

WINDVISION 2025

POWERING CANADA'S FUTURE



canwea

CANADIAN WIND
ENERGY ASSOCIATION

ASSOCIATION CANADIENNE
DE L'ÉNERGIE ÉOLIENNE



WINDVISION 2025

CanWEA believes wind energy can satisfy 20 percent of Canada's electricity demand by 2025.

Achieving this vision will pay huge dividends:

Generating \$79 billion of investment that will make Canada's wind energy sector a real player
in a \$1.8 trillion global wind industry

Creating at least 52,000 high quality, full-time jobs including many in rural communities

Producing \$165 million in new annual revenues for municipalities

Adding 55,000 MW of clean generating capacity that will strengthen our electrical grids
and head off potential power shortages

Stabilizing electricity prices

Cutting Canada's annual greenhouse gas emissions by 17 Megatonnes

To make WindVision 2025 a reality, CanWEA is calling on the federal and provincial governments to establish
policies and programs addressing these five priorities:

Providing fair value for the environmental attributes of wind energy

Enhancing wind energy procurement processes

Providing incentives to manufacturers of wind power equipment

Planning and building 'wind-friendly' transmission infrastructure

Streamlining permitting and approval processes for wind energy projects

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.

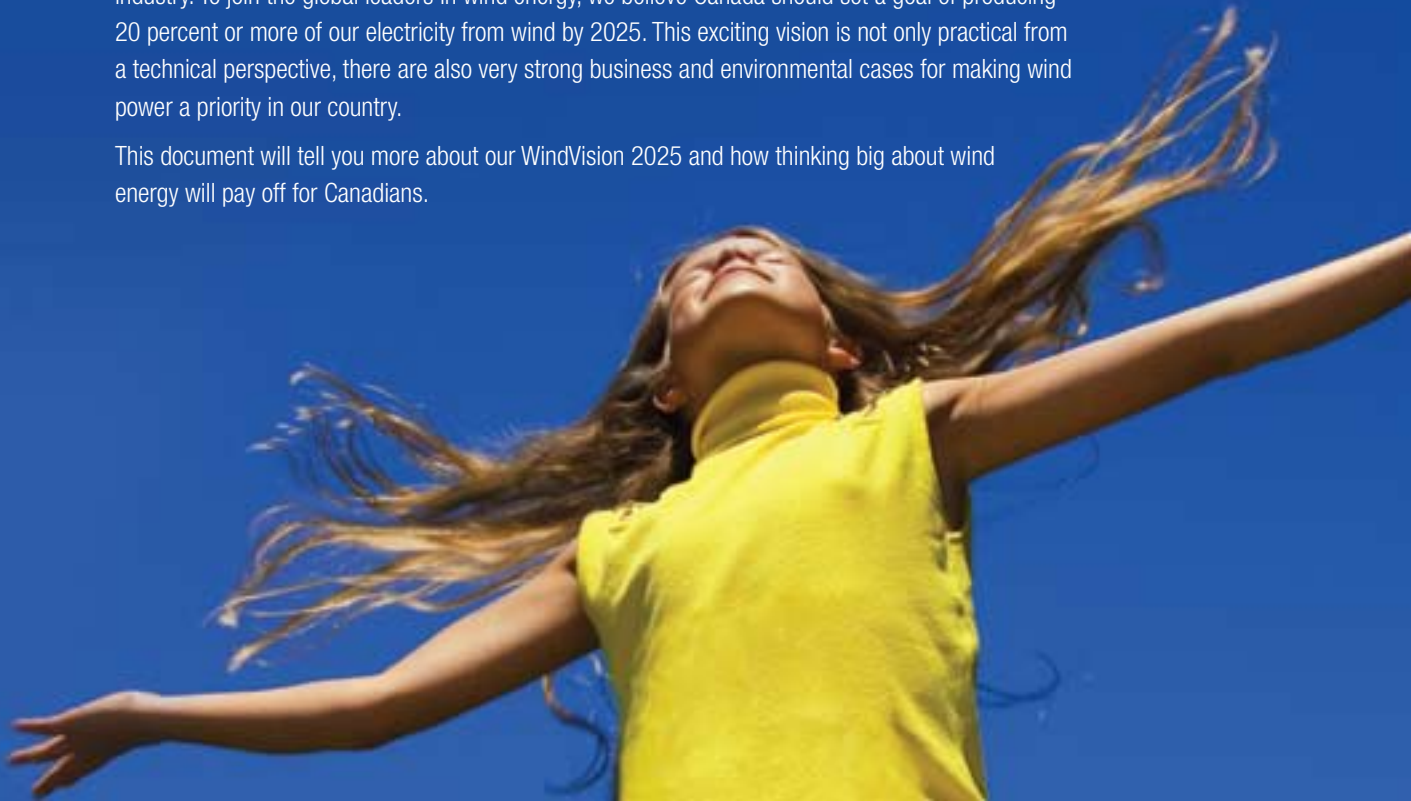
Today, wind power is a clean, reliable source of electricity in more than 70 countries. It is not only a green source of electricity; it is also becoming a low-cost option for generating electrical power that is delivering substantial benefits in terms of jobs, investment and rural economic development. 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?

Canada has trailed 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, sustainable growth of wind energy across the country 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 wants Canadians to start thinking big about wind energy, to power a greener future and to capture our fair share of the opportunities flowing from the explosive world-wide growth in this industry. To join the global leaders in wind energy, we believe Canada should set a goal of producing 20 percent or more of our electricity from wind by 2025. This exciting vision is not only practical from a technical perspective, there are also very strong business and environmental cases 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.

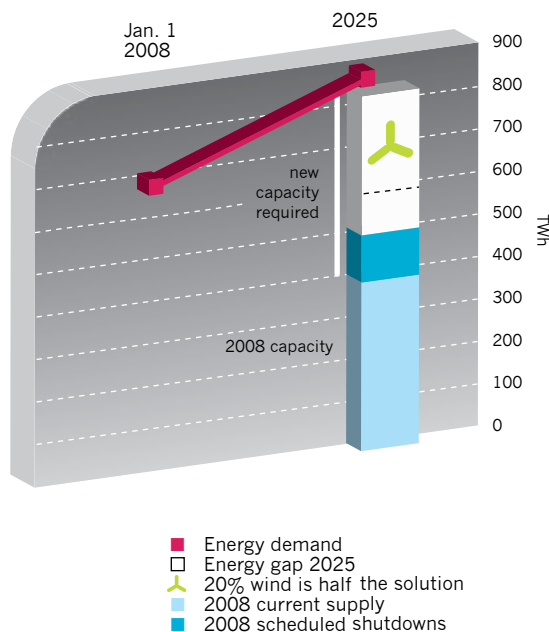


CANADA NEEDS A MORE SUSTAINABLE ELECTRICITY SYSTEM

Since the late 1800s, reliable, affordable electricity has been a driving force in the Canadian economy. It's been an enormous source of competitive advantage for our industries and a huge contributor to our quality of life. Today we have the 6th largest electrical system in the world¹ producing and distributing 600 Terawatt-hours (TWh) of power.² About 60 percent of our electricity comes from renewable sources, chiefly hydro. Another 20 percent comes from nuclear plants while coal and natural gas fired facilities account for 15 percent and five percent each.³

With reliable service and some of the lowest rates in the world, most Canadians take our electricity supply for granted. But cracks are starting to appear in the system that ought to concern us all. We still pay less than others, but electricity prices have been rising steadily and will likely go up even faster in the future. Some parts of the country will face power shortages unless new sources are developed soon. It's also clear that we have to reduce the environmental impact of electricity production.

WIND ENERGY AND CANADA'S ELECTRICITY SUPPLY GAP



Keeping the lights on, easing the environmental burden and preserving all of the benefits we get from electricity has to be a priority for our citizens, our governments and of course for our electrical producers and distributors. The challenge will be huge. In Ontario, for example, demand for electricity continues to rise while 80 percent of the province's generating capacity is either wearing out or will have to be shut down for environmental reasons. Some 24,000 MW of generating capacity will need to be replaced in Ontario over the next 20 years.⁴ In other regions, the picture is not yet critical, but the day of reckoning is fast approaching. Alberta is struggling to make annual additions to its generating capacity equivalent to more than two cities the size of Red Deer⁵ and electrical authorities in every province are under the gun to keep supply and demand in balance.

A 2005 study by the International Energy Agency projected that Canada would need about \$185 billion (US) of new investment in electricity generation (\$95 billion), transmission (\$27 billion), and distribution (\$63 billion) infrastructure by 2030.⁶ Provincial power authorities have already announced \$115 billion in new capital spending to produce and distribute the power Canadians will need in the next two decades.⁷ It will be a tall order to have this new generating and distribution capacity ready when it is needed, especially when we need to create a different kind of infrastructure for the future. We can't just expand our electricity system, we have to change it. We have to build a system that is much more sustainable, one that is reliable, affordable, economically viable, socially acceptable and environmentally sound.

Fortunately, we can count on a new ally to help us meet this challenge – the power of the wind.

We can't just expand our electricity system, we have to change it. We have to build a system that is much more sustainable, one that is reliable, affordable, economically viable, socially acceptable and environmentally sound.

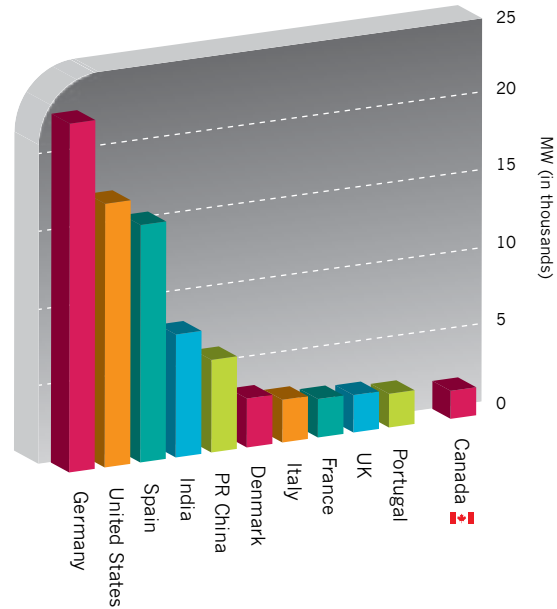
THE WIND POWER ADVANTAGE FOR CANADA

Canadians are only beginning to appreciate the contribution wind power can make to our energy future. Today less than one percent of our electricity comes from wind. Meanwhile other countries are turning to wind in a very big way. In Denmark, for example, more than 20 percent of electricity is wind-generated. In Spain the figure is 13 percent and in Germany it's seven percent.⁸ Closer to home, our American neighbours are building wind farms at a frantic pace and in 2008 the United States has become the largest producer of wind energy in the world.⁹

What do these countries know that we do not? Why is Canada in 16th place in the world when it comes to using wind energy? In part it's because we have always exploited cheap and abundant natural resources to keep electricity prices low. Until recently, it has been hard for wind to compete. In many other countries, governments have also offered powerful incentives to bring wind energy on stream. There is no single reason to explain why we trail the pack. It is clear, however, that many industrialized countries are factoring far more wind power than Canada into their long-term energy plans.

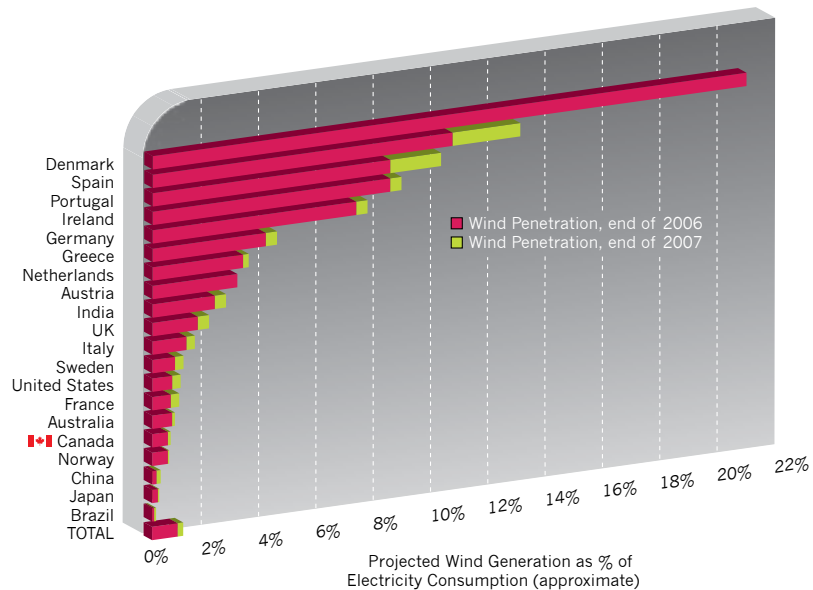
In 2007, for instance, European countries installed more new wind capacity than any other generating source.¹⁰ In the U.S. wind has been second only to natural gas in new generating capacity built since 2005.¹¹ In most countries, the growing interest in wind stems from concerns over rising prices, reliability and security of electricity supply and also the environmental impact of their electricity systems. These are the same concerns we have in Canada, so let's look at them one by one and see how wind can help.

TOP 10 COUNTRIES FOR INSTALLED WIND ENERGY CAPACITY IN 2007



Source: Global Wind Energy Council 2007 Annual Report

APPROXIMATE WIND POWER PENETRATION IN THE TWENTY COUNTRIES WITH THE GREATEST INSTALLED WIND CAPACITY



Source: U.S. Department of Energy, Berkeley Lab estimates based on data from BTM Consult and elsewhere.

CANADA'S ELECTRICITY COSTS ARE RISING RAPIDLY

As every home-owner knows, electricity is not the bargain it used to be. Between 1990 and 2005, residential electricity prices increased by 48 percent¹² and there are good reasons to believe that those monthly bills will keep on going up.

From 2008 to 2025 the demand for electricity in Canada will grow by 36 percent while over the same period, 15 percent of our current generation fleet is slated for retirement.¹³

So we are going to have to build a lot of new power plants to run our homes and businesses and keep the economy moving. Unfortunately for consumers, it will be much more expensive to bring new generating facilities on stream than it was in the past. For example, there are the coal, oil and natural gas-fired plants that give us about 20 percent of our electricity. In mid-2008, thermal coal prices in North America were double what they were a year earlier while oil prices were up by 80 percent and natural gas was up by more than a third.¹⁴ No one can say for sure what these fuels will cost 10 or 20 years down the road, but few expect they will get cheaper. In fact, many expect that natural gas prices are set to soar as utilities across the continent shift away from coal in favour of cleaner gas generation. In addition to market forces, government policies that effectively put a price on greenhouse gas emissions will strongly affect the price of fossil fuels and hence the electricity they produce.

With respect to new hydro installations, we are already finding that the best rivers are tapped to capacity. New dams and generators will be further away from consumers and more costly to develop. It is a similar situation with nuclear power. The new facilities that Ontario has announced will cost much more than their predecessors. Higher construction costs for hydro and nuclear stations can only mean more expensive electricity down the road.

If there is any good news for consumers, it is wind power. With current government support mechanisms, good wind energy sites are cost-competitive with a growing number of conventional sources. But soon, the balance will begin to tip in favour of wind. As the cost of building new hydro and nuclear plants heads higher and rising fuel costs drive up the cost of coal, oil and gas-fired power, wind will become one of the lowest cost options over the next decade.

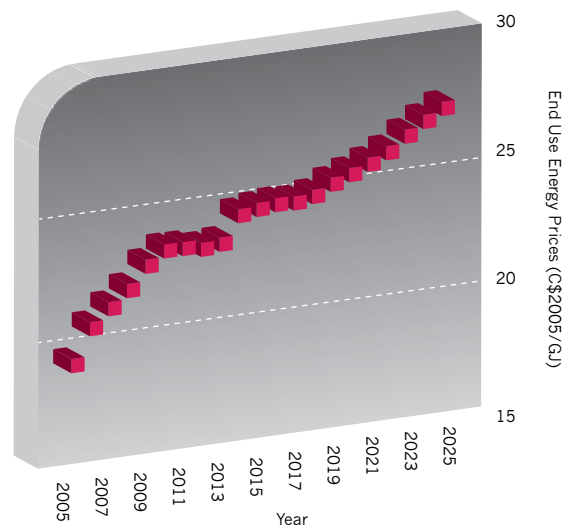
The cost of building wind farms, and all other generating facilities, has risen in recent years due to rising prices for steel, concrete, transportation and other inputs. Studies suggest, however, that installation costs for wind will remain relatively stable or even decline in the years ahead as wind turbine supply catches up to demand and wind turbine technology continues to improve.¹⁵

Once a wind farm is built, the cost of generating power stays pretty much fixed over the life of the project. There are never any fuel costs to worry about because there is an infinite supply of wind that is absolutely free.

Wind power won't mean that electricity rates will fall, but it will put the brakes on price increases. As we plan for our electricity future, the more we turn to wind, the cheaper and more stable our electricity rates will be.

NEB DATA FOR ELECTRICITY PRICE TRENDS (RESIDENTIAL) FROM 2005 - 2025

Electricity prices for residential consumers increased 48% between 1990 and 2005 according to Natural Resources Canada. The graph shows a recent projection of future growth in residential electricity prices from the National Energy Board.



Source: Natural Resources Canada, Energy Outlook Forecast.

CANADA NEEDS TO REDUCE THE ENVIRONMENTAL IMPACTS OF OUR ELECTRICITY SYSTEM

The electricity system has a huge impact on Canada’s environment. For example, our coal, oil and natural gas-fired facilities pump out 17 percent of our greenhouse gas emissions, 34 percent of our toxic mercury emissions and 25 percent of the sulphur oxides which are harmful to human health and cause acid rain and smog. On top of this, our nuclear power generators have piled up 6,800 cubic metres of highly radioactive waste for which no long-term disposal solution currently exists. Even renewable hydroelectricity can have an impact on ecosystems and biodiversity where hydro project divert rivers or dam them up to create reservoirs.¹⁶

Canada has set the goal of cutting greenhouse gas emissions 20 percent below 2006 levels by 2020, and 60-70 percent below 2006 levels by 2050.¹⁷ Meeting CanWEA’s 2025 target for wind energy will trim 17 MT of annual greenhouse gas emissions by 2025. What’s more, wind facilities are relatively quick and easy to build. They can start almost immediately to make a serious dent in greenhouse gas and other emissions. This early impact will be critical if the United Nations’ Intergovernmental Panel on Climate Change (IPCC) is correct in warning that we must

“turn the corner” on emissions by 2020 or face irreversible consequences.¹⁸

New technologies such as clean coal and large scale carbon sequestration may play a role in our long-term energy future. But they are still in the R&D stage. Renewable energy technologies like wind are the only commercially-ready, clean technologies that can be deployed fast enough and on a sufficient scale to make the real difference that we simply have to make to turn the corner on greenhouse gases commercially-ready, clean technology that can be deployed fast enough and on a sufficient scale to make the real difference that we simply have to make on greenhouse gases, toxic waste and other forms of pollution.

Compared to all conventional sources, wind-generated electricity is environmentally benign. It is emission-free, consumes no water, produces no waste and is 100 percent renewable. As wind projects move through the consultation and regulatory process, interveners sometimes express concerns over visual impact, noise pollution and potential impacts on wildlife. However, these misgivings are largely addressed and mitigated by fine-tuning site plans as a result of the environmental assessment process.

TO IMPROVE THE ENVIRONMENTAL PERFORMANCE OF THE ELECTRICITY SYSTEM, NO OPTION OFFERS ANYTHING CLOSE TO THE ADVANTAGES OF WIND.

ENVIRONMENTAL FOOTPRINT

This table provides a qualitative comparison of the different electricity generation options with respect to their potential (life-cycle) environmental impacts.

Technology	Criteria Air Pollutants	GHG ¹	Water use impacts ²	Extraction	Waste
Demand-side Management	None	None	None	No	Disposal of replaced equipment
Reservoir hydro	None	Low	Flow pattern changed	No	No
Run-of-river hydro	None	None	Minimal	No	No
Nuclear	None	None	Thermal discharge	Yes	Radioactive
Natural gas	Low	Medium	Thermal discharge	Yes	No
Oil-fired generation	High	High	Thermal discharge	Yes	Yes ³
Conventional coal	High	High	Thermal discharge	Yes	Yes ³
“Clean coal” with CO ₂ capture and sequestration	Low	Medium	Thermal discharge	Yes	Yes ³
Wind power	None	None	None	No	No

■ small or no impact; ■ low impact; ■ medium impact; ■ large impact.

¹ Greenhouse gas emissions from energy conversion process only, not manufacture or construction.

² Water use is difficult to compare for different technologies. In hydroelectric power stations, fossil, and nuclear plants, water use is largely non-consumptive. Thermal power stations may cause some water losses through evaporation, as well as thermal discharges into watersheds, within regulated maximum limits. Hydroelectric dams do not cause thermal discharges, but will affect flow patterns.

³ From ash management and/or flue gas treatment.

Source: Canadian Electricity Association, ‘Power Generation in Canada: A Guide’.

CANADA NEEDS TO BUILD NEW GENERATION QUICKLY

With growing use of electricity and many of our power plants approaching their best before dates, Canada's electricity producers must add 323¹⁹ TWh of new generation to keep supply and demand in balance between now and 2025 – more than half of what we currently produce. That means we must build the equivalent of more than four new hydroelectric facilities as big as the La Grande Riviere project in Quebec or 13 more of Ontario's Darlington nuclear stations by 2025.²⁰ This won't be easy to do in the short time available. Major nuclear and hydro projects can face long delays in clearing regulatory and social hurdles. Then, of course, these facilities take years to build. The two new nuclear plants which Ontario announced in 2008 are not expected to be in service until 2018 at the earliest. Even with conservation and efficiency measures, Ontario's Independent Electricity System Operator (IESO) predicts that as early as 2015, peak electricity demand will exceed what Ontario can supply from existing and planned facilities. The IESO forecasts a capacity shortfall as high as 2000 MW.²¹ Fortunately, wind power can help fill this gap.

Wind energy has the distinct advantage that it can be built rapidly and at varying scales. This allows utilities to bring wind on line as needed to keep pace with growing demand. Wind farms are also small in scale compared to nuclear or hydro plants. An average 50 MW wind farm with 20 turbines requires about five square kilometres of land of which all but five percent can be used for grazing or crops.²² While not wholly immune from the NIMBY syndrome, the environmental footprint of a wind farm is extremely modest. So, compared to other sources of power, wind projects are far less likely to face protracted and contentious assessment, consultation and approval processes.

CANADA'S ELECTRICITY SYSTEM IS INCREASINGLY FRAGILE

The blackout that hit central Canada and the U.S. north east in August 2003 turned the lights out on 50 million people and put the Ontario economy into neutral for days as major industries waited for the grid to stabilize. The blackout gave a vivid demonstration of how fragile our electricity system has become. It all started when a single generating plant in Ohio shut down unexpectedly and then dragged 265 plants down with it. There have been several smaller blackouts since 2003 and there will likely be more. The problem can be traced to two main factors: three decades of under-investment in the transmission and distribution system and an over reliance on centralized power generation.

To fix the situation, we need new transmission and distribution infrastructure. We simply cannot squeeze more electrical power through the same aging cables. Equally important, we need to disperse our generating facilities much more broadly. Instead of relying on a few large power plants, we need to feed our power grids from dozens of sources, large and small, spread over a wide area. Wind energy fits perfectly into this scenario.

To provide reliable power, wind generation facilities must be distributed across a wide geographic area. The more broadly distributed they are, the less likely it becomes that poor wind conditions will affect more than a few facilities at the same time. Thus, the more we rely on wind energy, the more sources we will have to feed power into the system. Over time, the electricity grid will migrate from its current "hub and spoke pattern" to one that looks more like a spider web that can reroute power through many strands when a generator is not working.

THE MORE WE TURN TO WIND POWER,
THE MORE RESILIENT OUR POWER GRIDS
WILL BECOME.

Once a wind installation clears the regulatory process, construction is fairly simple and they can generally come on stream and start generating power in less than two years. So wind can give us the power we need, when we need it and help get us past the looming energy crunch.

CANADA HAS A COMPETITIVE ADVANTAGE IN WIND ENERGY

When you take a close look at wind energy, it is easy to see why governments, consumers, industry and environmentalists around the world are getting so excited. CanWEA thinks Canadians should be excited too. That's why we are giving them the facts about wind and why we have developed WindVision 2025.

We can get 20 percent of our electricity – 55,000 MW²³ – from wind by 2025, by putting up 22,000 wind turbines spread over about 450 locations across Canada. All told, the wind farms we need would occupy a land area of about 5,500 square kilometers. That's about the size of Prince Edward Island.²⁴

It will take a very concerted effort to build this many facilities by 2025. But if a country like Spain, with an economy similar in size to Canada's, can install more than 3,500 MW of new wind energy in a single year, so can we. We can learn from both the wind power experience in other countries and from what we have done in other energy sectors here at home. Remember the 1980s, when the technology for producing oil from the Alberta oil sands was in its infancy and it was far more expensive than conventional sources of oil? Twenty years and \$90 billion²⁵ of investment later, almost half of Canada's petroleum production comes from the Fort McMurray area and huge new investments are planned.

Putting 55,000 MW of wind power in place by 2025 will be like developing Canada's electricity 'oil sands'. At \$132 billion²⁶, costs will be similar, but Canada's wind power pioneers will enjoy some advantages which their counterparts in Fort McMurray would have envied. For starters, wind technology is already well advanced and understood and price-wise, wind power is becoming more and more cost-competitive. The business and environmental cases for wind power are very solid, so there is no reason to believe that WindVision 2025 is unattainable.

Getting 20 percent of our electricity from the wind in 2025 is an ambitious goal, but we can get there if we roll up our sleeves and get down to work. In fact, we have already taken our first initial steps. By the end of 2008, every province will be generating some electrical power from wind and there is an emerging consensus at all levels of government on the need to move toward a more sustainable electricity future. So, the ground for our wind energy future is already being laid and there are other important factors that are working in our favour.



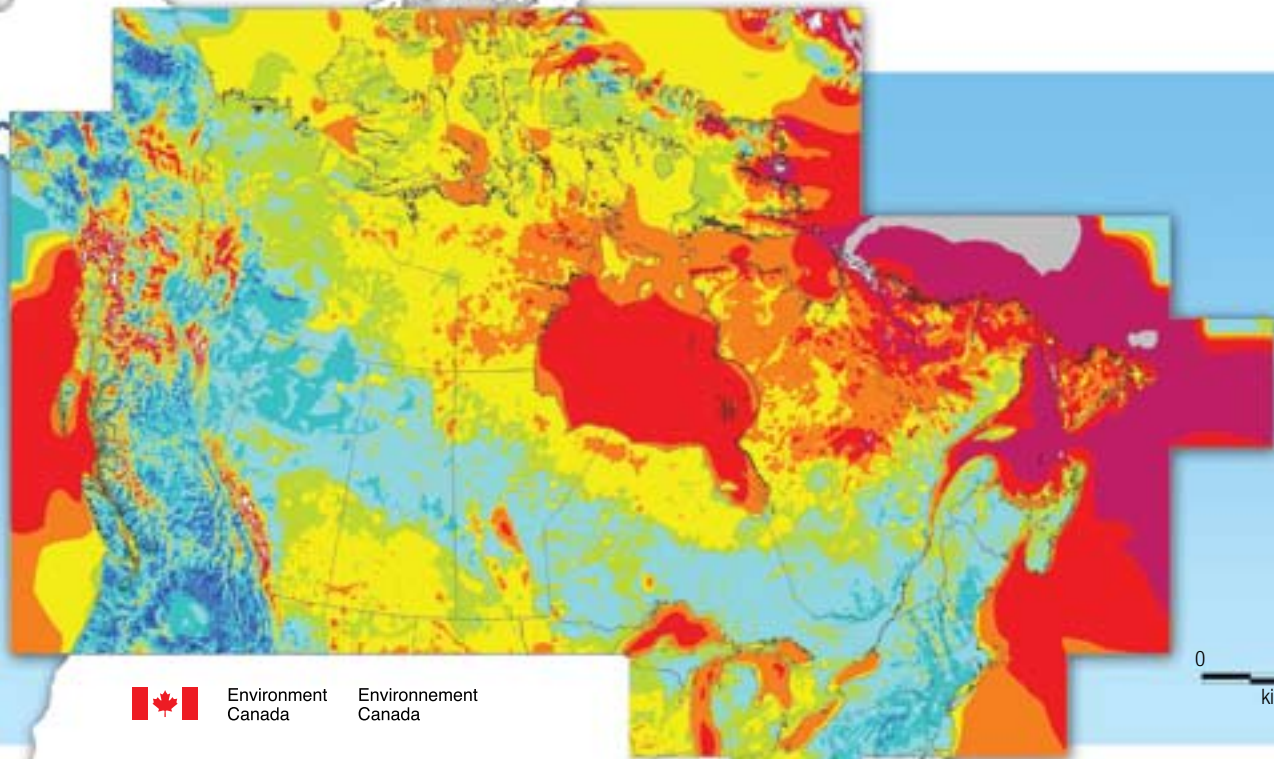
CANADA HAS A WORLD-CLASS WIND RESOURCE

The quality of Canada's wind resource is as good as or better than any of the world's leading wind energy nations such as Germany, Spain and the United States.²⁷ With our huge landmass and lengthy coastlines, we have more top-quality wind power sites than we could ever use. In fact, we could meet Canada's total electrical demand by tapping the wind potential of just one quarter of one percent of our landmass.

In Quebec alone, a 2004 study identified more than 100,000 MW of wind potential in sites within 25 km of Hydro Quebec's existing transmission lines.²⁸ The picture is equally encouraging in other provinces and that's just our onshore resources. Our offshore potential along our ocean coasts and in the Great Lakes is also huge. One thing we know for sure is that Canada will never be short of wind.

MEAN ANNUAL WIND VELOCITY AT 50 M ABOVE GROUND (METRES/SECOND)

As this map indicates, Canada has vast resources of wind.
Horizontal resolution of 5 km



CANADA'S ELECTRICITY SYSTEM CAN INTEGRATE LARGE AMOUNTS OF WIND ENERGY

On its own, wind energy cannot meet all of Canada's electricity needs. Just as a healthy person needs a balanced diet, a stable electricity system needs power from a variety of sources. Hydro, nuclear, natural gas, biomass and eventually solar and clean coal will all likely play a role in meeting our electricity needs. The rich mix of generating capacity that we already have will make it easier to incorporate large amounts of wind energy. Studies by North American utilities show that wind energy penetrations equivalent to 20-30 percent of peak electricity demand are technically and financially feasible.²⁹ Moreover, the cost of integrating wind into the electricity system is expected to fall as wind installations become more geographically dispersed, wind forecasting techniques improve and our electrical grids become more interconnected.

Wind power comes with the added advantage that it is an excellent partner with hydroelectricity, which makes up 60 percent of Canada's current electricity supply. System operators can easily vary hydroelectric production to balance any variability in wind energy supply. What's more, wind energy peaks in the wintertime when reservoirs are low, so wind can fill the gap when hydroelectric plants don't have enough water to operate at full capacity. Wind and hydro power bring out the best in each other and Canada is in a unique position to take advantage of this relationship.

THE GASPÉ EXPERIENCE

Around the world and right here in Canada wind power is doing more than generating clean, green electricity. It is also generating economic opportunity.

In Quebec's Gaspé region, many traditional industries such as fishing, agriculture, forestry and mining have been in decline or face an uncertain future. However, wind energy has brightened the economic picture. To take advantage of strong, reliable onshore winds from the Gulf of St. Lawrence, 8 wind farms with a total installed capacity of 422.25 MW have been in operation since 1998 and 8 more will join them by 2015.

In the peak summer periods, wind-related construction work is employing up to 1,000 people in the Gaspé region. But the news is even more exciting in manufacturing where \$63 million of investment has already created 600 permanent jobs and spawned a further 200 jobs in research, training, transportation and other services. Gaspé firms are now producing turbine towers, turbine blades, nacelle covers, control panels and other wind energy components. Some of these companies are already exporting wind turbine components to other parts of Canada and the United States and with a foothold in a global market that is set to explode over the next 15 to 20 years, who knows what the future holds?

Unlike traditional resource industries, wind energy development and spin-off activities in manufacturing and services will attract investment and generate new jobs in the Gaspé region for years to come.



CANADA'S EXPORT OPPORTUNITIES ARE TREMENDOUS

In 2008, Canada was the world's 4th largest exporter of electricity.³⁰ We sit next door to the world's largest electricity consumer which has a strong and growing appetite for green power. In fact, 25 American states now require a certain portion of their electricity to come from renewable sources. These initial efforts will lead to the installation of 61,000 MW of new renewable energy generating capacity.³¹

Canada enjoys a long history of energy and electricity trade with the Americans and there are great opportunities to build on this through wind exports. For example, Canada's Atlantic provinces have tremendous wind resources but a relatively small demand for electricity. Across the border, however, in the north eastern United States, there is a huge demand for electricity that will be difficult to meet from local renewable sources. Wind power from Atlantic Canada can fill this gap and there are similar opportunities in other parts of Canada as well.

CANADA'S INDUSTRIAL AND KNOWLEDGE BASE PROVIDES AN IDEAL LAUNCH PAD FOR WIND GROWTH

A typical wind turbine is made up of about 8,000 separate parts – from electronics to heavy metal components. The wind energy supply chain is extremely broad and diverse and holds enormous opportunities for Canadian manufacturers. We are already producing wind turbine towers, blades, and nacelle covers and we have the skills and the plant and equipment to produce an even broader range of components. Today, approximately half of the value of a wind turbine has the potential to be readily produced on a large scale in Canada.³² Given the pressure on our traditional manufacturing base, this represents a significant opportunity for diversification and renewal.

Canadian industry can capitalize on our knowledge, skills and ingenuity to sustain tens of thousands of new "green collar" manufacturing and service jobs supplying wind power operations in Canada and around the world.

THE PAY-OFF FROM INVESTING IN WIND

CanWEA believes that Canada has all it takes to make wind a big part of our energy future. Looking only at price, environmental impact, reliability and long-term security of supply, generating a substantial part of our electricity from wind only makes good sense. But that's not the whole story. The broader economic benefits will be enormous.

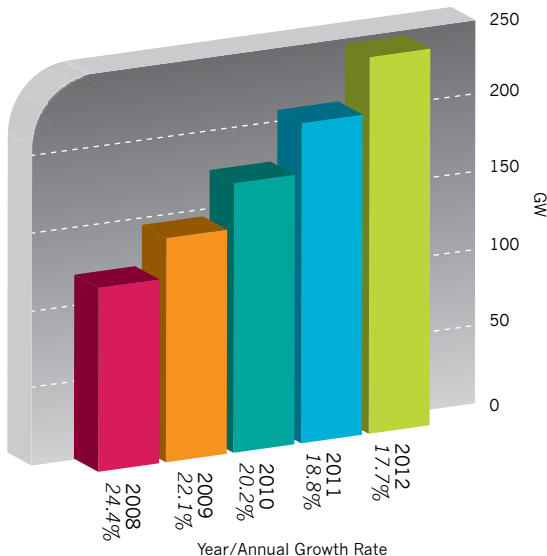
DIRECT INVESTMENT

Recent studies estimate that public and private investors around the world will pump between \$800 billion and \$1 trillion into wind power from 2008 to 2020.³³ If we act quickly and decisively, Canada can get at least our fair share of this investment. But it will require action by governments. Achieving CanWEA's WindVision 2025 target is going to cost about \$132 billion. But if governments send a clear signal that this is a national priority for Canada, the private sector will respond, and we believe that at least 60 percent of the total, some \$79 billion, can flow to the bottom line of Canadian equipment manufacturers, construction and engineering firms and other suppliers in all regions of the country.³⁴

JOB CREATION

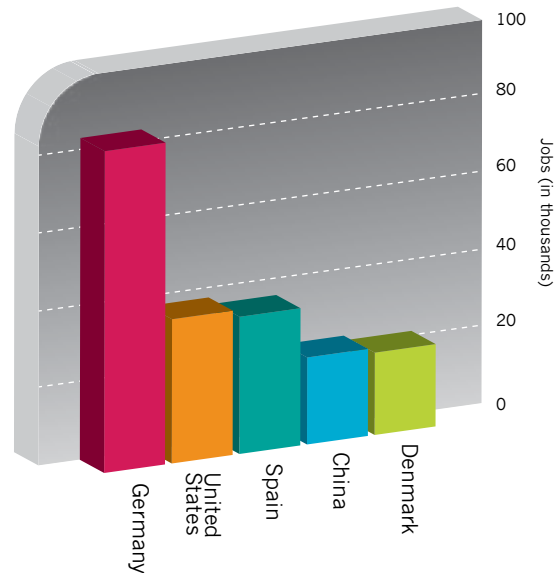
In terms of employment creation, the benefits would also be significant. Installing the 55,000 MW called for in CanWEA's Windvision 2025 would mean at least 52,000 new, "green collar jobs" for Canada in 2025.³⁵ Approximately half of these would be high quality manufacturing jobs and a third would relate to operation and servicing. If industry and government work together to establish a versatile wind turbine and component manufacturing capacity in Canada, the employment outlook would be even brighter. Also, these estimates are only for the Canadian market. With world-wide investment in wind power expected to top \$1.8 trillion by 2025,³⁶ export markets could mean tens of thousands of additional jobs for Canadian workers. By 2020, the Worldwatch Institute predicts there will be two million jobs world-wide in the wind power industry.³⁷

PROJECTED GLOBAL INSTALLED WIND ENERGY CAPACITY: 2008-2012



Source: Global Wind Energy Council 2007 Annual Report

ESTIMATED EMPLOYMENT IN WIND POWER IN LEADING WIND ENERGY NATIONS IN 2007



Source: World Watch study 2008

REGIONAL ECONOMIC DIVERSIFICATION

The benefits of achieving the WindVision 2025 target will be spread right across Canada. This is especially true for rural and remote communities as wind energy can help diversify and grow their economies and stabilize their tax bases. These communities will see construction jobs first, then long-term, stable employment and continuing investments associated with operating and maintaining wind farms. Moreover, financial returns to host communities will be impressive. Meeting CanWEA's 2025 target would result in a minimum annual payment to landowners of \$165 million by 2025 and an equal amount to municipalities in property taxes.³⁸

NORTHERN AND ABORIGINAL COMMUNITIES

Canada has roughly 300 northern and remote communities, mining and industrial facilities that are isolated from electricity grids. These include many small Aboriginal settlements and a number of larger centres. Most of these communities, home to more than 200,000 residents, depend entirely on expensive and polluting diesel generators to meet their electricity needs. With adequate incentives, wind power could meet about 10 percent of the electricity demand across these communities, including places like Tuktoyaktuk, Voisey's Bay, and Norman Wells. This would provide a source of revenue to local governments, create jobs, and replace up to 20 million litres of diesel fuel each year.³⁹

PINCHER CREEK

Most wind farms in Canada are located in rural municipalities. Even though most of the electricity they feed into the grid finds its way to major urban centres, many of the economic benefits stay close to the source.

Nestled against the Rocky Mountains in Southern Alberta, the Municipal District of Pincher Creek offers prime wind power locations and a prime example of what wind power development can do for a local economy. From a modest 20 MW of installed wind capacity in 1994, wind energy in the Pincher Creek area had grown to more than 220 MW by 2008, distributed among five major projects with numerous others on the horizon. As it has evolved into one of the wind power capitals of Canada, the town and its residents have profited in many ways, including:

- 50 person-years of employment during construction of each project
- More than \$10 million in locally sourced goods and services for each project
- Almost 30 full-time, permanent jobs in operations and maintenance with an almost \$2 million annual payroll
- Close to \$3 million in local tax revenues annually and growing
- More than \$2 million in annual royalty payments to land owners

There has also been an unexpected benefit from developing Pincher Creek's wind resources – tourism. Each year, thousands of visitors come to marvel at turbine blades reaching 100 metres into the air, supplying green power to nearly 90,000 homes in the province.

MAKING WINDVISION 2025 A REALITY

The economic and the environmental case for wind energy is extremely strong, but we can't take it for granted that this new and vital green industry will evolve on its own at the pace we need. We must act quickly and decisively to remove barriers which stand in the way of our wind energy future. If Canada is going to squeeze all of the benefits out of this opportunity, our utilities, manufacturing and service industries and our governments need to put their heads together and start thinking big about wind power.

To make WindVision 2025 a reality, CanWEA believes that six things have to happen.

1. WE HAVE TO MAKE WIND A NATIONAL PRIORITY

Experience around the world shows that wind energy success stories start with a national vision and a strategy. In 2000, Spain had about 1,000 MW of installed wind generating capacity. Then, led by national and regional government agencies, the country adopted an aggressive strategy to develop 13,000 MW of wind energy by 2011. Soon they realized that a much higher target was achievable and they are now well on their way to installing 20,000 MW by 2010.⁴⁰ In the process, the Spanish have cut annual GHG emissions by 18 million tones, spawned three of the world's largest wind turbine manufacturers and nurtured a wind energy sector employing tens of thousands of people.⁴¹

In Germany, there has been strong government leadership, aggressive goals and a collaborative approach to developing and implementing a strategy. Today the Germans are second only to the Americans in total wind energy output and generate about seven percent of their electricity from wind. Their goal is to meet 25 percent of their power needs from wind by 2025.⁴² The German wind industry now employs over 80,000 people and trails only the auto sector in steel consumption.

In the United States, people are starting to think big about wind energy. In 2008, the United States Department of Energy released a detailed study showing that the U.S. could get 20 percent of its electricity from wind by 2030.⁴³

Former Vice-President Al Gore has challenged America to commit to producing all of its electricity from renewable energy sources within 10 years. Investors like Warren Buffett and T. Boone Pickens are also calling for the U.S. to make huge investments in wind energy, to reduce GHG emissions, free up natural gas for use in transportation and to reduce U.S. dependence on imported oil.

Governments in Canada must give clear and strong signals that they are committed to a wind powered future. In Canada, the vast bulk of our electricity system is publicly owned. Plus we elect governments to manage the economy and take care of the environment. On both of these accounts, wind energy has a huge contribution to make. So our federal and provincial governments are big players on the wind energy stage. As a first step, they must send out a clear message that they are counting on wind to meet growing demand for electricity, to make good on our greenhouse gas commitments, and to stimulate huge new investments and create tens of thousand of "green collar" jobs.

Wind energy is big business in Europe, the United States, India, China and other countries. With the right strategies, policies and support mechanisms, it can be big business in Canada too and a corner stone for a sustainable energy future.

CanWEA calls on federal and provincial governments to collaborate on an action plan that will put Canada on the road to generating 20 percent of our electricity from wind by 2025. Intergovernmental co-operation is essential to create the regional synergies required to maximize Canada's wind energy opportunity. A Pan-Canadian Wind Energy Plan must respect jurisdictional boundaries, BUT parties must act together on five key priorities:

- Acknowledging and providing economic value for the environmental benefits of wind energy
- Increasing and improving wind energy procurement processes across the country
- Planning and building 'wind-friendly' transmission infrastructure
- Stimulating wind power equipment manufacturing through proactive measures
- Streamlining permitting and approval processes for wind energy projects.



2. WE NEED A LEVEL PLAYING FIELD FOR ELECTRICITY PRICES

Electricity prices in Canada do not currently reflect the environmental and health impacts associated with the different ways of producing power. This represents an indirect subsidy of those electricity generating sources that produce such impacts. While these costs are not currently found on electricity bills, they are real costs that are borne by consumers in other parts of society. As a result, consumers believe conventional sources of electricity are cheaper than they really are. We need policies that will put a price on the damage electricity production causes to the air, water and land and we need to reward green producers.

One element of leveling the playing field is to put a price on GHG emissions like carbon dioxide that cause climate change. The federal government and some provinces have taken initial steps in this direction, but it will take time for Canadian carbon prices to approach European levels that more fully reflect the environmental costs associated with climate change. Of course, the benefits of wind energy go well beyond greenhouse gas reduction. That's why in the European Union and the United States, governments have gone beyond carbon pricing and developed a wide variety of policy tools aimed at maximizing the broad economic and environmental advantages of wind power. In much of the EU, for instance, wind power producers receive guaranteed access to electrical grids at attractive prices. Generous tax credits are also available to wind power producers in the U.S. and to encourage demand for clean electricity, 25 to 26 state governments have implemented Renewable Portfolio Standards (RPS) which set minimum levels for 'renewables' in the electricity system.

Governments in Canada have also implemented supply and demand-side measures to stimulate wind energy investments. However, our incentives are far less aggressive than measures in place in the world's leading wind energy countries. In fact, a 2008 study by Ernst & Young pointed out that wind energy investments are less attractive in Canada compared to the US, Germany, China, India, the United Kingdom and Spain.⁴⁴ To secure our place in this rapidly growing global industry, Canada must have a comprehensive strategy that will make us an attractive destination for wind energy investment. Our competitors have taken these steps already. We must follow suit or lose out on this enormous opportunity.



CanWEA calls on federal and provincial governments to develop comprehensive strategies and implement bold measures to stimulate the supply and demand sides of the wind energy equation. We can draw on the experience of the world's leading wind energy countries to develop policy tools that will make Canada a globally competitive destination for wind energy investment. In addition, Ottawa and the provinces should move aggressively to implement policies and regulations that place a price on carbon emissions and other harmful by-products of electricity generation.

3. WE NEED UTILITIES TO ADOPT WIND-FRIENDLY PROCUREMENT PRACTICES

In most of Canada, provincial governments have directed Crown utilities to procure increasing amounts of wind energy and other renewables through competitive tendering. At face value, it makes good sense to contract for renewable energy supplies at the lowest possible cost. On closer inspection, however, current procurement practices can have unintended consequences which make it harder to capitalize on wind power's full potential.

With competitive tendering, utilities bring new wind capacity on stream in large chunks rather than in steady increments. While this may satisfy the utility's needs for more power, it means that equipment manufacturers face a 'boom and bust' scenario and an uncertain business climate that offers little incentive to set up facilities in Canada. This cycle of ups and downs also makes it difficult for wind energy developers to make long-term investment plans for Canada. Good wind projects which have passed the initial planning stage must sit on the shelf until new tenders are issued, by which time developers may well have placed their capital and people elsewhere. A procurement system which provided a more stable outlook and a steady flow of opportunities would encourage turbine and component makers to locate and produce in Canada and ensure that good wind energy projects move forward.

Another downside feature of competitive tendering is that it is technically challenging and very expensive for bidders to participate. Responding to a Request For Proposal (RFP) for a major wind project will entail thousands of hours of expert time and costs running into millions of dollars. Not only does this take time and resources away from project development and stakeholder engagement, it gives a distinct advantage to large firms that have the financial capacity to carry these costs and may deter community groups, municipalities,

co-operatives and Aboriginal communities from even taking part. One of the strengths of wind energy is that it can be deployed at varying scales by a great variety of potential project developers. Utilities and power authorities must adjust their procurement processes to ensure that it is not only the big players that can compete.

Competitive tendering can also lead to higher costs for wind power projects. When Canadian utilities issue RFPs for new wind energy capacity, they commonly receive proposals equivalent to three to four times the amount of power they are actually seeking. So, competing is a risky business and bidders factor this risk into their price proposals. An effective procurement process should also look beyond price and factor in other variables like community support and local economic benefits.

When it comes to procurement practices, experience in Europe may offer useful guidance to Canada. Wind energy projects in many European countries have an automatic right to connect to the grid and receive a fixed price (feed-in tariff) for their electricity production. If developers are willing to build wind farms at that price, they are free to do so and can start selling electricity as soon as projects are completed. The feed-in tariff system provides much greater certainty and lower risk as developers can easily project whether a project makes good business sense. So it's no surprise that countries which offer feed-in tariffs are attracting huge wind power investments. This underscores the need for Canada to rethink its procurement processes to improve our ability to compete for global wind energy investment.

CanWEA calls on provincial governments to examine best practices in the world's leading wind energy countries and adjust their procurement practices to provide a stable and steady stream of opportunities and accommodate a wide range of potential wind energy project developers. New procurement processes should reward disciplined, long-term development proposals and consider factors such as project quality, economic and environmental benefits in addition to price.

4. WE NEED TO INVEST IN SMART GRIDS

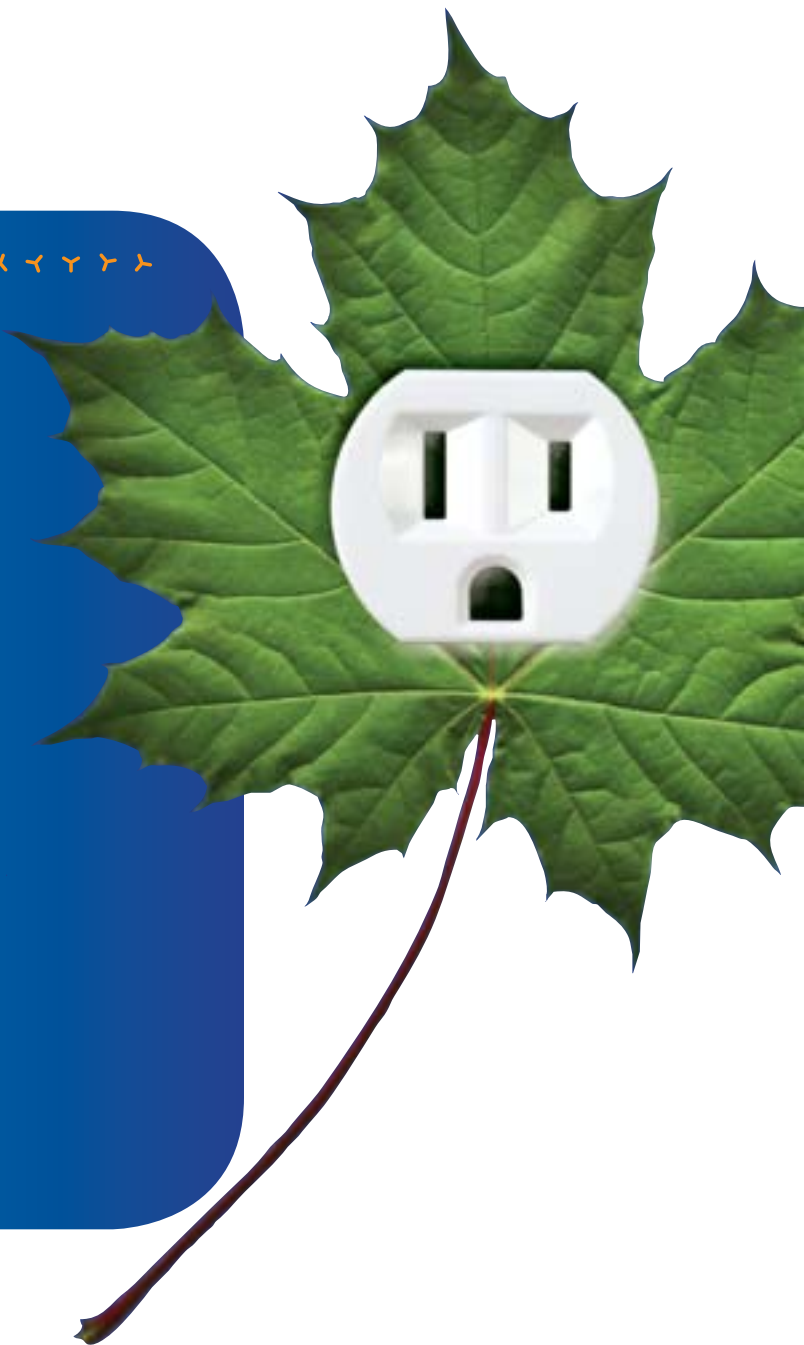
There is no point to developing new electrical generating capacity in Canada if we don't have a way to ship additional power to consumers. Investments in our electrical distribution infrastructure are long overdue and there are already several wind energy developments "on hold" because of a lack of transmission capacity.⁴⁵ Regardless of the power generation sources we develop, we need to ensure that new transmission sources are wind-friendly.

Smart grids facilitate access to wind energy resources, strengthen the connections between electricity grids and meet the technical specifications required to integrate large amounts of wind energy into the grids. It will also be important to plan new transmission facilities for the medium term because of the relatively short time frame for taking wind facilities from the drawing board to the operational stage.

Canada must make huge investments in transmission and distribution infrastructure to keep our electricity system reliable in the coming years. This will be essential whether or not we move toward CanWEA's 20 percent wind energy target for 2025. There will be a small incremental cost involved in making the new infrastructure 'wind-friendly', but this will be minor compared to the economic and environmental benefits. The United States Department of Energy estimates that accommodating 20 percent wind in the overall electricity supply would add about 50 cents to the monthly bill for average rate payers.⁴⁶ Wouldn't Canadians be willing to pay this price for clean, renewable wind energy?

CanWEA calls on provincial governments and transmission planning authorities to collaborate in identifying physical gaps in transmission infrastructure that are impeding the development of prime wind power sites. As a top priority they must map out an infrastructure investment strategy that will provide the necessary access and integration capacity to accommodate 20 percent wind power in our electricity grids by 2025. Because of the enormous impact investments in transmission infrastructure have on wind power development, CanWEA recommends that transmission planners work on a regional, rather than province by province basis, to build a robust transmission system which can accommodate optimal amounts of wind energy.

CanWEA also calls on provincial governments and transmission planning authorities to prioritise the development of transmission infrastructure that facilitates access to, and integration of, renewable energy into our electrical grids. To build this new infrastructure, policies and regulations must be implemented to allow transmission companies to finance their investments through the rate base, with cost recovery from new generation connected to these lines.



5. WE NEED INCENTIVES TO STIMULATE WIND EQUIPMENT MANUFACTURING

There is a long history of strategic government support to new and developing industries. For instance, government incentives have played an important role in the development of Canada's world-class aerospace, nuclear and auto industries and are still very important to their future prospects. Without that support, these sectors would not have seen the levels of success they have attained in Canada.

Once wind power is established as a significant source of electricity, market forces will generate profitable investment and employment growth at all points along the supply chain. However, steps need to be taken now to inform and engage the private sector in discussions related to taking advantage of these opportunities. Governments can assist this process by offering various kinds of incentives to companies that manufacture wind power equipment.

Now is the time to ramp up our investments in wind energy manufacturing. Rapid growth in global wind energy demand has led to significant bottlenecks in the supply of key components for wind turbines. In fact, many wind energy project developers are facing delays of up to two years in securing wind turbines for their projects. As a result, turbine manufacturers are adding new capacity and, with the right incentives, they may add this capacity in Canada.

In any global industry, investment will gravitate to countries which offer the highest returns. Traditional factors such as cost of capital, the supply of skills, raw materials and components and access to markets will all come into play as companies decide where to locate their facilities. However, governments that offer subsidies, tax rebates and other incentives to lower production costs serve as a magnet for investment. This is certainly the case in wind energy equipment manufacturing where governments around the world have recognized that hundreds of billions of dollars in equipment sales and as many as two million high quality jobs are up for grabs over the next two decades.

Whether we like it or not, our ability to grow the Canadian wind equipment manufacturing sector will depend to a considerable extent on how attractive Canada's investment climate is relative to other countries – and many other countries are using incentives to influence this decision. Our main competition is the United States, where manufacturers invested more than \$1 billion in 2007 and the first part of 2008 to build or expand 41 wind turbine manufacturing facilities, creating 9,000 high quality jobs.⁴⁷



CanWEA calls on the federal government to commission a global survey of incentives available to wind energy equipment manufacturers and to work with provincial governments to make Canada a more attractive destination for investment in this sector.

6. IMPROVE THE EFFICIENCY OF PERMITTING AND APPROVAL PROCESSES

One reason that Canadian electricity suppliers are having trouble keeping up with demand is that new projects must go through permits and approvals processes related to municipal zoning, environmental assessment, and integration with the electricity system. While such processes are important and necessary, the current system simply doesn't work very well. Permitting processes vary significantly from jurisdiction to jurisdiction, there is often significant duplication and overlap between processes, and often the requirements and timelines are not clear. An additional problem is a lack of dedicated government resources. There simply aren't enough people working on approvals and permits

to handle interest in new wind energy development underway across Canada. This is true at all levels.

Canada will not be able to bring the new sources of supply, wind or otherwise, on stream fast enough to meet the growing demand for electricity if the approval and permitting system remains unclear, cumbersome and time consuming.

CanWEA calls on federal and provincial governments to streamline regulatory and permitting practices, eliminate overlap among jurisdictions, and provide more transparent and timely decisions. In addition, governments must ensure that these crucial activities have enough people to do the job.

MOVING **BEYOND** 20%



CanWEA's WindVision 2025 offers an opportunity for all electricity stakeholders to begin to think "big" about wind energy in Canada. But there is no telling how much further or faster wind energy could develop down the road.

As consumers and businesses respond to increasing oil and gas prices, shifts in electricity demand will occur. An increased electrification of the economy is starting to happen, particularly in the transportation sector with the advent of plug-in hybrids, all electric vehicles, and electric intercity rail. We know for example, that a growing number of large car manufacturers now have plug-in electric hybrids (PHEVs) in development and the first PHEVs are anticipated to be introduced to consumers in 2010 (Chevrolet Volt, Toyota Prius etc.).

Policy makers are also looking at promoting the use of full electric delivery vehicles for use in city core areas to reduce smog and other emissions. Since most cars and delivery vehicles are parked at night there will be an interesting opportunity to use increasing amounts of off-peak electricity from wind energy to recharge a growing fleet of electric vehicles. A significant amount of work is also ongoing (especially in the US) on how to also use the stored energy in these PHEVs and EVs and to inject it back into the grid during peak demand (vehicle to grid / V2G). Developments like these may mean that the demand for electricity will likely be higher than projected only a few years ago and demand patterns can shift quickly. Wind power will be essential to keep our electricity supply growing in step with demand.

Wind power is clean, reliable, quick to install, economically viable, and it is ready to do the job, now. And the picture can only get better. Energy storage processes now under development around the world including batteries, pumped water reservoirs, compressed air, and hydrogen have the potential to make wind power an even bigger factor in our electricity future. Wind energy technology itself is evolving rapidly. The wind turbines being installed in 2008 bear little resemblance to the models first used to generate electricity on a large scale in the 1980s. Today, wind power is much more efficient, more productive, more environmentally friendly and, slowly but surely Canadian governments, utilities, private investors and consumers are waking up to its enormous potential to meet our growing electricity needs.

A hundred years ago Canada's electricity pioneers ushered in the hydropower age. Today, we are poised to repeat the process, this time with the wind. There is little doubt this new era will extend far beyond what we are calling for in our Windvision 2025. But we need to get started. We need to fall in line with the rest of the world and capitalize on this opportunity. It's time to start thinking big.

ENDNOTES

- ¹ International Energy Agency, Key World Energy Statistics 2007
- ² National Energy Board. *Canadian Energy Overview 2007: An Energy Market Assessment May 2008*. p. 36.
- ³ Canadian Electricity Association Handbook, Canadian Electrical Generation page 5
- ⁴ Ontario Power Authority's Supply Mix Advice and Recommendations Report, December 9, 2005
- ⁵ Addressing Challenges to Electricity Infrastructure Development, Canadian Electricity Association Submission to the Council of Energy Ministers September 2007
- ⁶ Addressing Challenges to Electricity Infrastructure Development, Canadian Electricity Association Submission to the Council of Energy Ministers September 2007
- ⁷ Powering the 21st Century – An Overview of Electricity in Canada, The High Park Group June 2008
- ⁸ U.S. Department of Energy, Energy Efficiency and Renewable Energy, Annual Report on U.S. Wind Power Installation, Cost, and Performance, Trends: 2007 (May 2008)
- ⁹ American Wind Energy Association Press Release August 5 2008
- ¹⁰ Global Wind Energy Council – Global Wind Report 2007
- ¹¹ U.S. Department of Energy, Energy Efficiency and Renewable Energy, Annual Report on U.S. Wind Power Installation, Cost, and Performance, Trends: 2007 (May 2008) page 4
- ¹² Energy Outlook Forecast, Natural Resources Canada
- ¹³ Study by ICF International for CanWEA 2008
- ¹⁴ http://www.sproule.com/prices/hist_gas.htm
- ¹⁵ Wind Energy: Economic Issues, David Milborrow for CanWEA 2008
- ¹⁶ An Environmental Scan of the Energy System, Environment Canada. 2008
- ¹⁷ *Turning the Corner: An Action Plan to Reduce Greenhouse Gases and Air Pollution*, Environment Canada
- ¹⁸ Intergovernmental Panel on Climate Change, Fourth Assessment Report 2007
- ¹⁹ ICF International for CanWEA 2008
- ²⁰ ICF International for CanWEA 2008
- ²¹ The Contribution of Wind Energy to Ontario's Future Supply Mix, Helimax Energy Inc.
- ²² Canada's Wind Resource relative to the major global wind markets, Garrad Hassan Canada Inc. for CanWEA 2008
- ²³ In a 2008 study prepared for CanWEA, ICF International projects Canadian Electricity Demand of 815 TWh in 2025. To generate 20% or 163TWh from wind would require installed capacity of 55,000 MW
- ²⁴ This assumes 10 MW/km² and a capacity factor of 30 percent. Canada's Wind Resource relative to the major global wind markets, Garrad Hassan Canada Inc. for CanWEA 2008
- ²⁵ The Association of Canadian Petroleum Producers
- ²⁶ Assumes wind costs will decline from \$2700/kW to \$2100/kW and average \$2400/kW.
- ²⁷ Canada's Wind Resource relative to the major global wind markets, Garrad Hassan Canada Inc. for CanWEA 2008
- ²⁸ The Electricity Forum – <http://www.electricityforum.com/news/apr04/quebecwind.html>
- ²⁹ Utility Wind Integration State of the Art, Utility Wind Integration Group. May 2006.
- ³⁰ Powering the 21st Century – An Overview of Electricity in Canada, The High Park Group , June 2008
- ³¹ United States Department of Energy Renewable Portfolio Standards in the United States, A Status Report with Data Through 2007
- ³² Overview of Canada's large wind turbine supply chain opportunities – Garrad Hassan Canada Inc. for CanWEA
- ³³ Emerging Energy Research, Press Release "Wind Turbine Industry Steps Up to Global Demand, June 19, 2008
- ³⁴ The 60 percent figure comes from HYDRO Quebec's local content requirement for investment in wind projects in the Gaspé
- ³⁵ The Delphi Group for CanWEA 2008
- ³⁶ This assumes the level of new wind energy installations in 2020 is maintained through 2025 as per reference 33
- ³⁷ World Watch Institute, Vital Signs Update. July 2008.
- ³⁸ This assumes an average landowner lease payment and municipal tax payment of \$3000 / MW. This is consistent with current industry practice and represents minimum levels.
- ³⁹ Proposal for a Remote Community Wind Incentive Program – CanWEA 2007
- ⁴⁰ Global Wind Energy Council – Global Wind Report 2007
- ⁴¹ ENVIRONMENT-SPAIN: Number Two in Wind Energy, article by Tito Drago, Interpress Service News Agency Inter Press Service News Agency, August 4, 2008
- ⁴² Global Wind Energy Council – Global Wind Report 2007
- ⁴³ U.S. Department of Energy, Energy Efficiency and Renewable Energy, Annual Report on U.S. Wind Power Installation, Cost and Performance Trends 2007. May 2008.
- ⁴⁴ Renewable Energy County Attractiveness Indices , Q1 and 2 2008, Ernst & Young
- ⁴⁵ Several wind developments in Alberta and Ontario are on hold because of a lack of transmission capacity
- ⁴⁶ 20 percent Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply, U.S. Department of Energy 2008
- ⁴⁷ American Wind Energy Association press release

The Canadian Wind Energy Association is committed to ensuring it operates in a manner that is protective of the environment and human health. As such, our print materials meet the highest standards of environmental and ecological responsibility. This product was printed on recycled stock in an FSC-certified facility. We opted to publish the document in two separate editions – English and French – and to print quantities on demand in order to reduce waste. We encourage you to circulate additional copies of WindVision 2025 via digital format at our website at www.canwea.ca





canwea

CANADIAN WIND
ENERGY ASSOCIATION

ASSOCIATION CANADIENNE
DE L'ÉNERGIE ÉOLIENNE



810-170 Laurier Avenue West
Ottawa ON Canada K1P 5V5

T > 613 234.8716
F > 613 234.5642

1 800 922.6932
www.canwea.ca