada's annual greenhouse gas emissions by 17 megatonnes

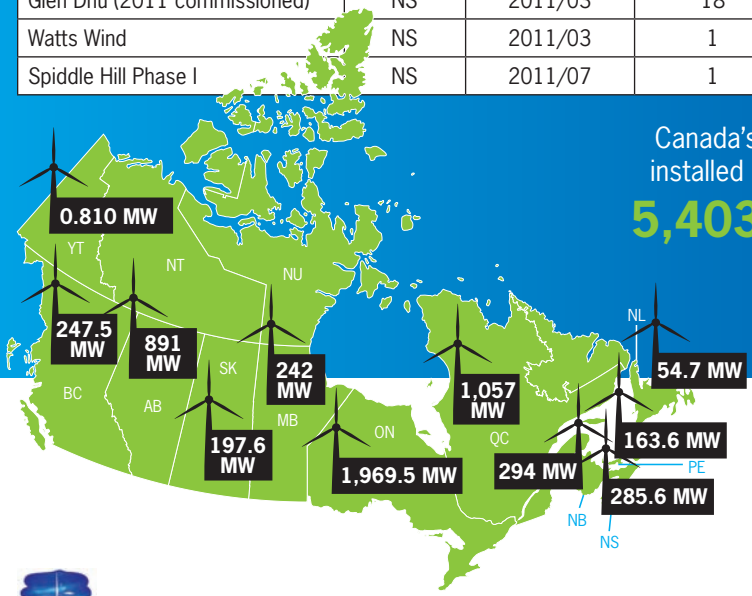
1 The Economic Impacts of the Wind Energy Sector in Ontario 2011 – 2018, by ClearSky Advisors, http://www.canwea.ca/wind-energy/talkingaboutwind_e.php

- CanWEA released a wind vision for British Columbia which called on the BC government to install **5,250 MW** of cost-competitive and low-impact wind power capacity **by 2025**. This would generate **$16 billion in new investment** with **$3.7 billion** flowing directly to **BC communities** and meet **17 per cent** of BC's total electricity demand. Download *CanWEA's WindVision 2025 – A Strategy for British Columbia* at: www.canwea.ca/windvision_bc_e.php

- CanWEA's *WindVision 2025 – A Strategy for Quebec* proposes that an average of **800 MW** of wind energy capacity be added each year between 2016 and 2025 – for a **total of 8,000 MW** – increasing wind energy to 20 per cent of Quebec's overall installed capacity for electricity generation. This long-term objective would stimulate **$25 billion in industry investment** and create nearly **91,000 new construction jobs**. Download the report at: www.canwea.ca/windvision_quebec_e.php.

New wind farms built in 2011

Wind Farm	Province	Date Installed	# of Turbines	Total Capacity (Megawatts)	Developer/Operator
Dokie Wind Project	BC	2011/02	48	144.00	Dokie General Partnership
Wintering Hills	AB	2011/12	55	88.00	Suncor
Red Lilly Wind Energy Project	SK	2011/02	16	26.40	Red Lily Wind Energy Partnership/ Algonquin Power
St. Joseph	MB	2011/02	60	138.00	Pattern Energy
North Maiden Wind Farm	ON	2011/01	5	10.00	Boralex Inc.
Kruger Energy Chatham Wind	ON	2011/01	44	101.20	Kruger Energy
Raleigh Wind Energy Centre	ON	2011/01	52	78.00	Invenergy LLC
Kent Breeze Wind Farm	ON	2011/05	8	20.00	Suncor Energy Inc.
Greenwich Renewable Energy Project	ON	2011/11	43	98.9	Enbridge & RES Canada
Pointes Aux Roches	ON	2011/12	27	48.60	International Power/GDF Suez
Comber East	ON	2011/12	36	82.80	Brookfield
Comber West	ON	2011/12	36	82.80	Brookfield
Mont Louis	QC	2011/09	67	100.50	Northland Power
Montagne-Sèche Wind Farm	QC	2011/11	39	58.5	Cartier Énergie Éolienne
Gros Morne Phase I	QC	2011/12	67	100.50	Cartier Énergie Éolienne
Lameque Wind Power Project	NB	2011/03	30	45.00	Acciona Lameque GP Inc.
Glen Dhu (2011 commissioned)	NS	2011/03	18	41.40	Shear Wind
Watts Wind	NS	2011/03	1	1.50	Watts Wind Inc.
Spiddle Hill Phase I	NS	2011/07	1	0.80	Colchester-Cumberland Wind Field Inc.



Canada's current installed capacity:

5,403 MW

Current as of March 2012

WINDVISION 2025
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WIND FACTS

PRICING

Wind energy is generating clean electricity, new jobs and economic development opportunities in communities across the country. While wind energy has enjoyed growing success in many countries for several decades, it is a relatively new contributor to the power system here in Canada. As such, it is natural for people to ask questions. As a responsible industry, we are committed to ensuring Canadians have the most up-to-date factual information on wind energy.

Wind Energy: A Reliable and Affordable Source of Power

Wind is an affordable source of new energy supply that protects against unpredictable fuel and carbon costs.

Any new source of electricity generation is going to cost more than the current generating plants, built and paid for decades ago, that now supply most of Canada's electricity. Among today's options, wind energy stacks up well. Wind is extremely competitive with new installations of coal, hydro, and nuclear power, when the cost of health and environmental impacts are considered.[1, 2]

The price we pay for wind today, though, is only one part of its value proposition.

Wind turbines do not use fossil fuels for producing electricity; this means that once a wind farm is built, the price of the electricity it produces is set and remains at that level for the entire life of the wind farm. In a time of increasing price volatility of traditional sources of energy, the price stability from wind farms

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provides important protection for consumers. There is no guarantee, for example, that natural gas will remain at today's low prices over the long term. Natural gas prices vary over time with changes in supply and demand – just a few years ago electricity from natural gas-fired projects was more expensive than electricity from wind.

Because wind requires no fuel, produces very little waste and consumes barely any water during operation, it also provides a hedge against the risk and uncertain costs of complying with future greenhouse gas emission restrictions and other environmental regulations.

Jurisdictions in Canada and around the world have developed strategies for capturing the value that wind energy brings to a power system. Feed-in tariffs (FIT), used successfully in countries like Germany, Spain, and France, are a well-established way of creating a stable market for renewable energy investment by providing predictable revenue to wind producers and increasing their access to financing. Ontario's FIT program is the first of its kind in North America, and is helping attract billions of dollars in new investment to the province.

WHAT DO THE EXPERTS SAY?

In 2010, the Ontario Power Authority paid electricity resource costs of $317 million for conservation programs, and $269 million for renewables. That is a lot of money – but you must realize that it is recovered over a total Ontario consumption in 2010 of 142 terawatt hours (that's 142,000,000,000 kWh), which amounts to 0.4 cents per kWh (split roughly equally between conservation and renewable subsidies). So the cost of conservation and all the renewable subsidies in 2010 amounted to 0.4 cents of the 13 cents we paid for a kWh in our homes.[3]

"Once the investment is made, you have a secure price for that power over many, many years. So we're looking for certainty in the electricity supply. This is one way to take out some of the volatility in the marketplace."

Nova Scotia Premier Darrell Dexter, March 2010

The California Energy Commission calculates that a new gas-fired combined cycle power plant has a levelized cost of operation of $115 per MWh.[4] Add $20/MWh to cover the estimated cost of environmental and health damages[5] and the total is $135/MWh – exactly the same as Ontario's feed-in tariff rate for onshore, non-community based wind energy.

Interested in learning more?

The Oil Drum, an energy information website, analyzes the cost of wind, the price of wind, the value of wind (**www.theoildrum.com/node/5354**). Lazard's Levelized Cost of Energy Analysis (**www.blog.cleanenergy.org/files/2009/04/lazard2009_levelizedcostofenergy.pdf**) and the World Economic Forum's report on Green Investing 2011 (**www.weforum.org/reports/green-investing-2011**) compare the cost of some generating technologies.

Sources:

1. Mining coal, mounting costs: The life cycle consequences of coal. Centre for Health and The Global Environment, Harvard Medical School, January 2011
2. Behind the switch: pricing Ontario electricity options, The Pembina Institute, July 2011
3. The True Cost of Renewable Energy and Conservation, Environmental Commissioner of Ontario, March 2011. http://www.eco.on.ca/blog/2011/03/22/the-true-cost-of-renewable-energy-and-conservation/
4. Comparative Costs of California Central Station Electricity Generation. (California Energy Commission, January 2010). Table 4, page 3
5. Cost Benefit Analysis: Replacing Ontario's Coal-Fired Electricity Generation. (DSS Management Consultants, RWDI Air Inc; April 2005), page ii.

WIND FACTS

PROPERTY VALUES

Wind energy is generating clean electricity, new jobs and economic development opportunities in communities across the country. While wind energy has enjoyed growing success in many countries for several decades, it is a relatively new contributor to the power system here in Canada. As such, it is natural for people to ask questions. As a responsible industry, we are committed to ensuring Canadians have the most up-to-date factual information on wind energy.

Wind Energy: Providing Significant Local Economic Benefits

There are a number of factors that impact property values and it is difficult to isolate the potential impact of any single variable. What we do know is that multiple studies have consistently found no evidence that wind energy projects around the world are negatively impacting property values. In fact, wind energy projects provide new sources of stable revenue for municipalities and landowners in the form of taxes and lease payments.

A 2010 study conducted in Chatham-Kent, Ontario, found there was no statistically relevant relationship between the presence of a wind project and negative effects on property values.[1]

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