WINDVISION 2025

POWERING CANADA'S FUTURE

BACKGROUNDERS ON WIND ENERGY

canwea

CANADIAN WIND ENERGY ASSOCIATION | ASSOCIATION CANADIENNE DE L'ÉNERGIE ÉOLIENNE

INTRODUCTION

Since the Egyptians launched the first sail boats more than 5,000 years ago humans have been harnessing the power of wind. As early as the 7th century, people were using windmills for grinding grain, pumping water and other industrial purposes . By 1900 more than 6 million windmills were in use for farm irrigation across North America. Electricity from wind power was the next big development. The first commercial scale operations were built in Denmark in the 1920s and the technology is now highly advanced.

Today, wind power is a clean, reliable source of electricity in more than 70 countries. It is not only a green source of electricity; it is also becoming a low-cost option for generating electrical power that is delivering substantial benefits in terms of jobs, investment and rural economic development. That's why governments around the world have established ambitious targets for extremely rapid wind energy growth. They know that making power from the wind is technically feasible, economically viable and environmentally preferable.

At the end of 2007, world-wide wind generating capacity stood at 94,000 MW. By 2020, close to $1 trillion in global investment is projected to bring global installed capacity to more than 500,000 MW. Will Canada be a major player in this green energy revolution?

At this time, Canada trails most of the developed world when it comes to wind power, but the Canadian Wind Energy Association (CanWEA) is working to close the gap. We are a national, not-for-profit organization and the voice of Canada's wind energy industry. We promote responsible and sustainable growth of wind energy in Canada and our almost 400 members include wind turbine and component manufacturers, project developers and owners, utilities and companies providing a broad range of services to the wind industry.

CanWEA believes that Canada must start thinking big about wind energy so that we can capture our fair share of the benefits that are coming from the explosive world-wide growth in this industry. In order to join the global leaders in wind energy, Canada should seek to produce 20 percent or more of its electricity from wind by 2025. This exciting vision is not only practical from a technical perspective, there is also a very strong business and environmental case for making wind power a priority in our country.

This document will tell you more about our WindVision 2025 and how thinking big about wind energy will pay off for Canadians.

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SECTION 1

CANADA IN THE WORLD OF WIND ENERGY

The pace of new wind power development has stepped up dramatically in Canada. In the five years between 2003 and 2008, Canada's total installed wind energy capacity grew by more than 500 percent, from 322 MW to 1,876 MW.[1] Despite this impressive growth, however, wind energy is growing faster in many other countries, and compared to many European countries and the United States, we are not yet serious players in the wind energy game. At the end of 2007 wind supplied less than 1 percent of our electrical power, leaving Canada outside the global top ten in installed wind energy capacity and in 16th place in terms of wind penetration.[2]

WHY DOES CANADA LAG BEHIND?

IT'S PARTLY ABOUT PRICE

Several factors explain why Canada has been slow to embrace wind power compared to other countries. Certainly, electricity prices have had a lot to do with it. Historically, electrical power has been cheap in Canada compared to other industrialized countries, so it has taken longer for wind energy to become cost-competitive here.

Canada's relatively cheap electricity comes from our abundant hydroelectric and coal resources and the fact that we have been much slower than others to factor the environmental costs of making electricity into its price. While public concerns about future electricity supplies, increasing electricity prices and the environmental burden of power generation are fairly new in this country, these have been top of mind issues in other countries for many years. As a result, Canadians have not been thinking big about wind energy because until recently, we didn't think we had to.

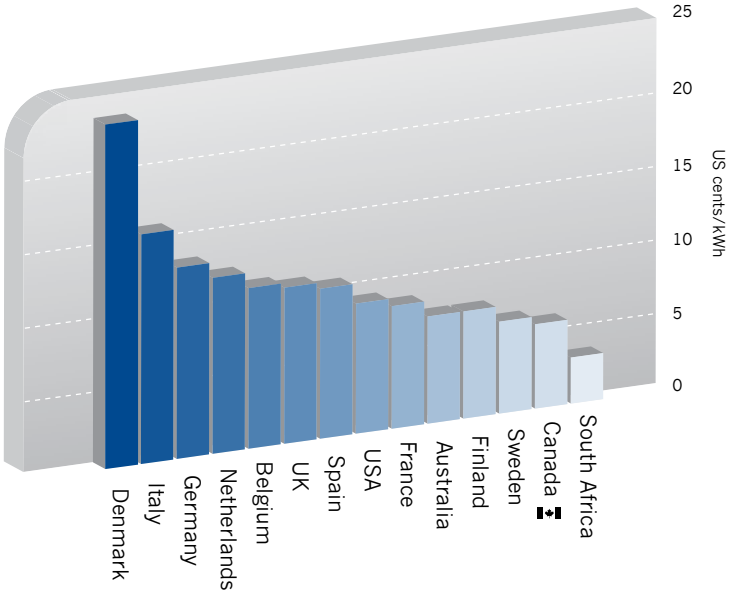
IT'S REALLY ABOUT POLICY

Around the world, governments have always taken steps to influence the price of electricity. In the past, this was often done to make power as cheap as possible for consumers. Today, however, more and more countries are using public policy to ensure that electricity prices reflect the relative environmental impacts of different generating technologies. Some of these policies include tax concessions, incentive payments, minimum green energy content requirements, price guarantees and measures which force power generators to build the cost of pollution and GHG emissions into the price of the electricity they produce. Governments are putting these policies in place to respond to growing environmental concerns among their citizens and voters. They are also very much aware of the employment and industrial development spin-offs from new, cleaner electricity generation.

In Canada, neither Ottawa nor the provinces have acted as forcefully as governments in other countries to encourage investment in wind power and other emerging renewable energy technologies. So, it's no surprise that we trail much of the world in terms of wind power generation. Countries like Germany, Spain and Denmark kick-started their wind energy industries by guaranteeing producers access to the electrical grid at minimum fixed prices for their power. These policies gave developers a clear and certain picture of the revenues which their wind farms would produce. With this advantage, investors poured huge amounts into wind energy. By 2007, Europe's installed wind capacity stood at 57,000 MW – more than half of the world's 94,000 MW of wind power.[3]

FIGURE 1

2007 INTERNATIONAL ELECTRICITY COST COMPARISON (US CENTS/KWH)



Source: NUS Consulting Group International Electricity Report and Cost Survey 2006-2007

In recent years, the European Union has reinforced individual country policies by mandating continent-wide renewable energy targets of 20 percent by 2020. Since sectors like transportation will take longer to adapt to renewables, the electricity system will likely have to do significantly better than 20 percent renewable content to meet the broad EU target. There is no doubt that wind energy will account for the overwhelming majority of Europe's new renewable electricity production. Indeed, in 2007, the Europeans installed more wind energy capacity than any other form of electricity generation. EU policy has also produced the world's most advanced carbon pricing system which favours producers of green, emission-free electricity.

Recent experience in the United States also speaks leagues to the power of government policies to encourage wind investment. The Americans are adding wind capacity faster than any other country (more than 15,000 MW from 2005 to 2008) and in mid 2008, the U.S. became the world's largest wind power producer. Federal and state governments use different tools to encourage wind production. Under the federal government's Production Tax Credit (PTC), wind energy producers receive a tax benefit equivalent to 2.1 cents per kilowatt hour of clean, pollution free energy for the first 10 years of production. The PTC has been the key driver of US investment in wind power since 1992.

Federal government support for wind energy development is quite different in Canada and the United States. Our ecoEnergy incentive is worth less than half the American Production Tax Credit (PTC). Our producers get 1 cent for each kWh while wind energy producers in the U.S. receive 2.1 cents per kWh. Plus, the American incentive is delivered after tax, while ours work on a pre-tax basis.

In the American Congress, there is broad bi-partisan support to extend the PTC while the fate of the ecoENERGY incentive beyond 2009 is unknown.

More recently, state governments have been adopting Renewable Portfolio Standards (RPS) which require utilities to ensure a certain portion of their electricity is produced from renewable sources like wind and solar power. RPS have now been adopted in 26 states. Levels vary from state to state but are generally in the 20 percent range and go as high as 33 percent in California.[4] As more and more states have opted for RPS, a market in renewable electricity credits has evolved. This allows utilities which have surpassed their minimum renewable content to sell their surplus to utilities which have not developed adequate sources of clean power to meet state RPS requirements. This ability to buy and sell surplus capacity has also helped drive significant investments in wind generating capacity.

One thing that is abundantly clear from experience around the world is that government policy counts. The countries with favourable tax and regulatory regimes are the ones that are adding capacity fastest and securing the lion's share of rapidly growing global investment in wind energy. At this time, the leading investment destination is the United States and many countries are more competitive destinations for wind energy investment than Canada.

GOALS ARE IMPORTANT

Around the world, many countries as well as multi-national organizations like the European Union have established goals for the development of their renewable energy sectors including wind. In some cases, Germany and Spain for example, experts believe it may be possible to achieve wind penetration levels as high as 25 percent to 30 percent by 2020.[5] In the US, there is no formal national goal for renewables, although the United States Department of Energy has recently issued a report indicating that 20 percent wind by 2030 is a challenging but feasible goal.[6]

Setting national targets with respect to wind energy penetration is important in order to focus attention on what is technically feasible and desirable in terms of wind energy's share of the overall electricity mix. Once targets are embraced by all key players, they provide a focus for developing the comprehensive strategies and policies needed to achieve that level of penetration.

TABLE 1

RELATIVE ATTRACTIVENESS OF DIFFERENT COUNTRIES FOR WIND ENERGY INVESTMENT.

Rank[1]		Country	Wind index	Onshore wind	Offshore wind
1	(1)	US[2]	71	77	56
2	(4)	Germany	68	67	70
3	(4)	China	68	72	59
4	(2)	India	67	76	44
5	(2)	UK	66	64	71
6	(6)	Spain	65	70	50
7	(7)	Canada	63	67	50
8	(11)	Ireland	60	60	59
9	(8)	Greece	59	63	49
9	(8)	France	59	60	54
9	(8)	Italy	59	64	46
12	(11)	Portugal	58	63	46
13	(13)	Australia	53	56	44
14	(16)	Denmark	52	49	60
14	(14)	Sweden	52	52	52
14	(14)	Belgium	52	50	57
16	(16)	Netherlands	51	51	50
16	(16)	Poland	51	53	45
19	(19)	Norway	50	50	50
20	(20)	New Zealand	47	51	38
21	(21)	Japan	46	48	40
22	(22)	Brazil	45	49	35
23	(23)	Turkey	37	38	33
24	(24)	Finland	36	36	37
25	(25)	Austria	30	41	N/A

Source: Ernst & Young
1 Ranking in Q4 2007 Long-term wind index in brackets
2 This indicates US states with Renewable Portfolio Standards (RPS) and favorable wind regimes

WIND ENERGY IN CANADA – LOOKING FORWARD

Canada trails much of the world in wind power generation capacity largely because in other countries the need to develop wind and other renewables was becoming clear in the 1990s. Today, Canadians are waking up to the potential wind holds to develop a new industrial sector, meet our environmental requirements and produce a sustainable electricity future. Our challenge now is to match what other countries have done in making good on the promise of wind.

There is nothing to stop Canada from joining the growing club of nations who have set their sights on generating 20 percent of electricity requirements from wind and other renewables. However, one thing is abundantly clear. We won't reach this level unless our government put the targets, strategies and policies in place required to get us there.

SECTION 2

WIND ENERGY IS COST-COMPETITIVE

When utilities need to build new sources of electricity supply, they have to choose among technologies which have different costs structures, and logically, they seek to minimize those costs, while maximizing system flexibility and reliability. This has led Canada to get 60 percent of its electricity from hydropower and a significant portion from inexpensive coal-fired generation.

For many years, wind energy was not cost-competitive with conventional power generation. From the 1980s until the early 21st century, however, the costs of generating electricity from wind energy fell by 80 percent as wind turbines became larger and more efficient. Today, electricity produced from wind energy is cost-competitive with electricity generation from natural gas and has significantly closed the gap with respect to other generating technologies.[7]

The improved cost-competitiveness of wind energy is not only a product of the cost of wind energy. It is also a reflection of the fact that the costs of other generating technologies are increasing. The costs of generating electricity from fossil fuels like coal and natural gas is increasing. Why? One key factor is rising fuel costs. In the first six months of 2008, for example, the price of coal more than doubled while natural gas rose by a third.[8] While nobody can be certain what these fuels will cost years hence, many planning authorities are making assumptions similar to those of the California Energy Commission which believes that coal, natural gas and uranium prices will all increase faster than the rate of inflation for decades to come.

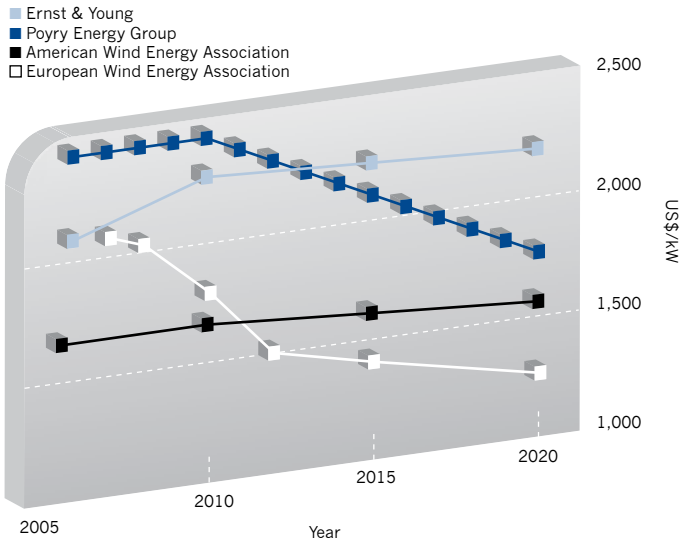
There is no getting around the fact that higher prices for the fuels going into power plants will mean more expensive electricity coming out. On top of this, it is widely expected that Canadian governments will take steps to force power generators to pay for the burden they impose on the environment through GHG emissions, pollution and other waste through measures like carbon pricing A price on carbon will have a significant impact on the cost-competitiveness of coal and a more modest impact on natural gas. However, if utilities shift out of coal in favour of cleaner burning natural gas, the surge in demand for gas will mean continued upward pressure on prices.

THE FUTURE COST-COMPETITIVENESS OF WIND ENERGY

While the costs of generating electricity from conventional energy sources are likely to increase in the years ahead, it is expected that the costs of wind generation will fall or remain stable as technological advances continue within the industry. Figure 2 shows projected wind energy cost trends under four different studies.

FIGURE 2

ESTIMATES OF FUTURE ONSHORE INSTALLED COSTS FOR WIND ENERGY



Source: Wind Energy: Economic Issues. David Millborrow for CanWEA. 2008

ICF International has conducted a study for CanWEA comparing the future generating costs of different electricity generating technologies. They concluded that even without a carbon price, a wind farm constructed in 2025 would produce electricity for a lower cost than electricity generated from peaking type natural gas, hydro, and coal plants that utilized carbon capture and storage. This analysis assumed that the costs of wind generated electricity will fall by 20 percent over the next 17 years. This is a conservative assumption because it would still leave wind costs higher than they were three years ago, before a global wind turbine shortage caused a spike in wind turbine prices.

The same study also looked at the cost-competitiveness of wind energy in 2025 if a carbon price of $36 / tonne were in place at that time. Once again, this is a conservative assumption because carbon prices in Europe's carbon market have already exceeded that level on occasion. In this scenario, the only technologies that produce electricity more cheaply than wind energy are biomass and coal with carbon capture and storage.

In addition to its improving cost competitiveness, wind offers investors another valuable benefit – certainty with respect to downstream costs. Once a wind farm is built, its generation costs are clear and remain virtually fixed for decades. Unlike coal or gas there are no volatile fuel costs or carbon charges to factor in.

SECTION 3

WIND ENERGY AND CLIMATE CHANGE

In its Fourth Assessment Report, released in late 2007, the United Nation's Intergovernmental Panel on Climate Change (IPCC) cited "unequivocal" evidence that greenhouse gas (GHG) emissions are the cause of climate change and warned that "unless humans can get greenhouse gas emissions under control, especially CO_2 by 2015, there will be little hope that we can avoid serious and dangerous consequences." To head off a worst case scenario, the IPCC concluded that global GHG emissions must be cut at least in half by 2050 and that significant reductions must occur in the next 10 to 15 years.[9]

Heeding this dire warning will require electricity producers around the world to fundamentally rethink the way they do business. No realistic plan to reduce GHG emissions can overlook the fact that electricity produced from fossil fuels pump more CO_2 into the atmosphere than any other activity. The United States, for instance, produces 22 percent of global CO_2 emissions. About 40 percent of US emissions come from the electricity sector with 83 percent coming from coal-fired generators.[10] Emerging industrial powers like China and India rely even more heavily on coal and, if current trends continue, will account for 57 percent of the world's coal consumption by 2030,[11] most of which will be for electricity production.

The growing world-wide use of wind power is one of the few bright spots on the climate change horizon. The world's biggest GHG producer, the United States, is turning to wind power in a very big way and now leads the world in installed capacity. In 2007, 35 percent of new US generating capacity came from wind[12] and this growth is expected to continue. There have also been encouraging developments in China which is the world's fastest growing wind energy market and now stands fifth in the world in installed wind energy capacity. India has become the world's fourth largest market for wind power and projections are for continuing steady growth.[13]

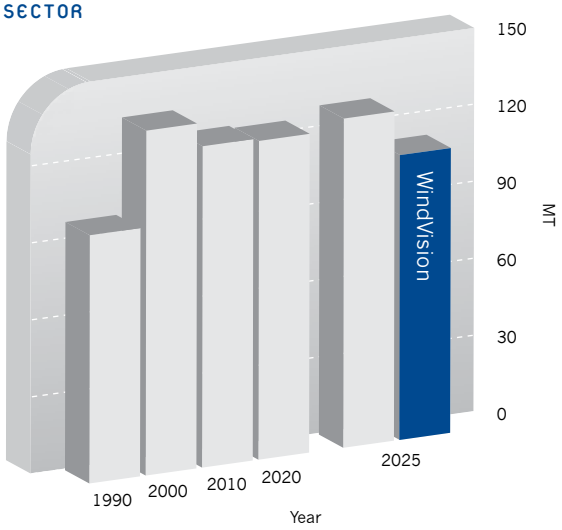
Despite these encouraging developments, the world's electricity producers will have to move much more decisively to lower GHG emissions, if the world is to come anywhere near to meeting the IPCC's call for a 50 percent reduction by 2050. To achieve reductions of this order, the International Energy Agency concluded in a 2008 study that a huge investment in wind energy along with energy efficiency measures and fuel-switching would be required over the next 10 to 20 years. The IEA projects that about 17 percent of global electricity production could come from wind by 2050. This would lead to enormous reductions in GHG emissions of which more than a third would be in India and China.[14]

In Canada, the electricity system is responsible for about 17 percent of our greenhouse gas emissions. Wind, hydro and nuclear generation produce no GHG emissions. Natural gas is the next choice from a GHG perspective while coal, diesel and heavy oil trail far behind. Since it can take many years to bring new hydro and nuclear facilities on stream, shifting out of coal generation into wind and natural gas along with efficiency measures offers the only route to significant reductions in GHG emission from Canada's electricity system by 2020 which the IPCC has warned is essential.

Figure 3 shows that GHG emissions from the electricity sector grew sharply through the 1990s, peaked in 2000 and have now dropped slightly as utilities shift to less GHG intensive forms of electricity generation. However, decreases in the GHG intensity of electricity generation are expected to be overwhelmed by electricity demand growth by 2015, leading to increases in total GHG emissions from the electricity sector to a level of 126 MT per year in 2025. That would represent a 29 percent increase over 1990 emissions levels.[15]

FIGURE 3

GHG EMISSIONS FROM CANADA'S ELECTRICITY SECTOR



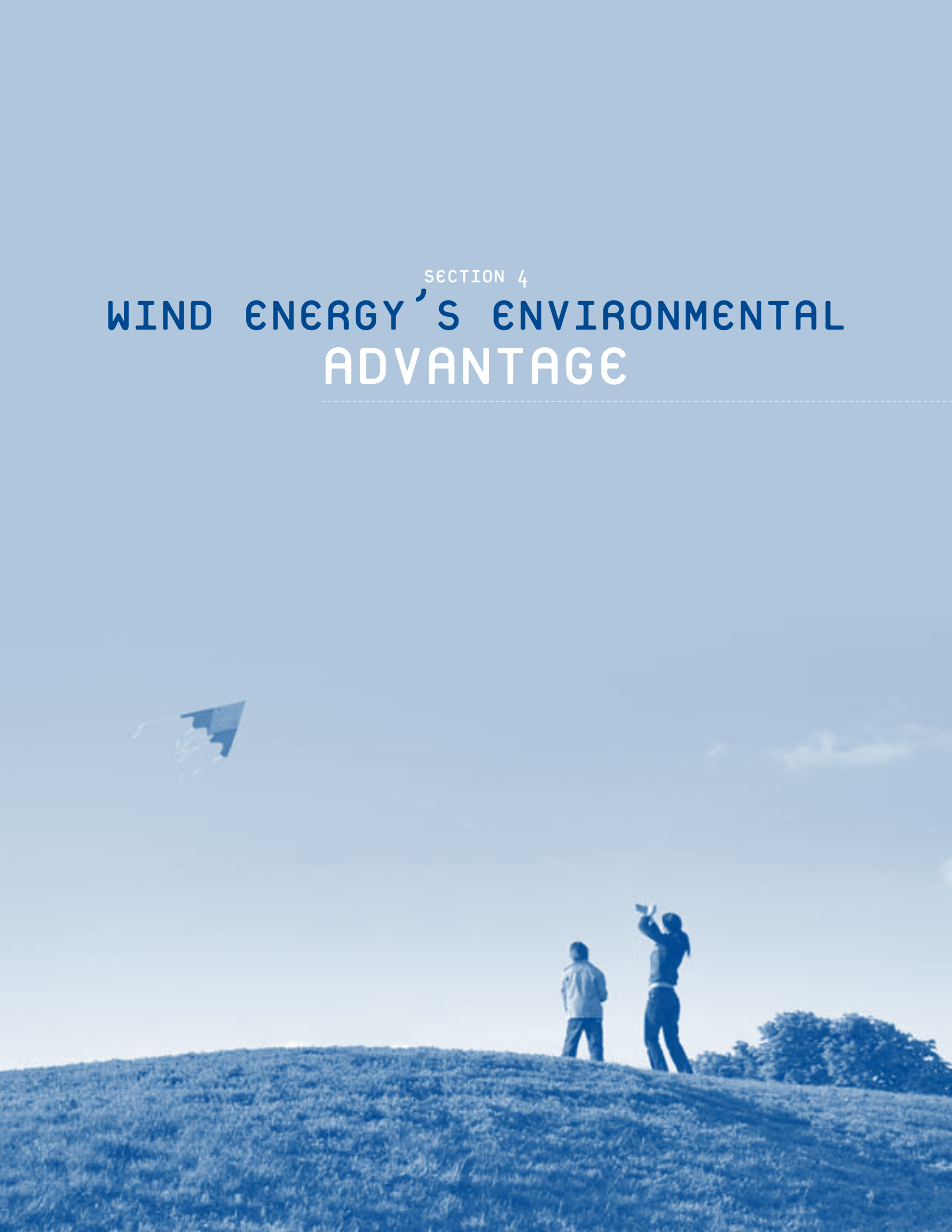
Source: Turning the Corner, Canada's Energy and GHG Emissions Projections, Reference Case 2006-2020

CanWEA believes that Canada can and must do better. There is a strong consensus among climate scientists that stabilizing GHG emissions will not be good enough and that substantial reductions will be required to head off serious consequences. That's where wind energy can play an important role. If we start to think big about wind energy like the US, China, India and others are doing, then Canada's electricity sector can move to the front lines in the fight against climate change.

Achieving CanWEA's vision of producing 20 percent of Canada's electricity supply from wind by 2025 could reduce GHG emissions by 17 MT or 13 percent of what they would otherwise be at that time. While this would still leave Canada's GHG emissions from the electricity sector above 1990 levels, it represents a significant contribution to addressing Canada's climate change challenge. Nonetheless, it also serves to demonstrate that there are no "silver bullets" to address climate change. We will need to substantially increase our use of other forms of low and no-carbon electricity generating technologies as well.

SECTION 4

WIND ENERGY'S ENVIRONMENTAL ADVANTAGE



No matter how you look at it, wind power is the natural choice for limiting the environmental impact of our electricity system and maximizing the use of wind energy will provide significant benefits to the planet.

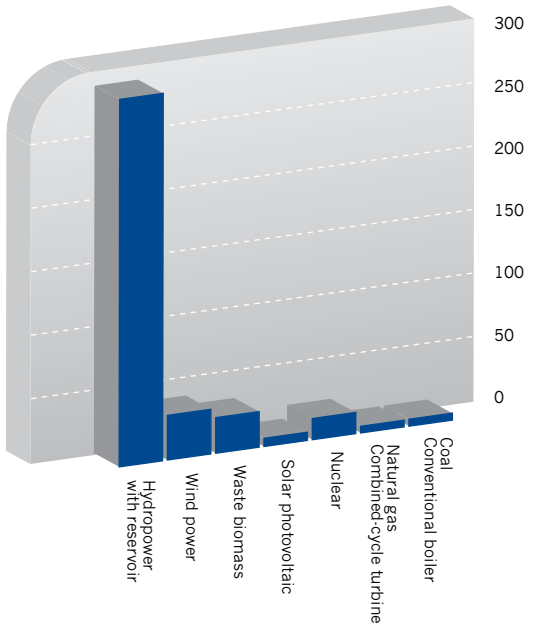
COMPARING ENVIRONMENTAL IMPACTS

To make useful comparisons about the environmental impacts of different ways of generating electricity, we need to do full cost accounting over the life-cycle of a power plant. In other words we have to identify the environmental burden that comes from obtaining the fuel source, building and operating the facility as well as closing it down at the end of its productive life.

One way to measure environmental performance in the electricity system is to look at the 'energy pay-back ratio' for different generating technologies. Figure 4 tells us how much electricity is produced during a plant's normal lifespan divided by the energy it takes to build, maintain and fuel it. While building hydro dams and generating stations involves huge amounts of energy and construction materials, they also produce huge amounts of electricity for up to 100 years. So, in terms of energy payback, hydro sits in first place with a ratio of 280. Compared to hydro, wind farms involve modest inputs of energy and materials, and produce modest amounts of power. Still, with an energy payback ratio of 34, wind energy takes second place while nuclear, gas and coal generation trail the pack.

FIGURE 4

ENERGY PAYBACK RATIO OF ELECTRICITY GENERATION OPTIONS BASED ON LIFE-CYCLE ASSESSMENTS



As they operate, all conventional electricity technologies produce unwanted by-products that are harmful to the environment. For example, coal and gas-fired plants give off pollution and huge amounts of GHGs. In fact, in 2005, Canada's fossil-fuel fired power plants produced 132 Megatonnes of CO_2,[16] about 17 percent of Canada's total GHG emissions for that year. They also produced 34 percent of our toxic mercury emissions and 25 percent of our emissions of sulphur oxides.[17] These emissions impose a cost on all of us. Some are harmful to our health and our ecosystems while others are the cause of climate change which is a serious threat to the entire planet. Although these costs are very real, they are not yet reflected in the price of electricity, and represent a subsidy to coal and natural gas-fired electricity generation.

Nuclear power also puts a burden on the environment. Huge amounts of materials go into building nuclear facilities and they use huge amounts of fresh water for cooling once in operation. Of greater concern, however, is the 6,800 cubic metres of highly radioactive waste which Canada's nuclear plants have produced since the 1950s. This waste will be extremely dangerous for thousands of years and currently sits in temporary storage facilities near reactor sites. While imposing no immediate threat, it must be regarded as a contingent environmental liability until a safe, permanent facility for storing or reprocessing spent fuel and other nuclear waste is built.

Other electricity technologies, such as reservoir hydro projects, can also impose a burden on the environment through flooding and destruction of habitat. With wind power, however, there is virtually no burden to speak of.

In 2008 the Canadian Medical Association stated that smog will contribute to the premature deaths of 2,700 Canadians, put 11,000 in hospital and cost the economy and health-care system $1 billion in 2008.

WHAT ABOUT SOUND, VISUAL IMPACT AND HARM TO WILDLIFE?

There is no doubt that a wind farm's environmental footprint is very small compared to a coal, gas or nuclear facility or even a hydro station. That is not to say, however, that no concerns come up when developers release plans for a new wind farm.

Sound is one factor that is often raised when wind farm proposals go through the environmental assessment process. As the blades of a wind turbine cut through the air, they produce a "whooshing" sound. However, noise levels decline dramatically as distance from a wind turbine increases. Studies show, for example, that at 350 metres the sound of a wind turbine can already be as low as 35 to 40 decibels, about the same level as a quiet bedroom or as the naturally occurring background noise in rural locations during night-time.[18] Clearly, the best way to address concerns over sound is proper wind farm siting that ensures that sound levels at residences are appropriate and regulations are in place to ensure this. This does not imply a standard distance between a wind turbine and a residence – the appropriate distance will depend on many factors including background noise, local topography and the type of wind turbine.

Potential neighbours also express concerns about the visual impact of a wind farm. Wind turbines are difficult to hide. They stand more than 25 stories tall and they are often grouped in clusters. It is also true that beauty is in the eye of the beholder. In Europe, where there are lots of wind farms and population density is high compared to Canada, studies show that people who live closest to the turbines have a more positive attitude about wind power than those living further away. Still, to mitigate concerns that wind farms will spoil the view, wind energy project developers must consult with and work with local residents to understand and work to address any concerns.

A final concern about wind farm development is its potential impact on wildlife. It is possible that poorly sited wind turbines could harm bird and bat populations. Environmental assessment processes, however, focus extensively on minimizing any potential impact on avian life and this process is working. US surveys have concluded that the average wind turbine kills about 2 birds per year and that buildings, house cats, and the impact of climate change on natural habitats represent a much larger threat to birds. While there have been isolated cases of significant bat kills at a small minority of wind farms, the cause of this is not yet fully understood. In response, the wind energy industry is collaborating with environmental organizations, governments and universities to fund research to better understand the problem and identify solutions.

"Audubon strongly supports properly-sited wind power as a clean alternative energy source that reduces the threat of global warming. When you look at a wind turbine, you can find the bird carcasses and count them. With a coal-fired power plant, you can't count the carcasses, but it's going to kill a lot more birds."

– John Flicker, President, the National Audubon Society

SECTION 5

CANWEA'S 2025 TARGET FOR WIND ENERGY

CanWEA's WindVision 2025 calls for Canada to meet 20 percent of its total electricity demand from wind energy in 2025.[19] From a starting point of less than 1 percent in 2008, that is an ambitious goal. However, our members believe it is a goal we should strive for and one that we can reach.

CanWEA is targeting a 20 percent wind penetration level by 2025 for two reasons. First, it would put us in good company. Around the world, governments are embracing renewable energy and see wind energy as the most advanced of emerging renewable energy technologies. Denmark is already generating 20 percent of its electrical power from wind and electricity planners in Spain and Germany have set their sights on eventual wind penetration levels in the 25-30 percent range.[20] The European Union has mandated that 20 percent of all energy will come from renewable energy sources by 2020 and in the electricity sector these targets will largely be met through expanded use of wind energy. Closer to home, in an extensive 2008 technical study, the U.S. Department of Energy concluded that 20 percent wind penetration was technically sound and achievable by the year 2030.[21] In addition, 26 American state governments have already adopted Renewable Portfolio Standards, some of which will push their electricity grids toward 20 percent wind penetration.[22]

It is clear that many countries believe a 20 percent wind target is practical and desirable. But there is an even more compelling reason for Canada to start thinking big about wind – we are going to need the power. Canada's electricity demand is expected to grow by 36 percent from 2008 to 2025 by which time we will be consuming 815 TWh of electricity per year. That is 214 TWh more than we produce today, not including imports. On top of this, between now and 2025, 109 TWh or 15 percent of our current electricity production will reach the end of its design lifespan and should be replaced. So, to keep supply in step with demand, over the next 17 years Canada will have to build new facilities to generate 323 TWh electricity per year. That's more than half our current production.[23]

Bringing 323 TWh of new capacity on stream by 2025 will require the equivalent of four massive hydro projects on the scale of Hydro Quebec's La Grande Riviere complex or 13 nuclear stations the size of Ontario's Darlington facility. This new power will not all come from hydro, nuclear, or wind. It will require a mix of generating technologies.

CanWEA believes half of the new electricity capacity that Canada needs to build by 2025 can come from wind energy. It is a proven technology that can provide reliable, economically viable, environmentally sound electricity on the scale we require that we can build in time to meet our needs. In physical terms it would mean Canada would have approximately 22,000 wind turbines at about 450 locations across the country with a total capacity of 55,000 MW. This would require a steady, but reasonable ramping up of our current pace of wind farm development. Figure 5 illustrates one potential path we could follow to reach the 20 percent goal.

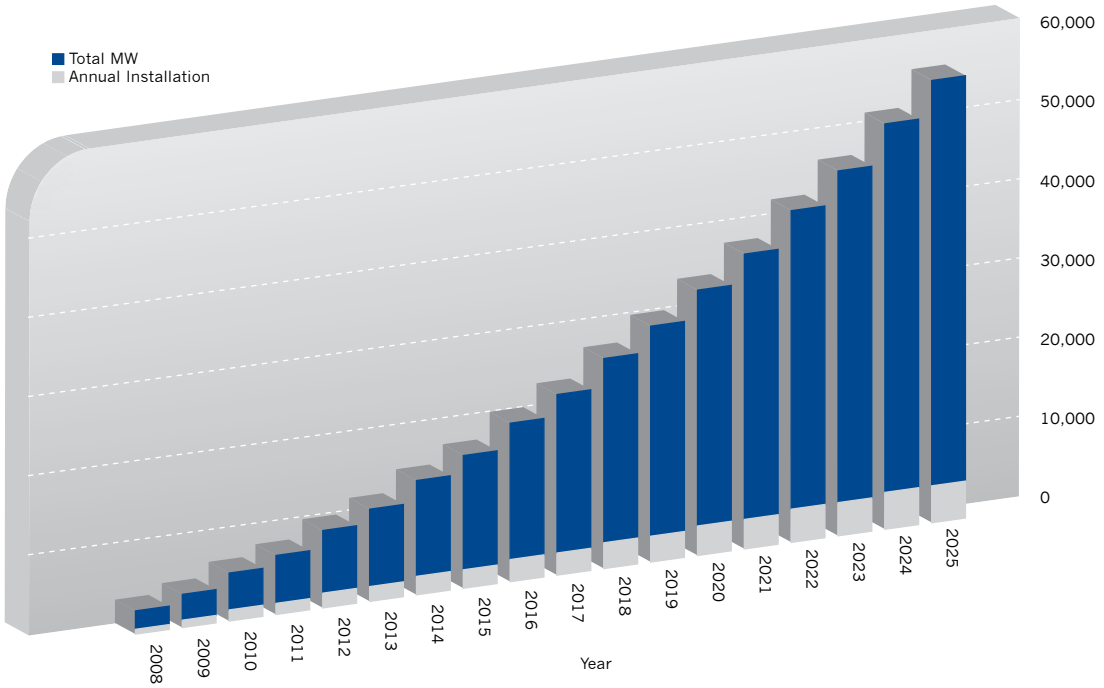
Figure 5 illustrates that under the CanWEA vision the steepest growth in capacity would begin in 2020, when Canada would have to add 3,500 MW annually and continue to 2025 when we would be adding 5,000 MW per year. To put this figure in perspective, Spain was already adding more than 3,500 MW to its installed wind energy capacity annually in 2007 and expects to sustain this pace for the coming decade.[24]

Achieving CanWEA's vision would require Canada to add approximately 400 MW of additional capacity per year to the growth path we are currently on through 2015. It would also require us to double the rate of new installations currently projected by the federal government through to 2020. Other countries have shown this can be done.

To achieve CanWEA's WindVision 2025, our three levels of government, electrical utilities, project developers, investors and consumers have to get on the same page and work with common purpose to build a clean, reliable electricity system that will meet our needs in the future. It's time for all of us to start thinking big.

FIGURE 5

THE CHART BELOW ILLUSTRATES HOW AN ORDERLY PROGRESSION IN CANADA'S WIND ENERGY PRODUCTION WOULD ALLOW THESE TARGETS TO BE MET:



SECTION 6

WIND ENERGY IN CANADA

Although Canada is a relative newcomer to the world of wind energy, we have come a long way in the last few years. From 2000 to 2007 our total installed capacity grew from 137 MW to 1,846 MW. Wind power now supplies about 0.8 percent of total Canadian electricity demand, enough to power 569,000 homes and there is more on the way. In 2008, we will add another 600 MW of new wind generating capacity and likely an additional 1,000 MW in 2009.

Today, there are 83 wind farms operating across the country with 1,410 turbines. By the end of 2008, every province plus the Yukon Territory will be generating some electricity from wind. As Table 2 shows, Alberta led the country in total installed capacity at the end of 2007, followed closely by Ontario. However, it is expected that Ontario will move into the lead by the end of 2008, with Quebec competing with Ontario for first place after 2010.

TABLE 2
INSTALLED WIND ENERGY CAPACITY AND FUTURE PLANS BY PROVINCE (AS OF MID-2008)

Province	Installed Capacity 2007	Planned Additions to Capacity
Newfoundland and Labrador	390 KW	54 MW currently planned or under construction with the first major windfarm to be completed in 2008. The province has identified the potential for a total of 80 MW of wind energy on the island of Newfoundland and is exploring the much more significant potential for wind energy in Labrador.
Nova Scotia	59 MW	It is expected that Nova Scotia's Renewable Energy Standard will result in the installation of up to 580 MW of wind energy by 2013.
Prince Edward Island	72 MW	An additional 79 MW is expected online before the end of 2008. The province is currently examining the possibility of building up to 500 MW of wind energy for both its own needs and export.
New Brunswick	0 MW	An initial 96 MW wind farm is to be completed before the end of 2008. The government has set a formal target of 400 MW by 2010 and has now contracted much of this power. It has also recently commissioned studies to examine the potential of moving to more than 2,000 MW of installed capacity by 2025.
Quebec	422 MW	The government has set a formal target of 4,000 MW of installed capacity by 2016 with an additional 100 MW of wind energy for every 1,000 MW of new hydroelectric capacity.
Ontario	521 MW	The Ontario Power Authority's Integrated Power System Plan has set a target of 4,600 MW of wind energy by 2020.
Manitoba	104 MW	Currently negotiating contracts for 300 MW of wind energy. The government has set a formal target of 1,000 MW of installed wind energy capacity by 2018.
Saskatchewan	171 MW	The government has established a target of 300 MW of wind energy by 2011.
Alberta	524 MW	The province has no official targets but is designing transmission upgrades to accommodate 3,000 MW of new wind energy development in Southern Alberta.
British Columbia	0	The first wind turbines in BC are expected to be operational before the end of 2008 and 325 MW of wind energy is currently planned or under construction. The BC Government's new energy targets could result in the installation of up to 2,000 MW of wind energy.
Yukon	810 KW	
Canada	1,846 MW	If current provincial targets or plans are achieved, Canada is projected to reach 12,000 MW of installed capacity by 2016 and 18,000 MW by 2020.

This table presents the latest data on provincial wind power as of August 2008 as compiled by the CANMET ENERGY TECHNOLOGY CENTRE and CanWEA. However, the figures can change rapidly. BC, Ontario and Quebec all have outstanding requests for proposals which will likely result in new contracts for wind power in 2009. To stay on top of these developments, visit canwea.ca

In 2008, less than 1 percent of Canada's electricity came from wind. That was good enough for 16th place in the world. But it is clear we can do much better and in some places, we are. In 2007 Prince Edward Island was already meeting 15 percent of its electricity demand from wind and this was expected to exceed 25 percent by the end of 2008.

LOOKING TO THE FUTURE

As Table 2 makes clear, all provinces have projects underway that will make wind power a bigger part of their energy future and some have set formal targets that will stimulate further development of wind resources. However, based on current projections, the wind component of Canada's electricity supply will grow to just 5 percent by 2016.[25] As other countries work toward more ambitious wind energy targets, Canada risks falling behind and losing out on our share of the investment, employment and other benefits that will flow from explosive growth in the global wind industry.

CanWEA believes that there are solid economic and environmental reasons for the provinces and the federal government to set much higher targets for wind energy production and to put policies in place that will make more ambitious goals achievable.

SECTION 7

CANADA'S WIND RESOURCES

On a typical Canadian wind farm, the turbines produce some power between 70 percent and 80 percent of the time and, over the course of a year, most will produce somewhere between 30 percent and 40 percent of their total potential maximum power production. This latter figure is called wind energy's "capacity factor". Of course, the key variable at play in the output equation is the wind resource; how fast it blows and how consistently.

Canada has one of the best wind resources in the world. As Table 3 illustrates, annual average mean wind speeds in Canada are equivalent to those found in the United States and higher than those found in other leading wind energy countries.

TABLE 3

	Annual Mean Wind Speeds[1] [m/s]	Wind Power Density[1] [W/m^2]
Germany	5.5 – 7.0	200 – 400
Spain	5.5 – 8.0	200 – 600
USA	6.5 – 9.0	300 – 800
India	5.5 – 8.0	200 – 600
China	5.5 – 9.0	200 – 800
Canada	6.5 – 9.0	300 – 800

[1] It is very difficult to generalize or reference the wind resource across entire countries; however it is expected that general values presented above are indicative of the relative "quality" of the wind resources in active commercial wind project areas with open terrain at 50 m without hill or ridge feature effects.

The quality of the wind makes a huge difference to wind power producers. Consistent winds lead to more steady energy production. In Canada, the quality of the wind resource is such that the average Canadian wind farm will have a capacity factor above 30 percent, whereas a typical German wind farm will have a capacity factor between 20 and 25 percent.

Like so many other natural resources, Canada is blessed with abundant wind. There are countless locations across the country where winds blow consistently and strongly enough to support efficient wind farms and there is excellent potential in every province and territory to develop wind power. We have the world's longest coastline, second largest landmass and a low population density. As a result, we are much better positioned than other nations to develop our wind resource as more land is available.

In fact, we could develop just 0.25 percent of Canada's land mass as wind projects and produce electricity equivalent to the entire annual electrical demand of the entire country.[26] In practice, our grids can't handle a diet of pure wind, but it is clear that we have more than enough wind to achieve the 20 percent target called for in CanWEA's WindVision 2025.

The 55,000 MW of wind energy capacity required to meet CanWEA's WindVision 2025 would require a land area equivalent to Prince Edward Island. Within that area, less than 5 percent of the land would actually be required for wind energy generation, the rest could still be used for complementary activities like farming.

A 2005 STUDY SHOWED THAT BY EXPLOITING 'GOOD' OR 'VERY GOOD' WIND FARM SITES ON AVAILABLE LAND LOCATED WITHIN 25 KILOMETRES OF EXISTING TRANSMISSION LINES, ONTARIO COULD PUT IN PLACE AS MUCH AS 33,000 MW OF WIND ENERGY CAPACITY. A SIMILAR STUDY IN QUEBEC FOUND MORE THAN 100,000 MW OF WIND ENERGY CAPACITY AVAILABLE TO BE DEPLOYED UNDER SIMILAR CONDITIONS.[27] CANADA HAS NO SHORTAGE OF WIND.

SECTION 8

WIND ENERGY IS A RELIABLE SOURCE OF ENERGY

Everybody knows that the wind doesn't blow all the time. There are windy days that make for great sailing and calm days that are ideal for canoeing. But what about for making electricity? Can we count on wind energy as a reliable source of electricity? The answer is "yes" and while it may be a surprise to some, it isn't for countries who have integrated large amounts of wind into their systems. The reason lies both in the way that wind farms generate electricity and how the utility (on the receiving end) deals with it.

First off, it's important to know that developers take a great deal of care in choosing the best sites for their wind turbines. From long periods of weather observation, they know where to find the strongest, most consistent winds and they only build wind farms in places where the data shows an average annual wind velocity high enough to make the project viable. As a result, most well-sited modern wind turbines produce at least some electricity 70 to 80 percent of the time. Over the course of a year, most of these turbines will produce on average anywhere from 30 to 40 percent of their rated capacity. But even the best-situated turbine will still produce varying amounts of electricity throughout the day.

Fortunately, as any sailor knows, the wind never stops blowing everywhere at once. So while Turbine A's production may be falling, Turbine B's production 10 kilometres away is ramping up, thereby compensating for Turbine A's decline. Add in tens, hundreds or even thousands of turbines spread over a wide geographic area and you find that they tend to balance each other out quite nicely. In fact, their overall output can be surprisingly constant. In a recent study, experts developed a model to simulate what would happen if 5,000 MW of wind

spread over 19 sites were integrated into Ontario's electricity grid. After running the model using real-time wind data and real-time electricity demand data, they concluded that there would be minimal impacts in terms of grid operation. In fact, they found that the variability of electricity demand was far greater than the variability of turbine production. The reason lay in the number and geographic diversity of the turbines. So, to coin a phrase, "size matters" when it comes to wind.

What about the electric utility who is on the receiving end of the electricity? The key words here are diversity, forecasting and connections Modern electricity grids are often quite diverse, and include a wide mix of generation technologies such as hydroelectric, nuclear, coal, natural gas and other sources. The output of these generators is controlled by a system operator who matches their electricity production with real-time demand from across the province. With wind production ramping up on the grid, the system operator is able to "dial back" certain flexible generation sources in favour of wind, and "dial up" these same sources as wind output drops. This is where the true benefits of hydro come into play – it is one of the most flexible generation sources available and therefore serves as a perfect complement to wind. As the wind output ramps up, the system operator can slow hydro production and stock water in the reservoir. In this way, hydro effectively acts as a battery.

The system operator also has another powerful tool at their disposal: forecasting. Recent advances in meteorology and the science of wind has led to a greater understanding of when and how the wind will blow. With the proper tools, modern forecasters can increasingly predict how strongly the wind will blow at a given location several hours – or even a day – in advance. From this, utilities can predict a wind farm's electricity production ahead of time and make the necessary adjustments. Another powerful tool at the system operator's hands is the electricity connections or interties with neighbouring jurisdictions. By using these strategically, the system operator can balance their supply and demand in the most economically efficient way.

Taken together, these are the "ingredients" of successful wind integration, and the reasons why countries such as Denmark have been able to integrate such high levels of wind. On average, Denmark gets 22 percent of its electricity from wind over the course of a year, and there are even times – generally at night when demand is low – that the country is entirely powered by wind. Other countries are following suit, including Spain which gets 13 percent of its electricity from wind and Germany which receives 8 percent of its electricity from wind. This compares with less than 1 percent in Canada in 2008. We clearly have a long way to go.

Experience in these countries has not only shown that wind can be easily integrated, but that it can actually help to increase the reliability of the grid. The reason? There is safety in numbers. In the past, utility grids were generally designed around a small number of large generating stations connected by large transmission "corridors" to the places where electricity was needed. The problem would occur when one of the generating stations suddenly went off-line or when one of the transmission lines failed. In this "centralised generation" model, each station represents a large portion of the electricity supply and its loss can result in a blackout or other failure. That's what happened in the great blackout which hit central Canada and the north-east United States in August of 2003. The system was overwhelmed when a single plant in Ohio shut down unexpectedly and sent power outages affecting 50 million customers cascading across the grid.

"Wind is an integral piece of our power supply portfolio….. Our studies and experience show that wind energy integrates effectively and reliably into our power systems to mitigate the impact of wind variability."

– Paul Bonavia, Chief Operating Officer, Excel Energy

The situation is somewhat different in a "distributed generation" model consisting of many wind turbines and other sources connected through a "spider web" of transmission and distribution lines. Here, the loss of a single turbine has a negligible effect on the rest of the grid, simply because it represents a relatively small portion of the overall generation. And seeing as how the turbines are connected by a "spider web" of transmission rather than a "corridor", loss of an individual line does not have calamitous effects.

It is clear then that wind power can make a serious contribution to overall reliability of the electrical system. That's why in the US alone, investment in wind capacity topped $ 9 billion in 2007 and why the Americans are adding wind capacity at a rate second only to natural gas.[28] In a country that is increasingly concerned about energy security, governments and power producers know that wind is an economically sound, environmental preferable and reliable choice.

SECTION 9

CANADA'S INDUSTRIAL DEVELOPMENT OPPORTUNITY

From 1996 to 2007, world-wide installed capacity in wind power grew from 6,100 MW to 94,000 MW.[29] In the process, a handful of companies from the big wind power countries like Denmark, Germany, Spain, and the United States became dominant in the most economically valuable portion of the wind energy industry – the manufacture of wind turbines.

In 2007, wind power producers around the world spent $28 billion to purchase wind turbines and key components like rotor blades, gear boxes, generators and other components. A further $27 billion went to design, development, construction, finance, and the operations and maintenance of wind energy projects.[30] The rapid growth in the wind energy industry means that the demand for wind turbines is now exceeding the capability of manufacturers to supply them. As a result, new customers are waiting two years or more for turbines to arrive and manufacturers have full order books for an extended period.

Clearly, it's a good time to be in the wind turbine business or to supply components to the major producers. Manufacturers are now rapidly making investments in new plants in an effort to get supply to catch up with demand. This will be challenging. Over the next 12 years, it is projected that more than $1 trillion will be invested in new wind energy projects as an additional 400,000 + MW are added to global wind energy capacity.[31]

Unfortunately, Canada is hardly visible in the world market for wind turbine manufacturing at this time, particularly for large wind turbines and components. This represents a tremendous lost opportunity for Canada.

Contrast the Canadian situation with tiny Denmark's. The Danes set out in the 1980s to be a major wind energy producer and were the first in the world to get 20% of their electricity from wind. Not surprisingly, Danish wind developers gave local firms the first shot at supplying turbines. This gave them a leg up on the rest of the world and today Danish firms control a quarter of the global market.

Developments in Spain have been just as dramatic. In 1998, there was not a single wind farm in the country and no equipment manufacturing industry to speak of. Subsequently, national and regional governments made wind power a priority and worked to bring 20,000 MW on line by 2010. This gave Spanish firms an opportunity to hone their skills in turbine making and today, Gamesa, Spain's largest turbine manufacturer has about 14% of the world market.[32]

In terms of installed wind energy capacity, Canada sits in 11th place globally and most of the components for the wind farms we have built have come from suppliers in Europe or the United States. Over the long run, there is no reason to believe that the relationship we see in many other countries, between local installed capacity and growth in the local manufacturing base, will not hold true for Canada. Indeed, the pattern is already starting to emerge.

In Quebec's Gaspé region, three component manufacturing plants have opened since 2006 in the wake of Hydro Quebec's tender for 1000 MW of wind power which called for 60% local content. These plants, which build turbine towers, blades and nacelle covers, now employ several hundred people and are starting to export to other regions of the province, to Ontario and the United States. Canada also has tower manufacturing facilities in Ontario and Saskatchewan. Hydro Quebec's recent tender for an additional 2000 MW of wind capacity in the region has resulted in commitments to build additional facilities from two leading wind energy turbine manufacturers: Enercon and Repower.

Currently, Canadian wind projects depend almost exclusively on European and US suppliers for turbines and key components. We have an opportunity to change this, however, as the pace of wind farm construction picks up. Canada has the skills and industrial capacity to serve this rapidly growing market, but Canadian companies are going to have to get more aggressive to seize these opportunities. A typical wind turbine contains more than 8,000 parts and using experience in other countries as a guide, multinational turbine manufacturers will procure many parts from local suppliers when price and quality are competitive. To attract investment, Canadian firms must also be open to licensing, joint-ventures and sub-contracting arrangements.

THE WIND ENERGY SUPPLY CHAIN

A 2008 survey of Canadian manufacturing capabilities and demand revealed that there are hundreds of Canadian firms which have or could easily acquire the technical competence to supply components for wind turbines destined for Canadian wind farms. Markets in which Canadian firms would enjoy a competitive advantage include:[33]

Turbine Towers – Due to high transport costs, turbine makers prefer to source towers locally.

Rotor Blades – Due to high transport costs and the risk of damage in transit, turbine makers prefer to source rotor blades locally.

Castings – Canadian producers with the right equipment could supply large castings for frames, gearbox housings and turbine hubs. Turbine makers compete with other industries for casting services and capacity is tight world-wide offering an opportunity for new entrants.

Forgings – Canadian producers with the right equipment will have ready access to this market. World-wide capacity is tight and demand comes from various sectors. Canadian experience from hydro electric turbine shaft forging will be an advantage.

Nacelle Assembly – High transport costs coupled with relative low set up costs favour local producers. The establishment of nacelle assembly facilities will stimulate development of a local sub-components supply chain.

Nacelle Covers – High transportation costs favour local suppliers with experience in large composite material construction.

Figure 6 illustrates the main components of a wind turbine. Together these components account for approximately 50% of the cost of constructing a wind turbine.

RETURNING TO THE CANWEA VISION

This brings us back to CanWEA's WindVision 2025 target. It will take about $132 billion in new investments to reach the 20% wind penetration level. But if governments act now to send a clear signal that this is where we are heading, CanWEA believes that at least 60% of the total, some $79 billion, will flow to the bottom line of Canadian equipment manufacturers, construction and engineering firms and other suppliers in all regions of the country.

FIGURE 6

TYPICAL SHARE OF CAPITAL COST FOR VARIOUS TURBINE COMPONENTS

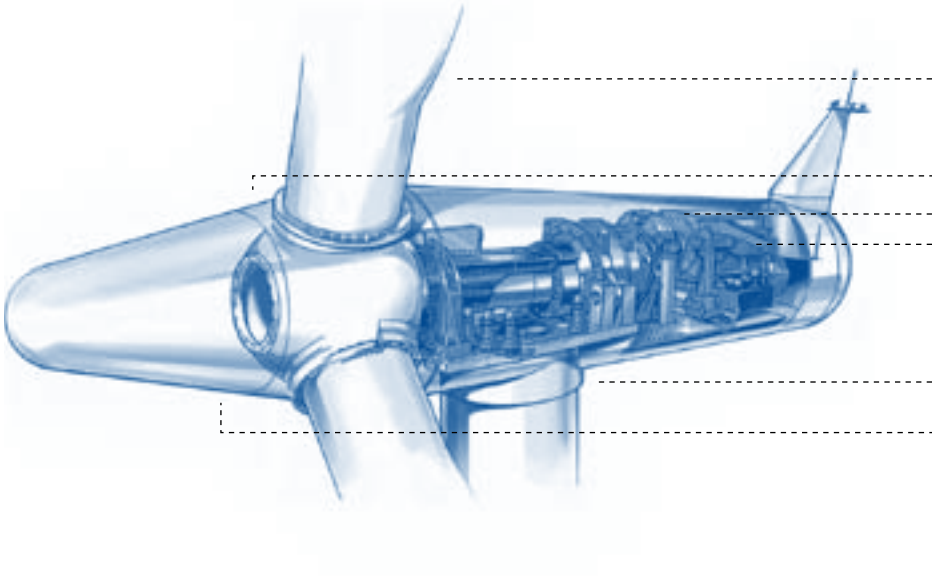


Image courtesy Siemens©
Source: 'Overview of Canada's large wind turbine supply chain opportunities'. Garrad Hassan for CanWEA. 2008.

SECTION 10

CANADA'S WIND ENERGY INVESTMENT OPPORTUNITY

Talk of a $1 trillion global market for new wind power installations between now and 2020 may sound like a hopeful prediction from environmentalists or wind industry advocates. However, the facts speak for themselves. For a technology that just a decade ago was seen as emerging and not fully tested, the world is turning to wind energy in a very big way. What's more, this trend is only beginning to pick up steam.

Since 1995, installed wind energy capacity around the world has increased seventeen fold to 94,000 MW by the end of 2007 and independent forecasters now expect it to more than triple from today's levels by 2015 to 290,000 MW.[34] Today, about 1 percent of the world's electrical consumption comes from wind. By 2012, it is projected to reach 2.7 percent and will continue to climb.[35]

Over the past decade, projections by governments and energy experts have consistently underestimated growth rates for wind energy. In fact, for the past three years, growth in global installed capacity has even exceeded the most optimistic annual projections by the Global Wind Energy Council (GWEC), the international voice of the wind energy industry. Currently, GWEC's "moderate" scenario for future growth projects that global installed capacity will reach 560,000 MW by 2020, a more than five-fold increase over current levels. This GWEC estimate is consistent with projections from many independent analysts.[36]

Annual additions to the global wind energy stock are expected to grow from a record 20,000 MW in 2007 to more than 30,000 MW a year by 2015. These are not pie in the sky figures. They come from front-line experts who are helping electrical utilities, turbine makers, components suppliers, and governments around the world make multi-billion dollar investment decisions over the next few years. If these projections seem ambitious through Canadian eyes, that's because we are not yet thinking in ambitious terms about wind energy. Those countries that are thinking big about wind energy are poised to reap huge economic returns as world-wide investment in wind energy sky rockets over the coming two decades.

Countries that host the world's leading wind turbine manufacturers like Denmark, Germany, Spain, and the United States are all profiting from this explosive growth in wind energy investment. At the same time, new names are appearing on the leader-board of the global wind energy industry. In 2007, for example, China became the fastest growing wind energy market and is expected to run "neck in neck" with the U.S. for the lead in annual capacity additions over the next decade.[37] In fact, wind energy is poised to take its place among the great Chinese industrial success stories. As China adds to its domestic installed capacity, it is also making huge additions to its domestic wind energy supply chain. In 2000, there were no globally competitive Chinese players in the wind turbine market. In 2007, two firms, Goldwind and Sinovel captured almost 8 percent of the world market.[38]

Meanwhile, in India, where installed wind energy capacity has grown 400 fold since 2000, there have also been significant developments in the manufacturing sector. Large multinational turbine companies operating in India now source more than 80 percent of their components locally and a number of Indian manufacturers are now exporting.[39] Indeed, India's most prominent producer, Suzlon supplied just over 10 percent of the world market for turbines and components in 2007.[40]

A number of factors are stimulating explosive demand for wind energy and an impressive supply side response around the world. Security of supply and environmental performance are certainly playing a role, but more and more, the key driver is economics. A modern wind turbine produces 180 times more power at less than half the cost per kWh compared to technology available 20 years ago. At good locations, wind power can now compete with the cost of gas-fired electricity, and it will get more competitive as carbon pricing becomes more prevalent.[41] With these basic fundamentals shifting in favour of wind, the current growth projections are easier to understand.

What does this rapid growth mean in terms of investment? In value terms, BTM Consult ApS, a world-leading expert on renewable energy, advises its clients to expect a market value for wind installations of $300 billion from 2008 to 2012. Currently in Canada, every MW of new installed wind energy capacity represents about $2.5-$2.8 million of total investment. For the purposes of CanWEA's WindVision document, we have assumed that total investment costs will decline over time from this level (consistent with the projection of most analysts as wind turbine technology continues to evolve) to a level of $2.1 million / MW in 2025.

WHAT ABOUT CANADA

It is clear that countries around the world are putting more of their electricity eggs into the wind basket than we are in Canada. While governments, electricity producers and others in most of Europe and much of the United States are thinking and talking publicly about wind energy penetration rates of 20 percent or higher, the federal government currently believes that wind energy will only supply 6 percent of Canada's electricity by 2020[42], a penetration level already exceeded in Denmark, Spain, Portugal, Germany and Ireland.

CanWEA sees our failure to match other countries in terms of wind capacity growth as a significant forgone opportunity. We see no reason why Canada cannot achieve 20 percent wind penetration by 2025. This would require a total investment of about $132 billion of which we estimate $79 billion or 60 percent could materialize as sales for Canadian manufacturing and service industries.

While it is estimated that just 30 percent of wind investments made to date in Canada remain within our borders, it is clear that much more is possible if we foster the development of a wind energy industrial base in Canada. In Quebec, where Hydro Quebec requires 60 percent provincial content in wind energy investment, several manufacturing facilities have been established and are to be built to help service the more than 3,000 MW of new wind energy capacity recently contracted in the province. As Canada's wind energy market grows, we have an opportunity to build a new industry, but we will need to compete with others for the rapidly growing global investment in this sector.

Evidence from other countries with industrial bases no more sophisticated than ours also suggests a much higher domestic content level is achievable. If India's wind farms, for example, are sourcing 80 percent of their components locally, there is no reason we cannot.

SECTION 11

CANADA'S JOB CREATION OPPORTUNITY

New investment in wind energy creates direct jobs in construction, operations and maintenance of wind farms and in the manufacture of wind turbines and components. Research in Germany, Denmark and the Netherlands demonstrates that each MW of new wind energy capacity will create 16 jobs in turbine and related component manufacturing along the global supply chain. As manufacturing processes improve, the direct employment impact per MW is expected to fall to 11 manufacturing jobs by 2030, but total employment will still grow quickly as wind power increasingly becomes the price-competitive option for producing electricity. These studies also show that each installed MW of wind energy sustains five construction jobs and one third of a job in maintenance and operations.[43]

It is difficult to get precise job figures for the wind energy sector because many national statistical agencies lump employment in the renewable energy sector (i.e. wind, solar, biomass, etc.) together. However, using available data, a 2008 WorldWatch Institute study put the global figure for renewables at 2.3 million jobs of which more than 300,000 were in wind. Looking further down the road, the Institute projected that employment in the global wind energy sector could rise to 2.1 million by 2030 and 2.8 million in 2050.[44] The WorldWatch study also pointed out that employment growth is strongest, at least initially, in countries like Germany and Spain which have offered strong and consistent support for their wind energy sectors.

Estimates are that in 2008, about 4,400 people were directly employed by the wind energy industry in Canada.[45] Of this total, 36 percent worked for wind farm developers or owners, 30 percent for turbine and component manufacturers and 17 percent as contractors to the industry. How many new jobs will materialize from wind energy development in Canada depends, of course, on how much wind capacity we build and how quickly we move forward. Experience in other countries shows, for example, that major turbine manufacturers generally set up production in host countries and begin to source components locally once they are certain that eventual market size will justify their investment. This is beginning to happen in the Gaspé region and prospects for continuing growth are good, provided provincial governments and utilities adopt more ambitious plans for procuring wind energy.

If CanWEA's vision of wind supplying 20 percent of Canada's electricity by 2025 were achieved, we predict that employment in the wind energy sector would grow to at least 52,000 by that date.[46] This is a conservative estimate since it assumes that only 30 percent of the total investment in wind energy projects will stay in Canada with the remainder flowing to countries with well established wind turbine and component manufacturing facilities. However, if our manufacturing base continues to broaden and we enhance Canadian content in the wind turbine supply chain, the employment figures for Canada will be significantly higher. There is good reason to believe that our 30 percent Canadian content assumption is low since wind projects now under development in Quebec already have demonstrated that 60 percent of total investment is staying in the province.

How do local employment opportunities in wind energy stack up against other technologies? A recent study in the United States comparing the employment impacts associated with the construction and operations and maintenance of similar coal, natural gas, and wind powered electricity generation facilities concluded that wind energy produced the most jobs, as illustrated in the table below.[47]

TABLE 5 COMPARATIVE JOB CREATION IMPACTS

Technology	Coal	Gas	Wind
Construction, direct	465	322	866
Construction, indirect and induced	391	271	751
Operations, direct	72	138	152
Operations, indirect and induced	48	231	107

SECTION 12

CANADA'S RURAL ECONOMIC DEVELOPMENT OPPORTUNITY

Except for a demonstration turbine on the Toronto waterfront, most of Canada's wind energy production comes from small communities. In the same way our rural farms put food on city tables, wind farms in towns like Tiverton, Ontario, Springhill, Nova Scotia and Matane, Quebec feed the major urban centres with clean, reliable electricity.

Wind energy development provides direct benefits to rural communities through jobs in construction, operations and maintenance and administration. It also supports local businesses through purchases of goods and services. And they support local municipalities in other important ways. For starters, they provide a new source of tax revenues that can be used for roads, recreation centres and other facilities which benefit the whole community. In Pincher Creek Alberta, for example, local wind farms contribute almost $3 million to municipal coffers, a significant portion of the municipal district's tax revenues.

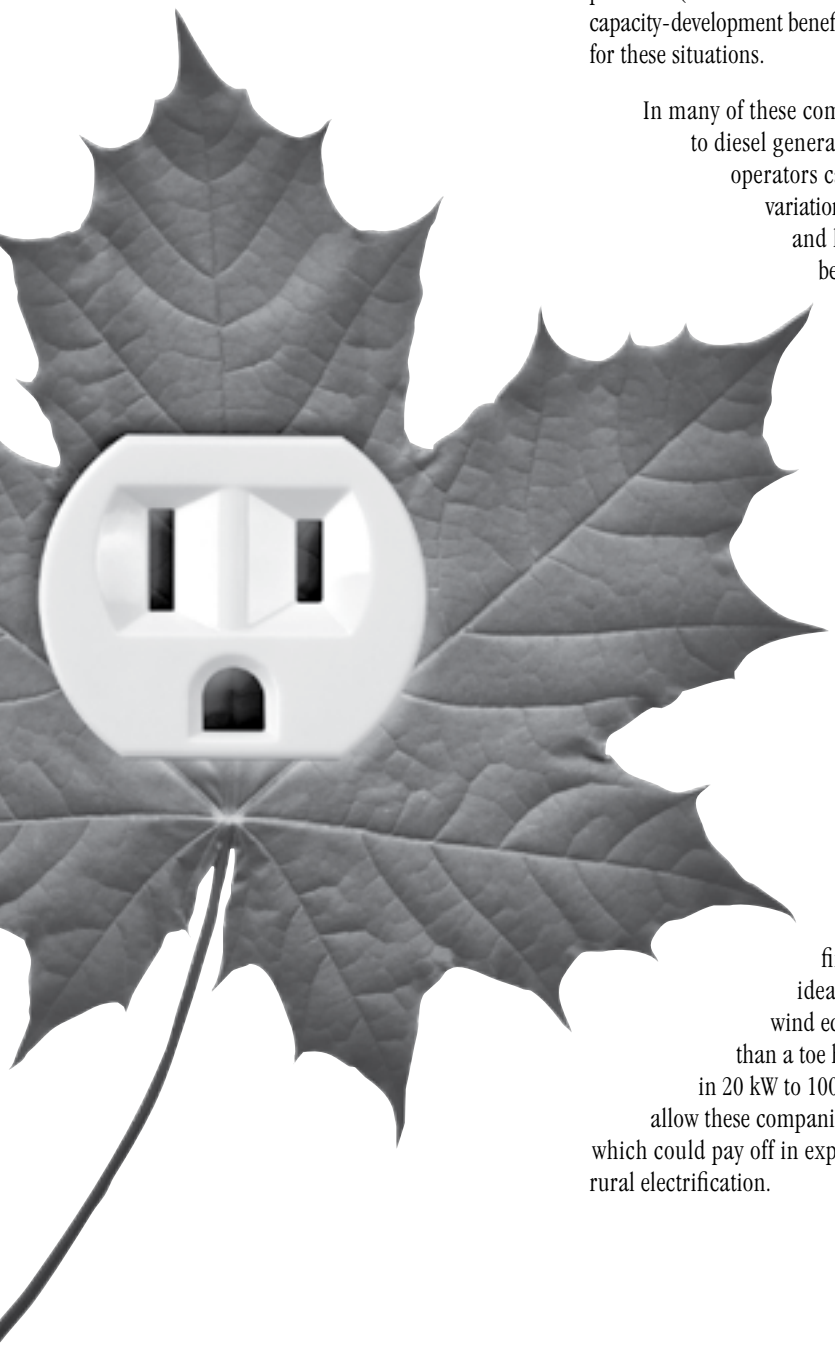
Wind farm operators also pay royalties to local land owners who host wind turbines on their property. These payments are negotiated early in the development stage for a wind project and often extend up to 20 years. Royalty rates vary from project to project, but a conservative estimate is that they average $3,000 per MW per year. For a farmer or rancher hosting one or two 1.5MW turbines this can be a significant long-term source of revenue. What's more, wind turbines do not significantly disrupt agricultural activities. About 95 percent of the land in a wind farm can be used as it always was.

In 2007, Canada's wind farms contributed approximately $5.6 million to municipal tax revenues and a like amount in royalties to landowners.[48] Achieving CanWEA's vision of generating 20 percent of our electricity from wind by 2025 would boost these annual contributions to $165 million.

A final and perhaps unanticipated local benefit of wind energy development is that wind farms attract tourists, sometimes by the thousands. For example, the North Cape wind farm in Prince Edward Island has been operating since 2004 and had more than 60,000 visitors in 2007. Think what those numbers mean in terms of sales in local shops and restaurants.

SECTION 13

WIND ENERGY IN REMOTE AND ABORIGINAL COMMUNITIES



Canada has roughly 300 northern and remote communities, including many Aboriginal communities, with a total population of about 200,000 people. These areas are isolated from the national grid and typically draw their electricity from diesel generator sets that are expensive ($1.50 per kWh), cause a great deal of pollution (local air contaminants and greenhouse gases), and bring few economic or capacity-development benefits to the community. Wind energy is an excellent alternative for these situations.

In many of these communities, wind energy can provide a useful supplement to diesel generation. The two technologies team up well because system operators can dispatch diesel generators quickly to compensate for variations in wind output. The overall result is lower electricity costs and lower emissions. Studies also show that the net economic benefits, notably job creation, are four times greater with wind energy than with diesel generation.[49]

Wind-diesel hybrid systems are a proven technology that can operate in harsh conditions. This has been amply demonstrated in Alaska where over 20 wind turbines are operating in remote communities. The government of Alaska, which has supported these projects through up front capital subsidies and long-term production incentives, reports solid results from an environmental, social and economic perspective. If this approach were replicated in Canada, CanWEA believes that 34 wind projects with a total capacity of 55 MW would be feasible and could meet roughly 10 percent of electricity demand in our remote communities. Over an 18 year period[50] this would save $300 million litres of diesel fuel costs and reduce GHG emissions by 100,000 tonnes per year – equivalent to taking 20,000 cars off the road.

Developing a strong wind capacity in northern and remote communities would also provide a real boost to Canadian firms which produce the “mid-sized” wind turbines that are ideally suited to these communities. This is one corner of the wind equipment manufacturing industry where Canada has more than a toe hold. In fact, half of the world’s producers of wind turbines in 20 kW to 100 kW range are Canadian. A growing domestic market would allow these companies to develop additional expertise and mature supply chains which could pay off in export sales as developing nations turn to wind power for rural electrification.

SECTION 14

WIND ENERGY PROCUREMENT

By the end of 2008, every province in Canada will be producing at least some wind energy and most are clearly looking to wind as an important and growing source of clean, renewable energy for the future. Most of Canada's wind energy capacity has been installed by successful bidders in competitive tendering processes launched by Crown utilities.

Canada has no shortage of wind resources, nor is there a shortage of domestic and international developers, turbine manufacturers and investors who are keen to develop our resources. This is clear from the brief, province by province review of major wind energy procurement activities presented below. As the data shows, in many cases where provincial governments and utilities have sought proposals for new wind and renewable energy facilities, the response has generally been more and sometimes many times more than the actual amount sought.

BRITISH COLUMBIA

In 2006, BC Hydro released an all-source call for up to 2,500 GWh/year of electricity from large-scale projects, as well as 200 GWh/year from small-scale projects. It received 53 proposals from 37 independent power producers totalling 6,500 GWh a year. Three wind projects with a total capacity of 325.2 MW were among the 38 winners.

SASKATCHEWAN

In 2004, SaskPower issued an RFP for 15 MW of small-scale "environmentally preferred" generation. It received 12 proposals totalling 34.36 MW. Eight were for wind projects totalling 25.14 MW. The following year, the provincial utility issued a similar proposal for 32 MW of power and received 17 proposals of which 13 were for wind projects totalling 224.15 MW.

MANITOBA

In 2007, Manitoba Hydro issued an RFP for up to 300 MW of wind power. It received 84 expressions of interest totalling more than 10,000 MW. The utility decided to negotiate with one developer on a project with a potential capacity of 300 MW.

ONTARIO

In 2004, the government of Ontario issued an RFP for 300 MW of renewable energy which elicited 41 wind power, water power and landfill gas proposals with a combined capacity of 1,060 MW. It eventually selected 10 bids totaling 395 MW of which five were wind projects with a capacity of 354.6 MW.

In 2005, the Ontario government issued an RFP for 1,000 MW of renewable energy. It received 22 bids totaling 2029 MW. Most bids were from wind producers and eventually eight wind projects were selected with a combined capacity of 955 MW.

QUEBEC

In 2003, Hydro-Québec issued tenders for 1000 MW of wind power to be delivered over seven years starting in 2006. Nine developers submitted 32 bids with a combined capacity of 3,995 MW. The utility eventually selected eight projects with a combined capacity of 990 MW.

In 2005 Hydro-Québec tendered for an additional 2000 MW of wind generation. This time, five turbine manufacturers and more than 25 developers submitted 66 proposals for wind farms totalling 7,724 MW of capacity. The utility selected two turbine makers and 15 projects from eight developers totalling 2004.5 MW.

NEW BRUNSWICK

In 2005, New Brunswick Power issued a request for expressions of interest to supply 400 MW of wind energy by 2016. The following year, the utility qualified 10 companies to submit final bids on 17 project proposals. It then signed a contract for a 96 MW project.

In 2007, New Brunswick Power issued an RFP for 300 MW of wind power. It received 25 proposals totaling 1400 MW. Three projects were selected with a combined capacity of 213 MW.

NOVA SCOTIA

In 2004, Nova Scotia Power issued an RFP for 20 MW of electricity from renewable sources and specifically projects under 2 MW in size. It received 17 bids totalling 28 MW and decided to accept all of them, including 15 wind projects totalling 25 MW. In the same year, the utility tendered for 30 MW of renewable energy from projects larger than 2 MW. From this process, the utility eventually selected a 12 MW and a 31 MW wind project.

In 2007, Nova Scotia Power issued an RFP for 130 MW of renewable energy. There was a very strong response from local and international wind developers. Eventually, the utility selected seven projects from six developers with a total capacity of 244 MW.

NEWFOUNDLAND AND LABRADOR

In 2005, Newfoundland and Labrador Hydro issued a request for proposals for 25 MW of wind power. It received seven proposals and selected a 25.2 MW project.

In 2006, Newfoundland and Labrador Hydro issued a request for proposals for 25 MW blocks of wind power and eventually chose one 24 MW project.

This review shows that developers and investors have often been prepared to build significantly more wind energy capacity than utilities have sought through their RFPs. This represents a lost opportunity to fill a looming electricity supply gap in many parts of the country with clean, renewable wind power. One way for Canada to start thinking big about wind power is to start rethinking our procurement processes. Why are we leaving viable wind projects on the shelf when we know for sure that we will need new sources of electricity generation in the very near future?

SECTION 15

IMPROVING THE EFFICIENCY OF PERMITTING AND APPROVAL PROCESSES

Before a wind power facility can be built, whether it's a single turbine or a substantial wind farm, developers must go through an extensive regulatory and permitting process. They need to seek permission from federal, provincial and municipal officials as well as grid operators and safety authorities before they get the go ahead to begin construction. Canada's wind developers fully accept the need for regulatory oversight to ensure that a wind project, like a nuclear, hydro, or gas-fired project coincides with environmental, health and safety, economic and social criteria established by citizens through their governments. At the same time, regulations can impose financial and other barriers on wind development which add nothing to public welfare. This is the case, for example, when regulators from different levels of government ask for and consider the same information from a developer or when they apply very different, even conflicting regulations to the same project. This duplication and overlap can lead to much longer and more expensive approval processes than are necessary, as well as delays in getting the clean power that we need.

CanWEA believes in 'smarter regulatory processes'. We want the three levels of government and other players in the regulatory and permitting process to sit down with our industry and work out a better approach to scrutinizing wind and other energy projects. We are convinced that much can be done to reduce costs and delays without weakening protection of the public interest. Moreover, we believe a new regulatory framework should embrace the following principles:

EFFECTIVENESS AND EFFICIENCY

Wherever possible, regulations should focus on the economic, environmental and other results we want to get from a project, rather than mandatory specifications for how the project should be built. In addition, review processes should be designed to minimize compliance costs and different levels of government should share information and define 'public interest' in the same way when they are reviewing a project. Finally, complaints and appeal procedures should be accessible and fair.

TRANSPARENCY

In developing new regulations or reviewing existing ones, authorities should clearly define their policy objectives and consult meaningfully with all stakeholders. There should also be a strong onus on authorities to explain regulatory decisions and demonstrate how they uphold the public interest.

TIMELINESS, CONSISTENCY AND CERTAINTY

Timeliness in the regulatory review process should respect the realities of business decision-making and all regulatory authorities should adhere to similar standards with respect to openness and fairness. Plus, regulatory decisions should provide clear and enduring direction to all parties involved.

ACCOUNTABILITY

Regulators should publish annual business plans which include performance objectives and their work should be subject to public scrutiny.

Federal Government organizations which may be involved in reviewing wind projects include: Environment Canada, Canadian Environmental Assessment Agency, Natural Resources Canada, Transport Canada, Fisheries and Oceans Canada, and NAV Canada.

At the provincial level, Ministries of Environment, Natural Resources, Transport and Culture as well as energy boards and regional conservation authorities may be involved.

Municipal authorities may scrutinize proposed wind projects for compliance with the relevant 'Planning Act', county, regional or city 'official plans', zoning and height restriction by-law, site plan agreements and building permits.

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