ONTARIO WIND POWER TASK FORCE
INDUSTRY REPORT AND RECOMMENDATIONS

Table of Contents

1.0 PREAMBLE

1.1 EXECUTIVE SUMMARY

Wind power is making an important and growing contribution to the energy supply, and the environmental and economic goals of such countries as Denmark, Germany, Spain and the United States.

Denmark and Germany are market leaders in developing their wind resources, as well as producing wind turbines. Both countries implemented wind energy policies to encourage wind turbine development. With the maturing of the wind industry, these policies are changing, but they were quite effective at establishing wind energy as the fastest growing energy source in the world. Equally important, Denmark and Germany are the primary beneficiaries of the jobs, investment and export earnings associated with the concentration of wind-related manufacturing and services in their countries.

Wind power has the potential to do the same in Ontario with the right combination of Industry and Government initiatives.

The Canadian Wind Energy Association (CanWEA) is working at the Federal and Provincial levels, offering recommendations for achieving Canada's wind energy potential. (See Section 13 – CanWEA 10x10 Wind Vision For Canada.)

The primary goal of CanWEA through *Wind Vision for Canada* is to:

> "*Install more than **10,000 megawatts of wind power capacity** by 2010 (10 X 10), thereby providing at least **5% of Canada's electricity from wind** by 2010. This is equivalent to about 30 million megawatt-hours of electricity per year based on current forecasts, sufficient to meet the electricity needs of nearly four million homes."*

CanWEA has issued the following "Call to Action":

> *"Considerable evidence points to the fact that our major trading partners are moving dramatically away from non-renewable resources to renewable energy, and erecting trade barriers to economies and trading partners that continue to be highly carbon-intensive. Coincident with these actions, renewable energy technologies continue to decline in cost due to volume and technological improvements. In short order, renewable energy may be less expensive than conventional fossil energy. Countries positioned with renewable energy resources and industrial strength to capitalize on this retooling of the global energy infrastructure will be highly advantaged. Currently, there is a significant risk that Canada will not participate in this infrastructure revolution. In addition,*

we may risk a loss of competitiveness by having to purchase technology and greenhouse gas emission reduction offsets from others, or by suffering large penalties for our lack of action and large fossil fuel base, which create immense emissions that will be regulated by the Kyoto Protocol or other international treaties. Wind energy is a proven technology, viable and competitive on a large scale. Canada's wind resources are among the world's best. Our priority should be to accelerate market penetration and provide the support required for the Industry to reach the scale at which it will be competitive with other forms of energy. We are calling on all Canadians – consumers, Industry and policymakers – to support CanWEA's 10 x 10 goal through action and policy."

Wind energy has indeed surfaced as a leading source of new, renewable energy due to significant technical advances in turbine design, better product reliability, advances in windpark siting and dramatic reductions in the price of turbines, installations and maintenance. Other factors encouraging the use of wind include:

- rising electricity prices
- increasing carbon constraints on electricity generation
- Government sponsored incentives for renewables
- energy security concerns (benefits associated with using indigenous renewable resource and distributed generation)

The table below compares the installed wind power capacity for selected countries.

Country	Installed Capacity in Megawatts (MW) Year 2000	Forecast Capacity (MW) Year 2005
Germany	6,107	14,307
Spain	2,836	11,236
Denmark	2,341	3,841
USA	2,610	7,360
TOTAL	13,894	36,744

Source – World Market Update 2000 – BTM Consult

The total installed wind power capacity in Canada today is less than 200 MW. In Ontario, it is less than 3 MW.

The Ontario Wind Initiative

Beginning in January 2001, discussions with Industry and Provincial officials indicated an interest in exploring the potential for development of wind power as a significant renewable energy source in Ontario.

As well, there was some consensus that there was a need for all parties to better understanding the financial, manufacturing, service and skills capacities and opportunities required to support a "cluster" enterprise that might supply the growing North American wind power market (C$ 3+ billion in 2001) and enhance the competitiveness of wind in the Ontario market.

There was clearly a good opportunity to build on the very positive outcome of a similar past effort with waterpower.

Based on the above, representatives from the Ontario wind industry proposed the formation of a Task Force to examine various aspects of the issue. The kick-off meeting for the Wind Power Task Force (WPTF) was held on April 26, 2001. The Task Force completed its work in September 2001. This final report presents fifteen recommendations. (These are summarized in Section 5.)

Benefits

The anticipated benefits from the adoption of the Task Force recommendations include the following:

- Attract $10 – $40 million in resource identification and pre-development investment.
- Provide, in Ontario, a secure climate for investment in up to 3,000 MW of wind energy (30% of CanWEA's 10,000 Megawatts by 2010 target or $4.5 billion).
- In 8 years, deliver up to 3,000 MW of low impact renewable energy to help Ontario meet its energy needs and emission reduction targets.
- Provide a long-term revenue stream to the Crown and communities from the sustainable use of Ontario's indigenous renewable energy resource.
- Promote local and regional job growth.

1.2 TASK FORCE STRUCTURE

- The Industry acted as the lead.
- Ontario Ministries provided staff participation as a resource to the Task Force.
- David Boileau, President of Seine River Power Inc. and Co-Chair of the Waterpower Task Force acted as Chair of the main Task Force.
- Ron Kervin, in addition to his role as MNR lead, acted as Secretary for the main committee.
- The subcommittees' reports and recommendations were reviewed by the main Task Force group. Following this review, the Industry developed this report and action recommendations for Ministers' consideration.

1.3 INDUSTRY PARTICIPANTS AND MINISTRY RESOURCES

Industry representation on the main committee included:

- **Developers/marketers/financiers** - Ontario Power Generation (OPG), Great Lakes Power, Seine River Power, Regional Power, British Energy Canada, Vision Quest, Sky Generation, Probyn and Co., Suncor
- **Manufacturers** - Vestas Wind, Blenkhorn and Sawle, Steelcraft, Wenver-Vergnet, Enron
- **Service and Skills** - Zephyr North, Acres International, Brock University
- **Industry Associations** - CanWEA (Canadian Wind Energy Association), IPPSO (Independent Power Producers Society of Ontario)

The following Ministries participated and provided resources:

- MEST (Energy Science and Technology)
- MNR (Natural Resources)
- MOE (Environment)
- MOF (Finance)
- MEDT(Economic Development and Trade)
- MNDM (Northern Development and Mines)
- OMAFRA (Agriculture and Food and Rural Affairs)

1.4 TERMS OF REFERENCE

General

- The North American wind industry is growing at a rapid pace. The Task Force focused its efforts on major issues in order to complete the bulk of its work by September 30, 2001.
- This aggressive schedule facilitated the development of timely Industry recommendations that might, if adopted, set the stage for significant wind energy industry participation in the new Ontario electricity market – scheduled to open by May 2002.
- Equally important, “cluster” opportunities needed to be identified early, so that Industry and Government could cooperate on business development strategies before an Industry “cluster” matures in an out-of-province jurisdiction.
- Wind power presents a real opportunity to add a new source of renewable low, impact energy to the existing mix of electricity generation in Ontario. Participants recognized that existing generation (waterpower, fossil, nuclear) is required to meet the security and supply needs of Ontario industry and consumers. The merits of wind power were explored in a positive and constructive fashion – not at the expense of other fuels and sources of supply.

- The Task Force offered an opportunity for Industry and Ministry participants to achieve an understanding of the current state of wind energy in Canada and around the world.
- With Ontario moving to a competitive market, the Industry recognized that recommendations on any incentives for the wind industry will need to consider the reality that competitive pricing and secure supply will be a priority of the Government and a reality of the market.
- Where wind power might help the Government achieve its stated emission reduction objectives, the Industry attempted to quantify the benefits.
- The Task Force sought to quantify the cost/benefit of any policy considerations that seek to improve the climate for investment.
- Participants worked to create an ongoing Government/Industry dialogue.
- The WPTF identified wind industry issues that fell under federal jurisdiction and considered measures that would encourage co-ordination of Federal and Provincial policy initiatives.

1.5 OBJECTIVES OF THE TASK FORCE

The Ontario Government has declared that jobs, investment and environmental protection are policy priorities. The wind energy industry has a large role to play in helping the Government meet its objectives. The timing could not be better, especially since market opening will likely coincide with the presentation of the report from the Government's Select Committee on Alternative Fuel Sources. The WPTF believes that a full review of Ontario's energy options will show that wind energy initiatives provide an opportunity to merge policy and technology to meet Ontario's energy and environmental needs.

Priority Objectives

- Identify the investment climate required to attract private investment in the wind industry.
- Quantify the jobs and investment benefits (development, manufacturing and services) that will occur when firm policy direction is established and investor confidence is encouraged.
- Provide the Government with an Industry perspective on a renewable energy strategy for Ontario and how wind energy can play a significant role in helping the Government meet its emission reduction targets.
- Propose regulatory policies for wind power and determine the need/role for a lead agency for wind.
- Clarify the current status of the Ontario wind resource data. Examine opportunities for Industry/Government co-operation to help Ontario "catch up" to the U.S. and Europe on wind energy initiatives so that development opportunities can proceed.
- Provide the Ontario Government with constructive recommendations that, if adopted, might help make Ontario a leader in wind energy.

WPTF participants agreed that policy recommendations to Government should be offered well before market opening and before the completion of the report of the Select Committee on Alternate Fuel Sources. To that end, an aggressive 6-month schedule was established and met (April 2001 to September 2001).

1.6 COMMITTEE TASKS

Specific items that were addressed included the following:

- Update on the technical aspects of wind power and world market trends.
- Status and impact of legislation, regulation and taxation and Crown land-use policies
- Jurisdiction and regulation of development on private and Crown Lands and issues related to developers and landowners.
- Economic wind development opportunities in Ontario and the impact of various Industry and Government initiatives.
- Assessment/quantification of the potential impact of incentives/policy alternatives on electricity prices and Government revenues (Provincial and Municipal).
- Identify areas of Federal jurisdiction and policy opportunities/constraints.
- Examine wind energy policies in other jurisdictions.
- Assessment of synergies between wind power and other forms of generation.
- Quantification of manufacturing, service industry and skills training/intellectual capacity and opportunities for "clusters."
- Examination of foreign investment and export opportunities.
- Identification of wind energy related "science and technology" opportunities that might build jobs and investment in Ontario.
- Quantification of some of the social, economic and environmental impacts of wind energy.

1.7 SUB-COMMITTEES

1. **Markets, Taxation, Incentives and Regulation** – Co-Chairs – Steven Probyn (Probyn and Company) and David Boileau (Seine River Power)
2. **Wind Resource Assessment and Land Use Policies** – Chair – David Carter (Regional Power)
3. **Manufacturing and Human Resource Development** – Chair – Claude Mindorff (Blenkhorne and Sawle)

1.8 CHALLENGES

1.8.1 Wind Industry Credibility and Recognition

- WPTF recommendations must be realistic in terms of available new renewable capacity/energy at a competitive price.
- The Industry requires that wind power be recognized as a significant and competitive electricity option that has the benefits of ecological sustainability.
- The wind industry needs to satisfy the Government that wind power interests should be included in decision-making aspects of policy and planning.

1.8.2 Government Commitment

- To achieve the benefits associated with a strong wind energy industry in Ontario, there needs to be a tangible commitment from Government.
- It is imperative that this contribution be reflected in the Government's resourcing.
- This includes a statement of wind policy direction to the Ministries and designation of lead staff to work in a business relationship with Industry.
- Leading by example is also important. This could be done in a variety of ways including a Government internal procurement initiative that would support renewable energy use for its own electricity needs.

1.8.3 Market Opening

The WPTF commends the Premier and the Minister of Energy for their recent remarks assuring Industry that the Government is firmly committed to moving forward with competition by May 2002.

Electricity market restructuring will provide an opportunity to address long-standing institutional arrangements that in some cases have not always recognized the needs of suppliers, consultants and professionals working in the fields of wind energy, waterpower, biomass, co-generation and other alternative energy technologies.

Market opening is demanding considerable effort from Government, the electricity industry, electricity users and the Regulator. Because of this heavy workload and tight schedule, it will be challenging for the Government to address, in a timely fashion, the WPTF recommendations. This concern can be addressed by:

- building commitment/political will to ensure that the required resources are available to implement recommendations adopted by the Ministers.
- ensuring cooperation from Industry on implementation issues.
- the Industry contributing towards a continuing role and expanded responsibility on major administrative issues; i.e., Renewables Portfolio Standard (RPS).

1.8.4 Wind Park Impacts on the Environment and Communities

In addition to presenting wind power benefits, the wind industry needs to educate the public, policy makers and regulators about wind energy impacts

It is important that Ontario citizens and regulators benefit from the experience in other jurisdictions. It is significant that in developed wind energy areas, many widely held assumptions (high bird kills and loud noise) have been found to be untrue. There is a wide body of independent studies and reports that can be accessed through web sites. (See Section 2.1.6 for additional discussion on environmental impacts and visit the following web sites www.canwea.ca www.awea.org www.ewea.org www.nationalwind.org).

1.8.5 WPTF Schedule Limitations

The 6-month Task Force schedule could not accommodate a detailed review of every wind energy issue. The schedule was compressed because participants agreed that the committee work should facilitate a "kick start" for wind energy. Generally it was recognized that most jurisdictions were struggling to adapt to a rapidly maturing wind technology. There was some concern that investment/job opportunities and environmental benefits might be lost or delayed if Ontario did not receive early access to a status report and action recommendations.

Two areas will require additional study:

Small Wind and Distributed Generation: The Task Force review tended to focus on impacts and policy issues related to "large wind turbines/parks." This is not intended to diminish the potential contribution of smaller wind turbines and net metering.

Transmission Access: Another aspect that will require additional study is the future impact of large-scale wind generation on transmission capacity. Wind energy will compete for transmission space with other generators that have a higher capacity factor. These other generators will have the ability to contract for priority consideration in transmission constraint situations that will surely develop in the open market. As demonstrated in Section 2, the WPTF determined that inherent wind generation features and forecasting (seasonal and time of day) facilitates wind energy integration into the electricity system. As well, there is a growing appreciation for the security benefits associated with distributed generation (many medium-sized generators spread over a broad geographical area). The Ontario Government will need to consider the merit of transmission system regulations that encourage access for "must run" wind parks. (See Section 3.2.11.)

2.0 INTRODUCTION TO WIND POWER

2.1 UNDERSTANDING THE RESOURCE

2.1.1 High Value Sites

- High value projects feature:
  - strong wind speeds (greater than 6.5 m/sec annual average)
  - low shear and turbulence effects due to land forms
  - close proximity to existing transmission lines, roads, communications and markets
  - socially and environmentally acceptable impacts
  - cost-effective impact mitigation

2.1.2 Relationship of Wind Speed to Energy Production

- Energy yield is a cubed function of wind speed. Doubling the wind speed increases energy yield by **8 times.**

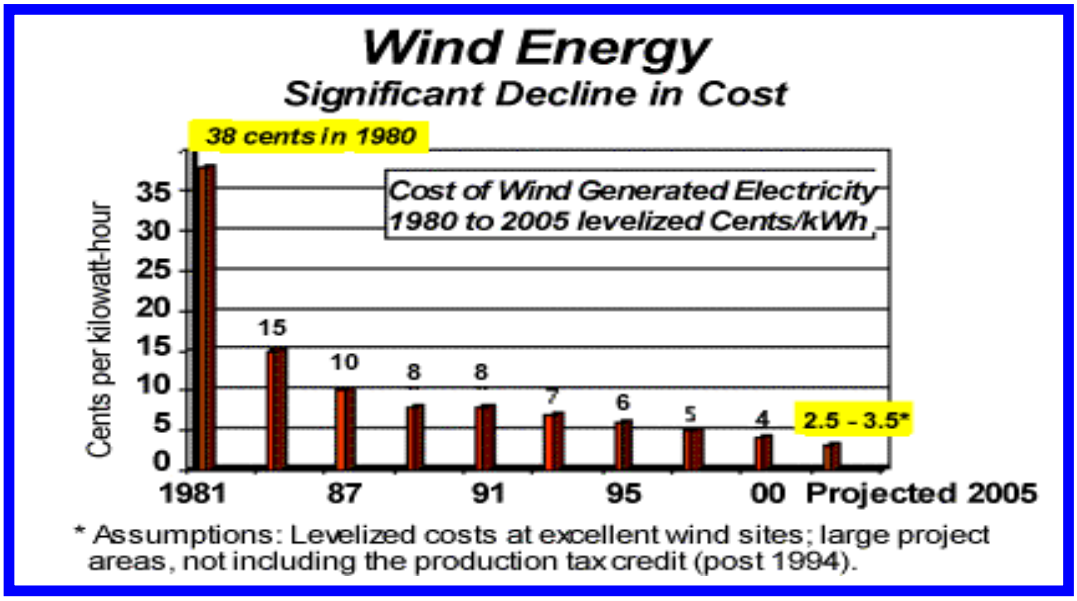
Wind Site Location	Average Wind Speed – m/sec	% change in wind speed	Annual Energy per km^2 in GWh	% change in energy yield
A	**6.7**	**-**	**11.65**	**-**
B	**7.8**	**16 %**	**18.06**	**55 %**

The above table shows that a modest 16% increase in wind speed (A to B) produces a 55% increase in energy yield. Finding the **"BEST"** site yields a huge competitive edge.

- Air density is a second consideration. Heavy cold air yields up to 15% more power.
- Tower height is crucial: Wind speed 60 metres above ground will be 20% to 60% higher than at 20 metres depending on the terrain.
- Hills on the downwind edge of extensive flat areas are generally good sites.
- Hills at the end of flat areas are ideal (Great Lakes and Prairies).

2.1.3 Declining Unit Energy Costs

The cost of electricity from utility-scale wind systems has dropped by more than 80% over the last 20 years. The following table (from http://www.awea.org/faq/cost.html) shows the magnitude of this change. (**Note that the prices in this graph are in US$.**)



In the early 1980's, when the first utility-scale wind turbines were installed, wind-generated electricity cost as much as 55 cents (C$) per kilowatt hour. Now, state-of-the-art wind power plants at high value wind sites are generating electricity at costs as low as 6 cents/kWh (C$), a price that is competitive with many conventional energy technologies. Costs are continuing to decline as more and larger plants are built and advanced technology is introduced.

All technologies experience a "learning curve" cost reduction. Generally, equipment costs decrease by 20% (progress ratio of 0.80) each time experience (number of units produced) doubles. **Worldwide, there are now over 50,000 wind turbine generator units. The combined capacity is more than 20,000 megawatts. Global capacity is expected to double in the next 5 years** (Source: World Market Update 2000 – BTM Consult).

Costs are dropping rapidly due to:

- Blades and nacelles are lighter — towers can be higher. Higher towers reaching into higher winds. Today, 50- to 90-metre tubular towers have replaced old-style 25-metre lattice towers.
- Lower O&M costs and higher unit reliability. Tower and turbine life is longer - 25 to 30 years.
- Better siting of units (increases capacity factor).
- Average capacity is increasing rapidly. Megawatt machines will account for over 50% of new capacity in 2002. Asea Brown Boverie (ABB) is developing a 3.5 MW direct drive DC unit (2003) and 5 MW offshore units are in the design phase.
- Since 1981 there has been a huge "rotor area" productivity gain:
    - **1981 – 350 kWh/m^2**
    - **1998 – 950 kWh/m^2**

Forecast Wind Energy Costs for Developed Markets

Cost cent/kWh (1998)	Year
7.05	1998 actual
6.00	2004 forecast
5.87	2005 forecast
4.98	2010 forecast
4.17	2015 forecast
3.69	2020 forecast

Source: World Market Update 1999, BTM Consult
Based on a 750 kW machine at 28% capacity factor (Class 4-5 site).

2.1.4 Capital Cost

Current cost is approximately C$ 1500 per kW (See Section 10)

- 5% - siting and land acquisition
- 75% - turbine and tower
- 20% - foundation, transformation, grid connection, roads, engineering, construction finance and insurance

2.1.5 Project Risk and Operating Costs

- Experience and technology improvements have combined to minimize project risk from the standpoint of construction, equipment reliability and extreme weather.
- Cost for operations and maintenance is about 10% of annual revenue.
- Lower than other forms of generation — assumes no wind royalties to Government.

2.1.6 Large Windparks – Social and Environmental Impacts

(The following edited text has been taken from the Vision Quest Windelectric Inc. pamphlet – see Section 9.)

What are the environmental benefits of wind energy?

Wind energy does not create emissions or hazardous wastes that pollute the air or water. Furthermore, it does not deplete natural resources or cause environmental degradation through extraction and transportation of fuels. The energy generated by wind turbines reduces the consumption of hydrocarbons such as coal, oil and natural gas, and therefore significantly decreases air pollutants. These include carbon dioxide, a leading greenhouse gas, as well as nitrogen oxide and sulphur dioxide, both of which are contributors to acid rain and smog.

Are wind turbines compatible with agriculture/forestry/recreation? How much land do they use?

Wind energy is popular with farmers because the wind turbines provide a consistent source of revenue and take very little land out of production. Land can be cultivated within a few feet of the base of the turbines. The machines do not disturb livestock. Wind parks can also be compatible with other land uses like forestry and recreation. On average, a wind farm will use between 1% and 2% of the land base in a wind park, with 12 to 24 turbines for every square kilometre.

How much sound do wind turbines make?

Significant advances in wind turbine technology over the past 10 years have dramatically reduced the sound from the turbines. As a result of improved blade design and enclosed generators, it is now possible to stand under a wind turbine and hold a conversation without having to raise your voice. At distances greater than 200 metres, the sound of a wind turbine is negligible. Ambient noise, such as wind blowing through the leaves of trees or shrubs, tends to be higher than the sound from wind turbines.

Do wind turbines harm birds?

Although wind turbines can result in bird deaths, studies and experience to date indicate that in most cases the frequency of bird deaths at wind farms is very low. In fact, studies in Europe and the United States indicate that a modern wind turbine causes fewer bird deaths than the standard house. The impact of wind turbines on birds is significantly less than many other structures such as large power lines, office buildings and communication towers. (See reports posted on www.nationalwind.org)

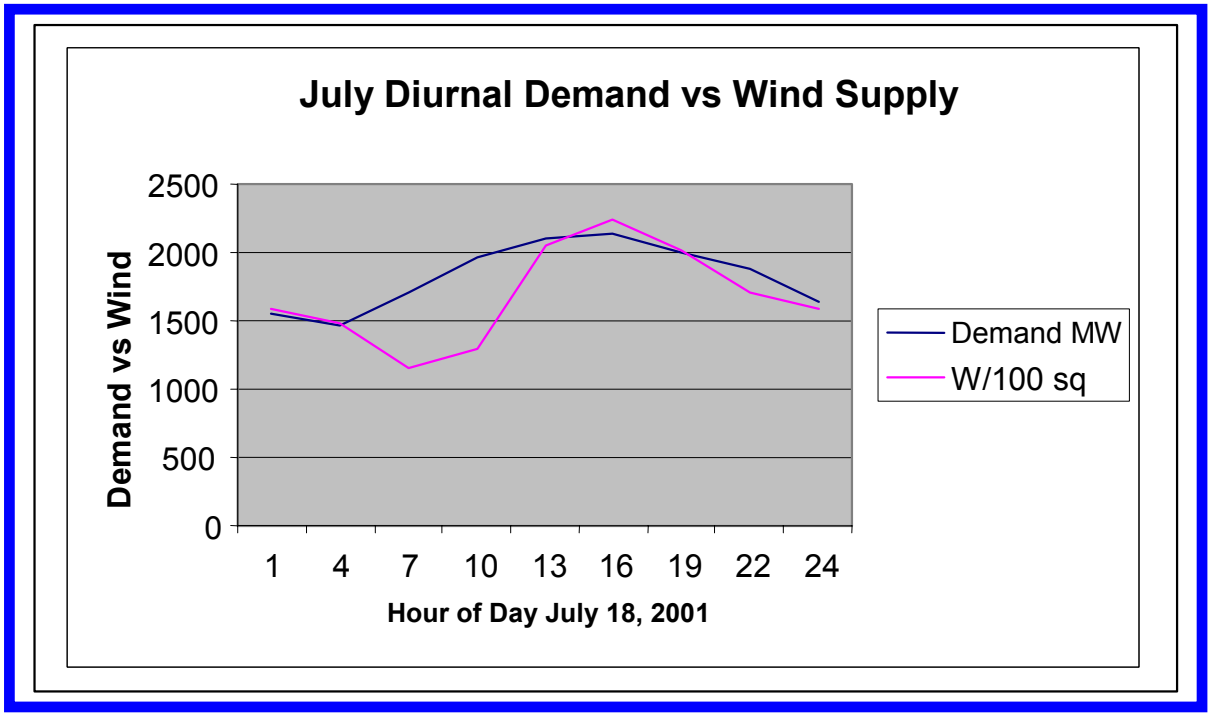
2.2 POTENTIAL CONTRIBUTION OF WIND TO ONTARIO'S ELECTRICITY MARKET

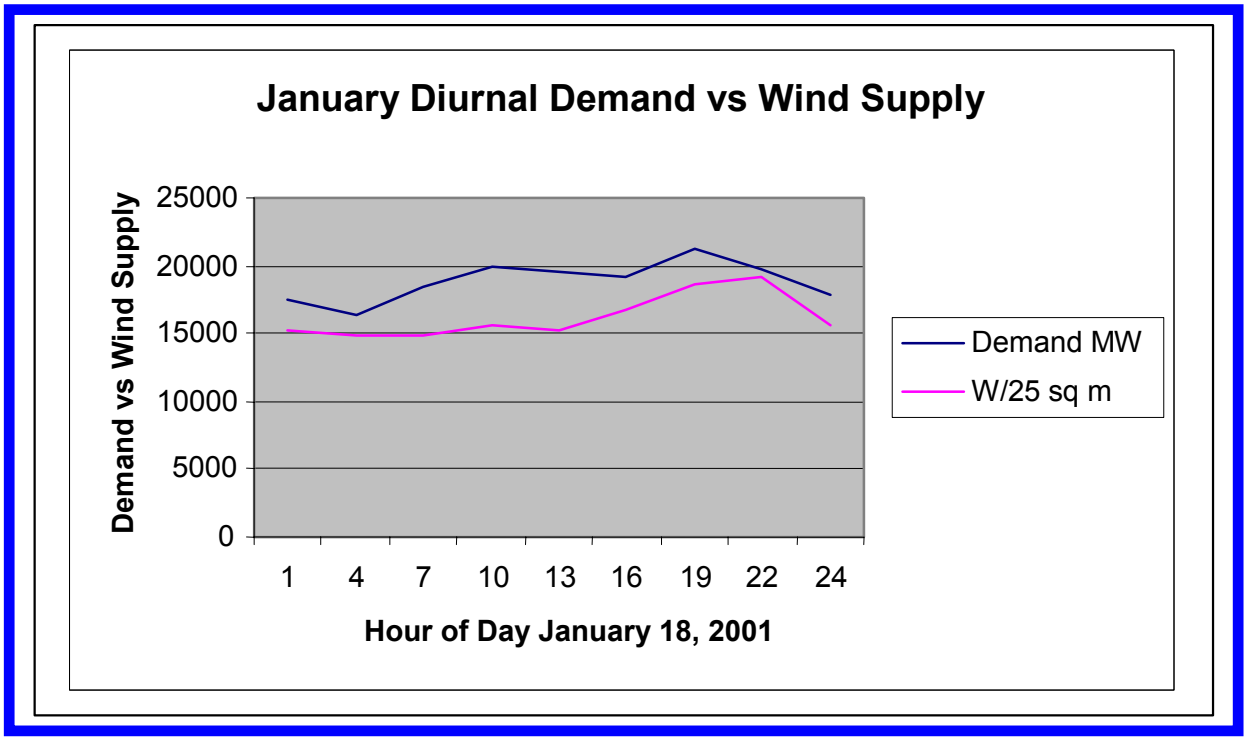
2.2.1 Generation Supply and the Grid

Wind energy is often depicted as an unpredictable and unreliable source of electrical energy. It is a fact that turbines in good wind areas typically achieve annual capacity factors between 25% and 35%. However, the predictability of this production is quite good. Studies of Ontario wind speed patterns reveal that wind can make a predictable and reliable contribution to our electricity supply mix. Consider the following graphs:

Diurnal

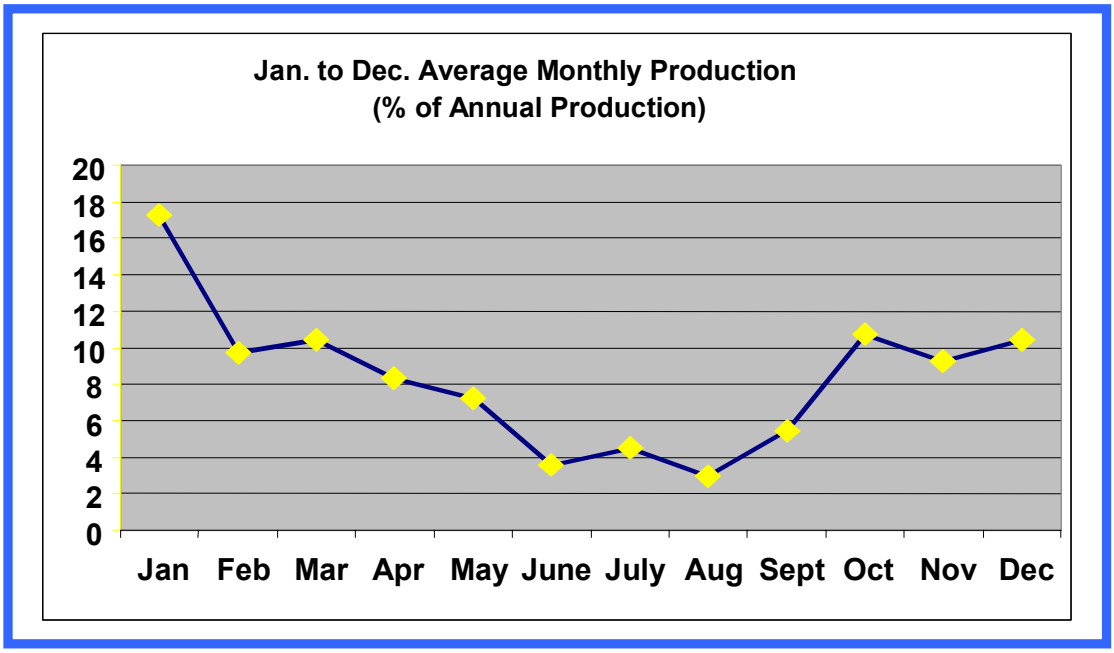
There is a good correlation between Ontario's peak demand and the characteristics of Ontario wind speeds. On a daily basis, summer and winter, the highest production from wind parks would generally track the curve of load demand.




January Diurnal Demand vs Wind Supply
Demand vs Wind Supply
25000
20000
15000
10000
5000
0
1
4
7
10
13
16
19
22
24
Hour of Day January 18, 2001
Demand MW
W/25 sq m

Seasonal

- Ontario enjoys very "energetic" winds in winter months when electricity demand is high.
- Higher winter wind speeds coupled with colder dense air combine to deliver a big energy yield.
- The graph below shows the monthly distribution of production from a typical Ontario wind turbine.
- Approximately 68% of annual energy production would occur during the heating season (October to March).



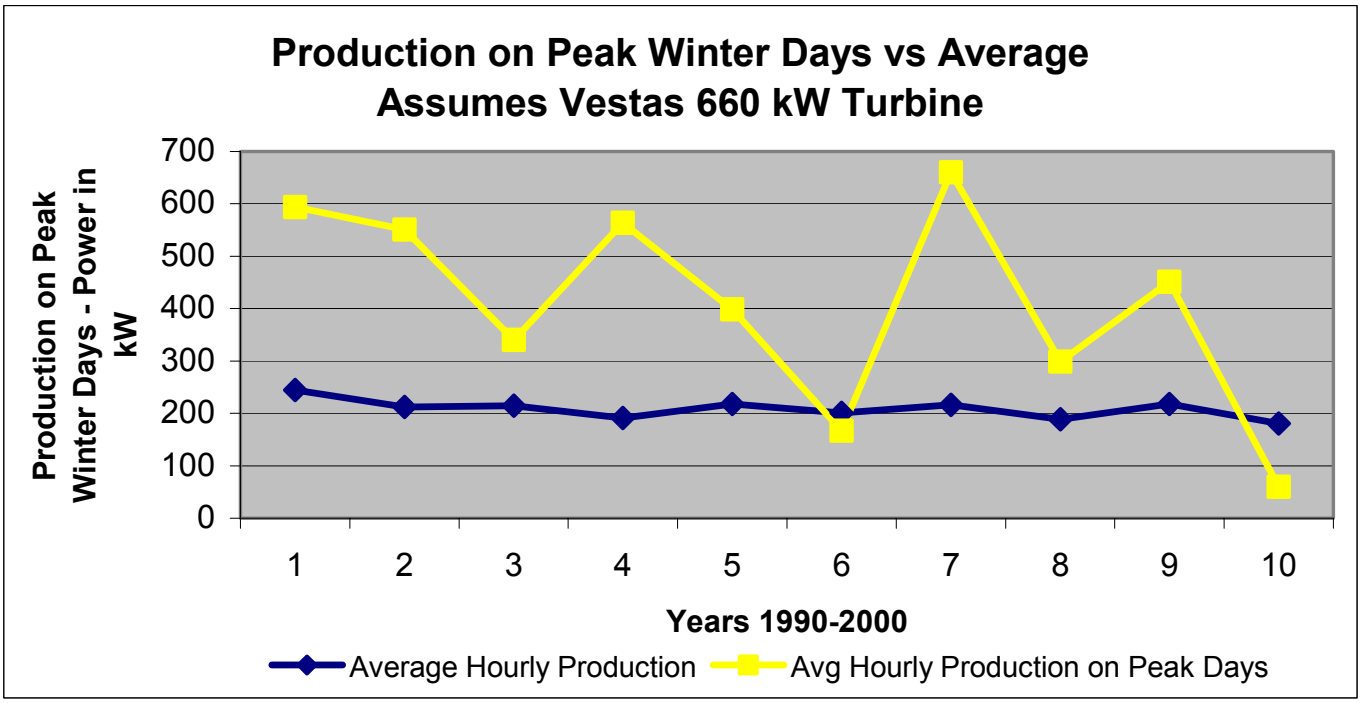
Wind on Winter Peak Days

There would be a beneficial matching between peak winter demand days and future power production from Ontario wind parks.

- The power in wind at –20ºC is 12% greater than at 10ºC.
- Supply increases from wind when it is needed most, and acts to reduce peak prices[1].
- There is a strong correlation between cold, windy days and high heating load.
- This "wind chill" effect accelerates building heat loss, especially on poorly sealed buildings.

[1] Based on sample wind data from two privately monitored sites in Ontario.

- The graph below shows the simulated production of a Vestas 660 kW wind turbine on the highest peak load winter days as provided in the IMO report for the period 1990 to 2000.
- 1991 is excluded, as wind data was not available for the peak winter day that year.
- Turbine production on peak winter days would be 93% above average, and daily production for the site is above average 8 out of 10 winter peak days.
- The power data in the graph is based on modelled production from a wind turbine located near Goderich.
- Wind data for the simulated run is based on winds recorded at the Goderich airport over the period from 1990 to 2000.



More Winter Supply = Lower Prices

Equally important to the consideration of the peaking requirements of the system, is the total demand of the system. Supply and demand can be expected to influence the price of power in an open market. The winter demand for power from December to February is more than 7% higher than the period from June to August. This higher demand in the winter is forecast to continue through 2011. Wind power acts to smooth winter pricing pressures.

How does Wind Compare to Other Electricity Sources?

	Efficiency	Availability	Capacity Factor
Wind	85%	98%	30% - 35%
Uranium	35% - 40%	80%[2]	55% - 80%[3]
Coal	33%	85%	60% - 80%
Natural Gas	40% - 60%	80% - 98%	60% - 80%
Storage Based Water Power	85% - 93%	95% - 98%	50% - 75%
Run of River Waterpower	80% - 93%	95% - 98%	50% - 65%
Landfill gas, MSW/AD, biomass	40% - 60%	90%+	80% - 90%

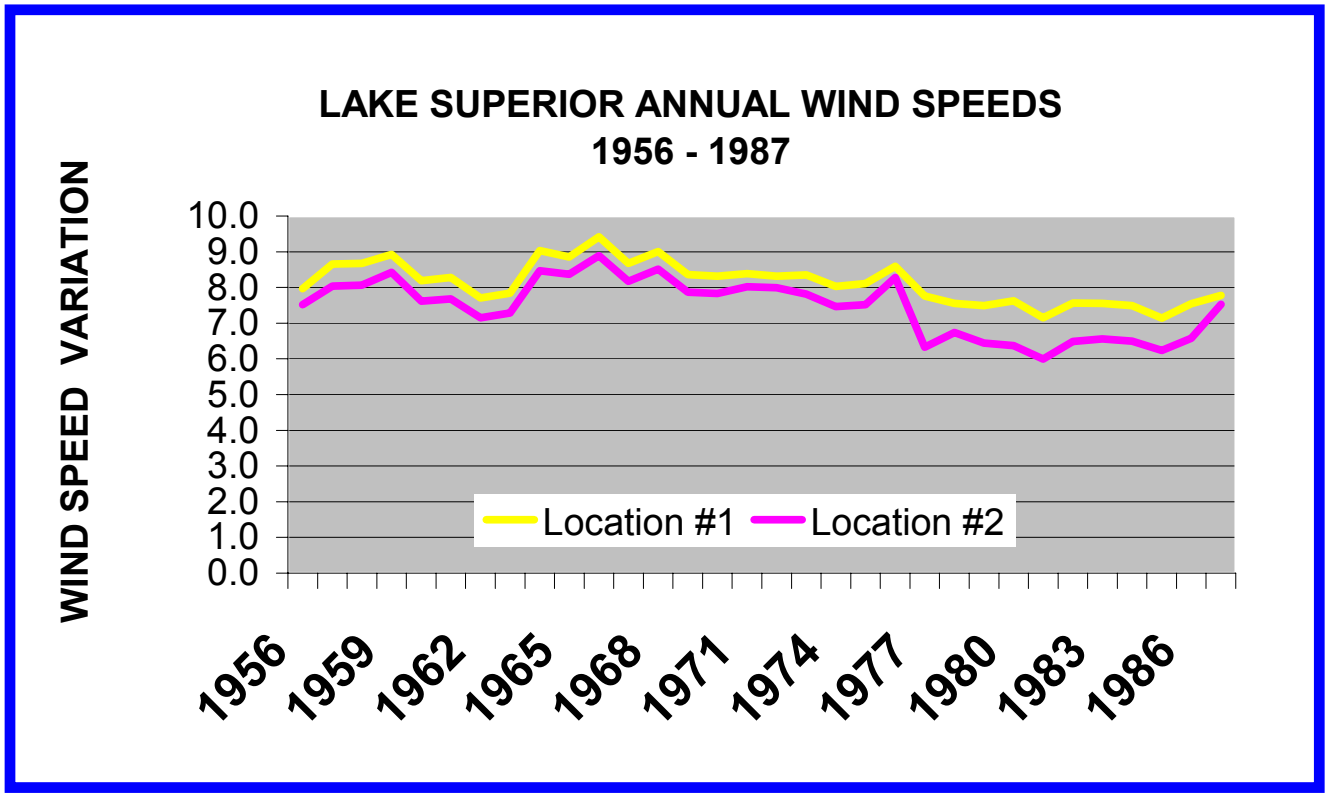
- No form of generation has 100% availability, efficiency and capacity factor.
- State-of-the-art wind turbines are capturing 85% of the theoretically available wind energy.
- Wind doesn't generate in low winds (<10km/hr) or very high winds (90km/hr) and not 100% of the potential energy is captured.
  - Wind will generate some power more than 75% of the time.
- Nuclear has scheduled and unscheduled downtime.
- Coal only uses 33% of the potential energy, with the rest emitted up the stack, or into closed cooling circuits or lakes.
- Natural gas, only 40%-60% efficient, is sometimes removed from the grid when the price of gas is high, and the generator company sells the gas instead of producing electricity.
- With waterpower, rainfall varies by the season, and from year to year as evidenced by the serious drought situation in Western U.S. and BC this year.
- Above data is based on available Industry information.

[2] Direction for Change – Table "Declining Nuclear Availability"
[3] OPG Nuclear Performance Report December 2000

2.2.2 Wind Forecasting

Annual

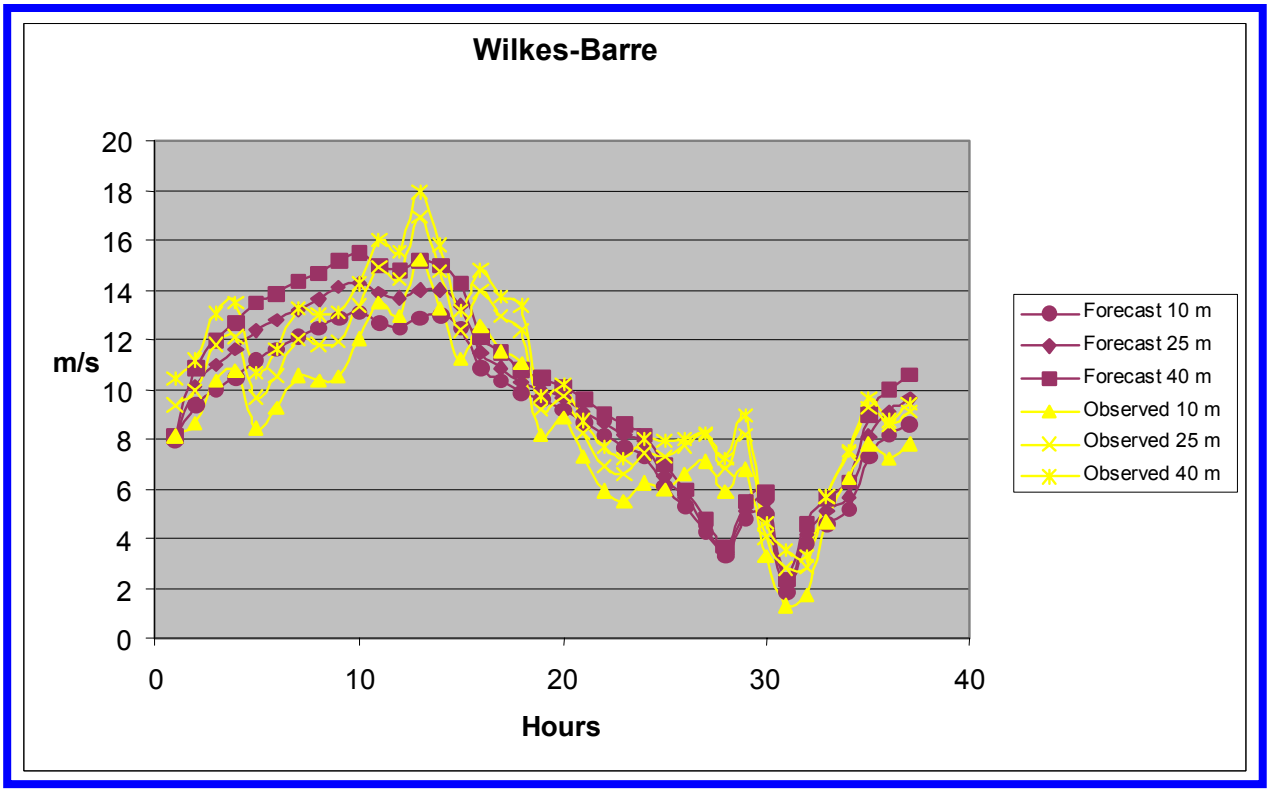
In the coming open market for electricity, predicting year over year variations in wind energy will be very important. The graph below shows the year over year relatively modest variation in wind speeds at two locations above Lake Superior.



Daily and Weekly Forecasting

When the installed base of wind turbines becomes large, then forecasting of wind output may be essential to balance the output of generators with the demand at a given time. Fortunately, meso-scale forecasting has progressed dramatically, so wind output can be forecast with great accuracy at least a day in advance. TrueWind Solutions, for example, uses MASS (Meso-scale Atmospheric Simulation System) to provide forecasting for several U.S. wind parks and major utilities. The MASS modelling system was originally developed for the U.S. Department of Defense and NASA. The graph below demonstrates the accuracy available from this type of forecasting.

The success of this type of forecasting demonstrates that, as wind energy becomes a larger part of Ontario's energy mix, it can become a predictable supply, easily integrated with other generation sources. The graph below shows the relationship of forecast wind speeds to observed wind speeds over a 40-hour period at a meteorological station at Wilkes-Barre in southern Pennsylvania (graph courtesy of TrueWind Solutions – New York).



2.2.3 Cost Performance of Wind

Renewable energy costs have generally been lower than past price projections. However, lower cost fossil generation has prevented renewables from gaining greater market share. Is the era of low cost fossil generation ending? Clearly, there is a trend towards policy initiatives that seek to address the "externalities" costs associated with fossil generation. In Ontario, the MOE has implemented emission caps. MOE and MEST are now examining a variety of policy measures that will support emissions reductions.

When "externalities" are recognized, the competition between energy alternatives will depend only on technical and managerial advancements – areas where renewables, particularly wind, have so far excelled.

Supply and Demand Trends/Prices of Electricity Generation Sources

Major Sources

Coal

- Coal is abundant, and likely the most stable priced fossil fuel source.
- However, even coal prices have increased 25% recently.
- Emission caps will cause some additional upward cost pressure as generators commit additional capital to emission reduction equipment purchases.

Nuclear

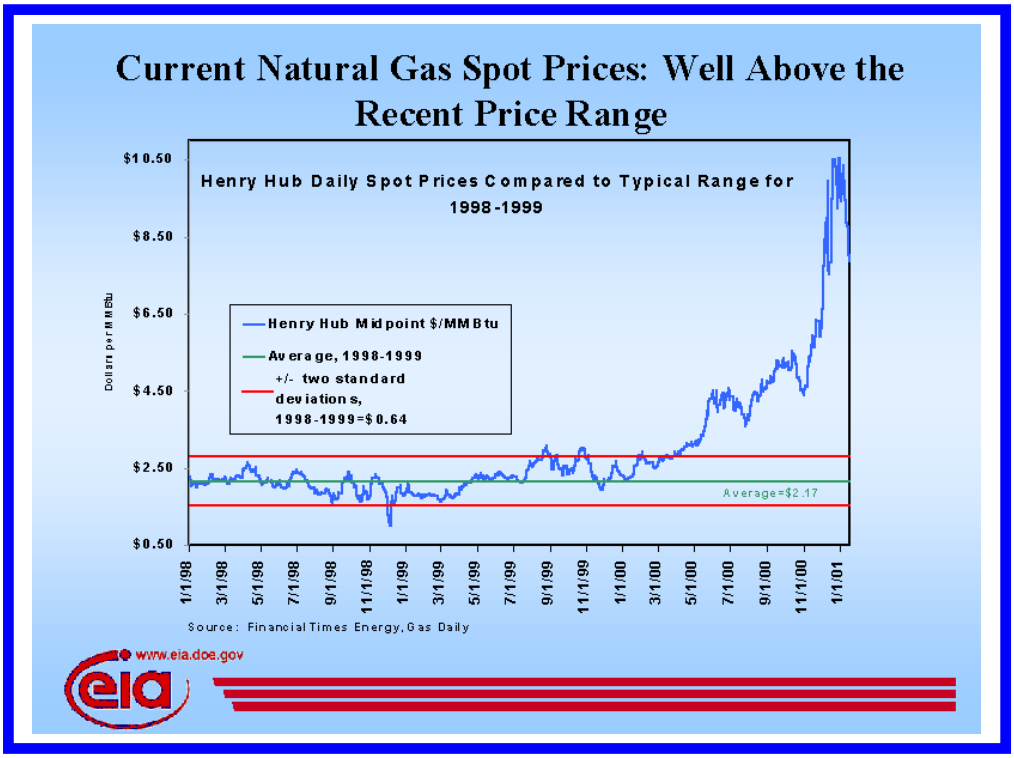
- Uranium prices are relatively stable.
- The nuclear recovery programs at Bruce and Pickering expect to restore considerable base load capacity to Ontario.
- Quantifying the present and future cost of nuclear generation is challenging.

Natural Gas

Gas power generation is forecast by IMO to provide the bulk of new energy in Ontario. However, consider the following:

- Conventional natural gas production is declining, demand is surging.
- New sources are costly to access.
- Risk of major permanent price increases.
- The best-combined cycle natural gas generators use 6,000 BTU's/kWh. When the price of gas is $4 US/1,000,000 BTU's, cost of fuel alone is 6,000/1,000,000 X $4 X 1.55 (exchange) = $.0372/kWh. This cost excludes the pipeline delivery charge, plant depreciation, O&M and profit, which adds 2 to 3 cents/kWh.

- During the winter of 2000/2001, the price of gas was over $10, so cost of fuel alone was over $.093/KWh.
- Gas is not only expensive, but subject to suddenly increasing cost.
- The huge increases planned for natural gas electricity generation in Canada and the United States will create strong demand for gas.
- It is uncertain if capacity can be added quickly enough to avoid price volatility and higher prices in the future.
- In a tight supply market, prices can rise quickly; e.g., winter 2000-2001.



Waterpower

- The capital cost of waterpower facilities is high.
- The plant expense occurs at the time of construction or during major rebuilds.
- To offset this high capital burden, the Ontario Government enacted legislation that provided lower property taxes and water rentals in the early years of new and rebuilt projects.
- Facility life is typically 50 to 100 years.
- Most Ontario waterpower enjoys the distinct market advantage of low-cost load following as well as seasonal and daily energy storage in reservoirs.

Wind

A good mix of wind in the grid acts to stabilize the price of power

- Like waterpower, the capital cost for wind is quite high.
- However, wind has no fuel costs.
- The resource is "made in Ontario," and not subject to international or out-of-province pricing/supply issues.

2.2.4 Proximity to Loads

Much of the high value wind resource in Ontario is found near the Great Lakes shoreline, close to transmission lines and markets. Broad distribution of wind parks along this band ensures that generation is close to the load, reducing line losses. The lower Great Lakes are also close to large U.S. markets and there is an opportunity for export sales.

2.2.5 Industrial Development

Wind is the world's fastest growing source of electricity generation. In 2001, worldwide capacity will grow by 26% to an aggregate of 25,000 MW.

- Ontario is Canada's industrial heartland, with many advantages for manufacturers, including mature infrastructure, low taxes, low dollar, a strong electrical grid and the largest Canadian electricity market.
- Ontario has a long history of manufacturing electrical generation transformation and control components.
- Ontario has high quality steel production and a strong fabrication industry for towers.
- Ontario can attract additional manufacturing jobs and investment.
- Ontario has a skilled workforce and can train specialists for the many needs of the wind power business, assuming timely support and direction from Industry, Government and Educational Institutions. (See Section 3.1.3 and Section 10.)

2.2.6 Modularity/Quick Construction

Wind turbine capacity, by design, is modular and can be built with short lead times.

- If the land and wind resource is available, an owner can add 20 MW or 200 MW.
- Wind is uniquely positioned among all forms of generation to add capacity in an incremental fashion, thus following demand growth.
- The recent problems in California, with the increased demand resulting from the growth of Internet use, vividly shows the challenges in estimating future demand.
- Ontario's experience with long-term load predictions in the 1980's was an expensive lesson.
- Wind turbines can typically be constructed within 12 to18 months, depending on planning issues, EA's and prior wind resource assessment.

- This compares with a 2- to 10-year schedule for waterpower/coal/nuclear plants.
- Achieving the short lead-time for wind is dependent on an active wind business in the province.
- Investment will be reluctant to commit until precedents are known, and the process is better understood by Industry players.

3.0 RECOMMENDATIONS OF THE TASK FORCE

Context

The WPTF helped Industry identify three priority areas for recommendation to Government. These are:

a) Renewables Portfolio Standard (RPS) and Federal Production Tax Credit (PTC)
b) Wind Resourcing Issues and Crown Land Use Policies for Wind
c) Government/Industry co-operation to build a critical mass for the "wind energy business."

The RPS and PTC are discussed **first** because implementation efforts associated with the other WPTF recommendations would be stranded if a business case for investment in Ontario is not encouraged. The Industry also determined that investment would flow to jurisdictions where RPS and PTC are already providing required interim development incentives.

3.1 PRIORITY RECOMMENDATIONS

3.1.1 RPS and PTC

Context

The wind industry believes that wind and other renewable energy technologies are burdened by a cost disadvantage that is at least equal to the costs associated with fossil generation "externalities." "Externalities" are the costs arising from environmental and human health impacts of NO_x, SO_2 and CO_2 emissions from fossil fuel burning.

Both the Federal and Ontario Governments will need to consider policy initiatives that will address this cost gap in a manner that will encourage displacement of emissions from fossil fuel burning while keeping Ontario electricity prices and industry competitive.

As previously discussed in this report, the cost of wind production is dependent on the following variables:

- The cost of the wind turbines, wind park construction and grid connection
- The cost of land, maintenance/operations including property tax, insurance
- The cost of financing
- Wind speed resource – power and energy

Many of these costs are dependent on scale, both the scale of the wind park and the critical mass of the wind business in the Province. The cost of wind energy will decrease if the number of wind turbines increases. This is because a critical mass of equipment suppliers, service personnel, transport specialists, financiers, spare parts, erection and service cranes and development companies will be required. The resultant efficiencies and competition will drive down the cost of wind production. Long-term power purchase contracts will also encourage lower prices.

The impact of transportation cost is not to be underestimated, especially on towers and blades. Local production reduces this cost.

Wind turbine costs have been declining by 5% per year as manufacturers increase their volume and improve their technology. So, in 5 to 10 years, wind energy could be available for 5 to 7 cents/kWh, competitive with all other forms of generation even without incentives.

Private developers have indicated that in the current market, a business case for investment is unlikely to be made until the net present realized price of wind energy is 8 to 10 cents/kWh. If, as expected, the Ontario wholesale price for power remains in the 4- to 6-cent range, large-scale wind energy development will not occur without incentives and policies that address the "externalities" that account for the cost gap between wind and fossil.

What about retail green power premiums? In a competitive market, purchasers of "electrons" are reluctant to pay more for a wind-generated electron. Some markets have experimented with retail "green power marketing" as one means of bridging the "rate gap." Initially, it was assumed that a large number of electricity customers would be willing to pay slightly more for "green power." However, experience has shown that the "green power" sign-up rate is generally less than 5% of the market. Also, the period of commitment is typically one year. This short period is at odds with the long-term financing requirements of wind energy projects.

Sub-Committee #1 examined a wide variety of incentives that have been employed in other jurisdictions to encourage investment in wind power. Many of these incentives were found to be inappropriate for Ontario. Some programs were difficult to administer, inconsistent with market objectives, unfair to other generators and costly to Industry/ratepayers.

By far, the most preferred and equitable methods of stimulating investment in U.S. renewables are the RPS and the Production Tax Credit (PTC). RPS (discussed below) is a complementary incentive that has been adopted by several states and is now being considered at the U.S. federal level. The PTC (discussed below) is a U.S. federal incentive that has been the single largest factor in stimulating investment in wind energy

in that country. Together, these two measures have helped the U.S. wind industry commit to large-scale investment — over C$ 3+ billion in 2001.

To foster the development of an Ontario-based wind industry, Ontario will need to:

- **select incentives that will best bridge the "externality" rate gap during the period required to "kick start" investment leading to the creation of a fully competitive industry**
- **address the competitive challenge posed by U.S. incentives policies**
  - **Clearly, investment will flow to U.S. jurisdictions, where, because of RPS and PTC, the realized price for wind energy is approximately 8 cents/kWh C$.**
  - **It is also important to remember that because wind generators in the U.S. benefit from these policies, they will have a competitive advantage over Ontario generators when supplying energy to the Ontario market.**

Renewables Portfolio Standard (RPS)

What is RPS?

The Renewables Portfolio Standard (RPS) is a market-based policy for increasing the amount of renewable energy serving a province. It requires each seller of electricity to end users to demonstrate, through ownership of tradeable "renewable energy credits" (RECs), that they have supported the generation of a certain amount of renewable power. Because the RPS applies equally to all sellers, it is competitively neutral. The regulatory role is limited to:

- certifying credits
- making available proxy credits at a specified price
- auditing the creation and retirement of credits
- verifying that sellers possess the required number of credits at the end of each year, and
- to ensure full compliance, imposing a sufficiently large penalty on sellers that fall short.

A primary advantage of the RPS as compared to other methods for promoting the commercial development of renewables, is that it does not require the centralized collection and dissemination of funds or require Government agencies to make decisions about winners and losers. The market makes all decisions regarding which renewable plants to build, where, and for what price. The bottom line is results and certainty: the generation of a designated amount of renewable power by a specified date. It is the task of the market to deliver these results at the lowest possible costs.

The U.S. experience with RPS revealed another important benefit. The RPS encouraged electricity sellers to sign long-term purchase agreements with wind developers. These contracts (often for both RECs and energy) were used by the wind park developers to secure long-term project financing at attractive rates.

WPTF and RPS – A Co-operative Effort

Where practical, the WPTF sought to build on the efforts of other organizations. During the term of the Task Force, the IPPSO (Independent Power Producers Society of Ontario) Environmental Committee commenced work on a RPS recommendation.

The IPPSO Environment Committee consulted with a wide cross-section of generators/organizations in an effort to develop RPS recommendations to Government. Industry participants in the review include IPPSO, Ontario Waterpower Association, Ontario Wind Power Task Force, TerraChoice, OPG, British Energy Canada, Sky Generation, Vestas Wind, Seine River Power and Great Lakes Power. The recommended RPS rules (See Section 6) achieved support in principle from this group.

In a parallel effort the Industry met with MEST and MOE staff to consider implementation and impact issues associated with the adoption of a RPS policy. The main implementation challenges are schedule constraints and the requirement to expand the role of Local Distribution Centres (LDCs) to include the administration of RECs for standard supply service.

The Industry believes that a co-operative and determined effort by Industry, Government and the LDCs can address these issues in a timely fashion.

Considerations

The RPS recommendations attempt to consider and balance the following overall objectives:

1. The RPS targets will encourage investment and generation decisions that will help the Ontario Government meet its emission reduction targets.

2. The RPS would commit Ontario to sourcing 8% of its 2010 electricity consumption from qualifying renewable energy. This standard, achieved over time, needs to be sufficiently high to create a market for RECs that will encourage investment in renewables without causing a windfall to renewable generators and/or a corresponding increase in electricity rates that will burden the ratepayer and/or cause Ontario industry to be competitively disadvantaged.

3. The RPS targets must be realistic in terms of available new renewable capacity/energy at a competitive price and achievable schedule.

4. The RPS rules will seek to be inclusive by not unreasonably discriminating against large or small projects from a variety of renewable sources, providing that the qualifying renewable generation is low impact and sustainable.

5. The RPS rules will not cause a stranding of existing generation assets nor will its implementation result in the de facto exclusion of future non-renewable forms of generation from the market.

6. The RPS targets and schedules must be sufficiently firm to provide a solid basis for investor confidence while providing for adjustment and adaptation to changing market and regulatory conditions.

(For more information on RPS see **www.awea.org/policy/rpsmechste.html#note1** and **http://www.naruc.org/rps.pdf**)

Recommended RPS Rules

The Industry participants in the WPTF believe that the set of rules (See Section 7) should address the above objectives. It proposes a basic RPS framework with design features that are central to the efficiency and effectiveness of the policy and to the achievement of a workable RPS in Ontario.

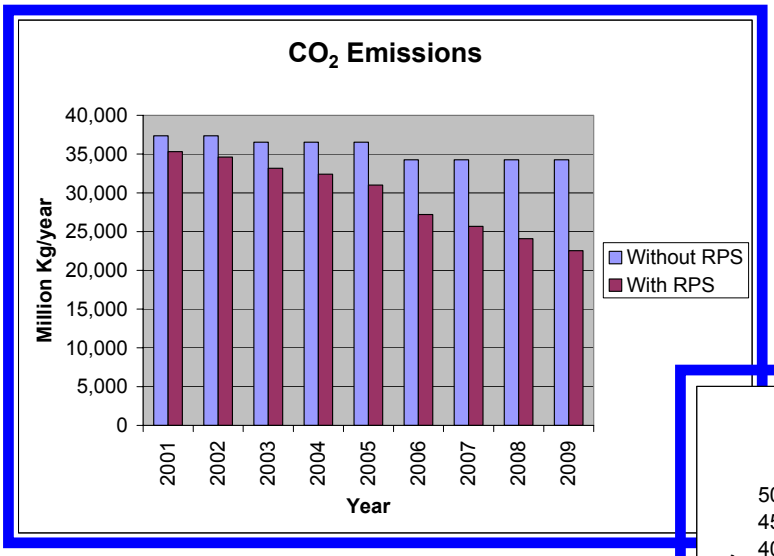
In the drafting of these rules, the WPTF and other organizations have considered the capacity of the renewable industry to meet RPS targets and the impact of RPS on electricity rates. There are many factors that can make the cost of a RPS low. And indeed, a scenario exists where a RPS will lower the cost of electricity in the Province. The probable impact on blended wholesale prices is < 1% for the first years and < 2% by 2010. (See Section 7 — Cost of RPS.)

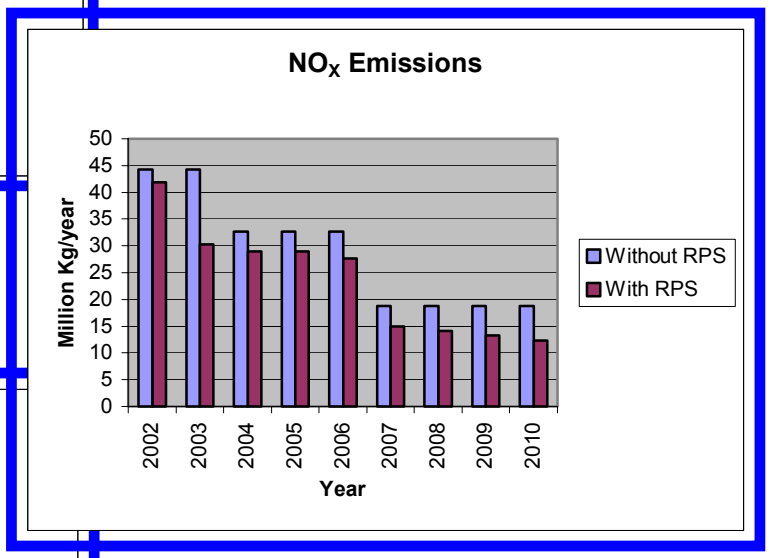
There are, of course, implementation details that will need to be addressed. It is anticipated that a RPS policy would be adopted through legislation, regulated by MEST, which would direct the OEB to implement and administer the policy directly or through a special sub-committee.

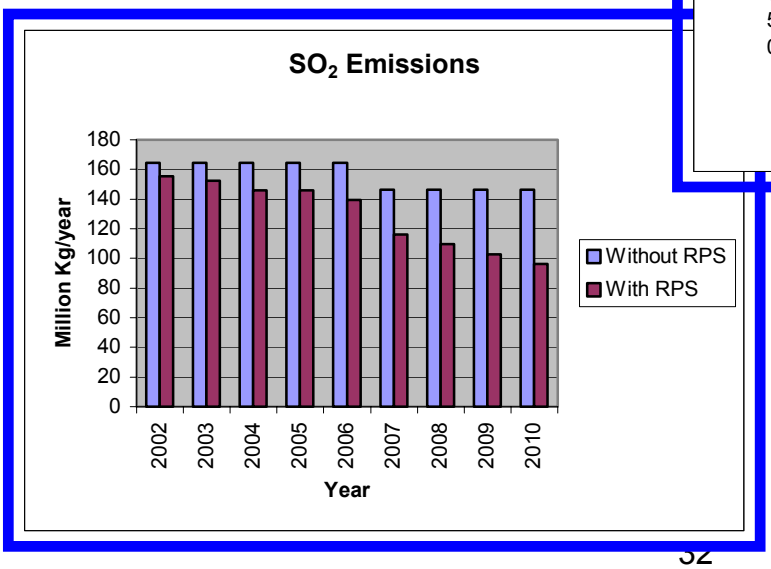
Environmental Benefits of the RPS Proposal

How will the proposed RPS help Ontario meet its emission reduction targets? The graphs below show the anticipated reductions for CO_2 , No_x and SO_2. The information in these graphs are derived from system-wide emissions forecast by OPG.

For a more complete discussion on CO_2 emission levels and reductions, see the U.S. Department of Energy/Environmental Protection Agency report *Carbon Dioxide Emissions from the Generation of Electric Power in the U.S. – July 2000* available at http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf







RECOMMENDATION # 1

1a) The Ontario Government should adopt the proposed RPS that will, by 2010, result in 8% of total provincial electrical consumption being met by qualifying renewable energy sources.
Proposed timeline for action – prior to market opening.

Year	Percentage	Comments
2003	1.5%	Includes post 1991ECP
2004	2%	
2005	3%	
2006	4%	
2007	5%	
2008	6%	
2009	7%	
2010	8%	Minimum to 2020

1b) The Ontario Government should adopt a renewable power procurement commitment for its own electricity needs using the same "Eligible renewable energy resource" criteria recommended in the RPS rules.
Proposed timeline for action – December 2001.

Production Tax Credit (PTC)

What is PTC?

In addition to the RPS, the PTC is another incentive that partially addresses the "externality gap" and encourages investment in high capital cost generation like wind power. In the U.S., the PTC is a federal tax incentive for wind energy that, since 1995, has provided a tax credit of C$0.023/kWh (1995 $) for each unit of qualifying energy. The tax credit applies to all production for 10 years following project commissioning. The Canadian Wind Energy Association (CanWEA) and the CARE Coalition have been actively lobbying the Canadian Government to adopt a similar policy. CanWEA advocates that the Federal Government should:

"Implement market-wide production-based incentives for wind energy. This means that all wind power suppliers – large or small, profitable or emerging, public or private, can benefit from Federal Government financial incentives."

The current U.S. PTC legislation is before Congress. The House and the Senate support this measure and it is expected to be renewed in 2001 for an additional 5-year period. When enacted, projects built in the following 5 years will receive a tax credit that is tied to inflation. In 2001, this credit has a value of C$ 0.026/kWh. This credit applies to all energy production from the facility for 10 years. In the U.S., a similar measure, the Renewable Energy Production Incentive (REPI), was adopted for public utilities. The REPI is a payment to public utilities to compensate for the fact that since they are not subject to federal taxes, they cannot qualify for the Production Tax Credit (PTC).

Even considering the discount over time, it is clear that these incentives provide a huge advantage for U.S. jurisdictions in attracting investment in wind energy.

Considerations

Canada risks surrendering the wind business to the U.S. if it does not act promptly to enact similar competitive legislation. In the context of the North American Free Trade Agreement, Canadian industry is seriously disadvantaged by this U.S. incentive. The U.S. Government adopted the PTC to help meet its emission reduction objectives. This is a worthwhile objective and Canada needs to "get in step."

In recent years the Federal Government has been encouraging Provincial Governments to develop emission reduction plans. Ontario responded by adopting specific codes and firm policy direction. However, the magnitude of change and the schedule for reductions has been constrained by the fact that Ontario also needed to ensure reliable supplies of electricity for Ontario consumers and Industry. Additional fossil generation was ramped-up due to the unavailability of several large nuclear units.

To date, the Canadian Government has not acted on the competitive challenge embodied in the U.S. PTC. Ontario has an opportunity to take the lead on this issue by encouraging our Federal Government to implement the PTC in their next federal budget.

By being the first province to adopt a RPS and by advocating a federal PTC, Ontario can set the stage for a large investment in wind energy from a competitive, Ontario based, wind energy industry. (See Section 13 — *CanWEA 10 x10* brochure.)

RECOMMENDATION # 2

Following the acceptance of an Ontario-based RPS, the Ontario Government should challenge the Federal Government to follow Ontario's lead by adopting a Production Tax Credit for sustainable renewable energy production.
Proposed timeline for action – prior to market opening.

3.1.2 ONTARIO'S WIND RESOURCE AND CROWN LAND USE POLICY

Context

- The Ontario Government owns 87% of the land in the Province. Most of this land is administered by the MNR.
- The Government has a stated policy objective that supports sustainable development of Crown resources.
- The Government is also pursuing a policy direction that encourages the development of low impact renewable energy resources to help meet Ontario's growing energy needs and meet emission reduction targets.
- With the opening of the electricity market scheduled for 2002, the Ontario wind energy industry believes that wind energy may play a significant role in helping the Province meet its electricity generation emissions targets.
- To that end, the Industry has indicated an interest in exploring the opportunities for development of wind power on Crown Lands.

Current Policy

- At present, there are no "wind specific" policies related to land use/disposition for the purpose of wind energy development.
- There are a variety of tools available to MNR that are related to resource dispositions in "general land use" areas.
- Conceivably, a wind energy development proposal could be considered under these rules.
- However, in order for wind power to have a significant impact on the Province's energy mix, Industry and Government will need to consider a specific development strategy.
- The adoption of clear and consistent policy/procedures and regulations will ensure that the public interest is protected, while providing orderly responsible development and investor certainty.

Considerations

Wind Resources in Ontario — Is There Enough Wind? Enough Area?

- Ontario wind energy resource data is not well developed.
- Previous "limited" studies in the 1970's and 1980's identified macro isobars.
- Data from airports and Environment Canada meteorological stations supplemented this information base.
- The prior studies are out of date. This is because recent technological changes have increased average turbine tower height from 20 metres in 1970 to 80 metres in 2001.
- Productivity (expressed in kWh/year/m^2 of rotor area) of the tall tower turbines is 50% higher than the older towers.
- Due to variations in wind shear, much of the previous wind data cannot be extrapolated for the new tower heights.
- Ontario lags the U.S. and European jurisdictions in the acquisition of wind energy data.
- (See Section 8 — Wind Resourcing in Ontario and other jurisdictions.)

Classes of Wind Power

As discussed in Section 2.1.2 "Relationship of Wind Speed to Energy Production," energy yield is a cubed function of wind speed. Doubling the wind speed increases energy yield by 8 times. Commercially viable wind parks will be developed first on the "best" wind lands. An international system of wind power classification has been adopted to assist developers and Governments.

Wind Power Class	Wind Speed m/s	Notes
1	< 5.6	NOT COMMERCIALLY VIABLE
2	5.6 – 6.4	
3	6.4 – 7.0	
4	7.0 – 7.5	COMMERCIALLY VIABLE WITH TAX AND MARKET INCENTIVES
5	7.5 – 8.0	
6	8.0 – 8.8	
7	> 8.8	COMPETITIVE WITH ALL ELECTRICITY GENERATION SOURCES

Although it is generally assumed that Ontario has a poor wind resource, the committee investigations indicate that there are significant Class 4 and Class 5 wind zones and smaller areas of Class 6 winds.

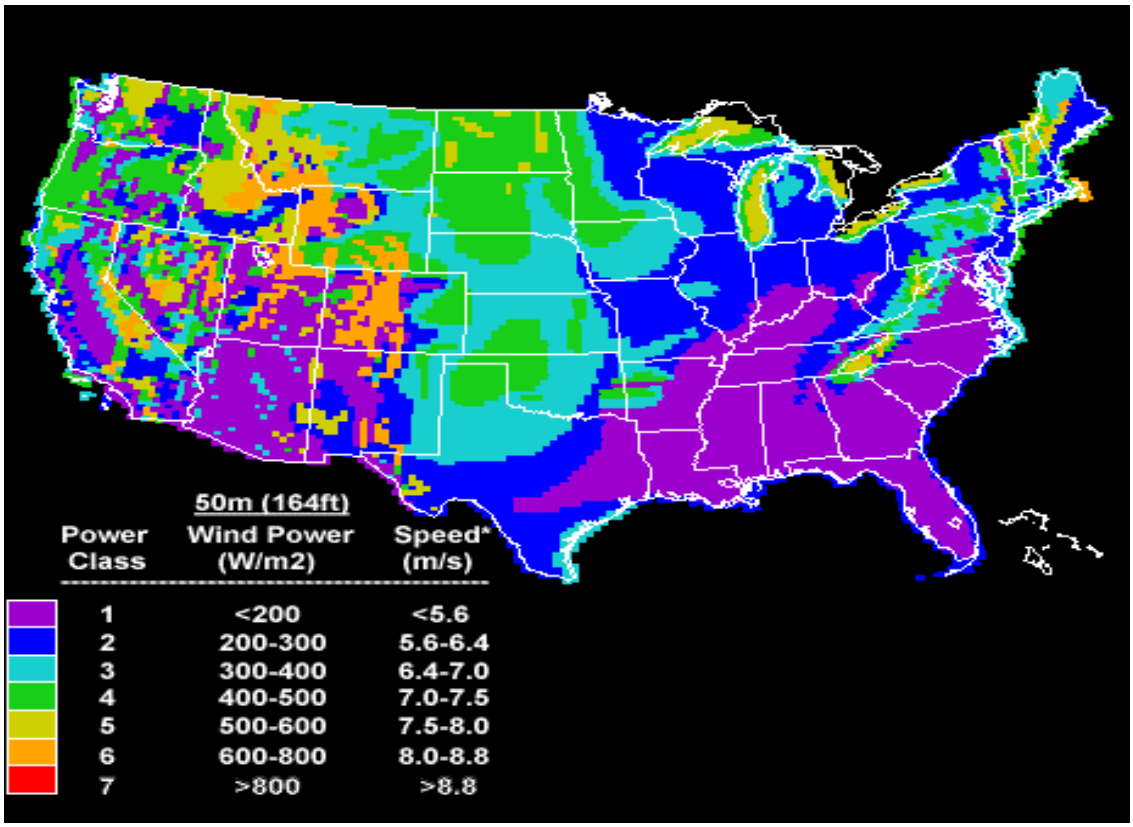
How Big is the Ontario Resource?

Denmark obtains 15% of their electrical energy from wind (Source: *BTM – World Market Update 2000.*) The average wind speed at hub height for Danish wind turbines is 6.3 m/sec. There are vast areas in Ontario that have higher average wind speeds.

Germany has 7,500 MW of wind capacity installed. If Ontario had 7,500 MW of wind at a 30% capacity factor, this would produce an average of 19.7 terawatt hours, or 13.7% of Ontario's current energy use.

- Ontario's wind speeds are comparable or better than Germany's. Ontario's land mass is three times the size of Germany.
- Ontario has a longer coastline than Germany. Most of this shoreline (over 2,000 km) is located on the windy side of the Great Lakes and can take advantage of the prevailing Southwest winds.
- The coastal wind resource along a good portion the Great Lakes is 6-8 m/sec at hub height.
- Many highland areas of the province have acceptable wind resources as well.

- In addition, a recent presentation at the American Wind Energy Conference assessed offshore wind potential for the United States. Lake Erie, which is shallow enough for offshore wind turbine construction was considered to have a 144 TWh potential.
- The U.S. wind map below shows the high value offshore wind resource on the U.S. side.
- The Ontario resource would be similar or greater.



Obviously, not all of the offshore potential is commercially and/or environmentally/socially acceptable. As well, storage of power and timing of deliveries is a key issue. However, the fact remains that Ontario has abundant wind resources.

Finding the Resource

There is at least 1,500 km^2 of "useable" Class 4 to Class 6 wind lands. Assuming 0.2 km^2/MW, this means that the land-based commercial potential might be up to 7,500 MW. The offshore potential is much larger.

Finding good sites for wind power generation is, unfortunately, not as easy in Ontario as it is in other jurisdictions. This is due to mixed terrain features and variation in lake effects.

Historically, it has been the mandate of the Federal Government to survey the distribution of fuel sources to develop contemporary surveys using the best available technology. All other G8 countries have done this for wind, but there is no comprehensive wind atlas for Canada. As a result, prospecting for good wind energy production sites is an expensive undertaking for the individual developer.

To find the **"Niagara"** wind stream areas, models have been developed that have the ability to predict actual values at +/- 10%, 80% of the time. Model data is subsequently confirmed by erecting an array of test towers (or renting space on existing towers) with instrumentation connected to data loggers. Data is gathered for 2 years and used to confirm/correct the predictions. Detailed relief mapping is added to produce an optimum wind park layout. The cost of this program for a complete Ontario inventory is estimated at $2 to $4 million. The schedule is 2 to 3 years.

If the Government chooses to encourage wind power development, as part of its renewable energy strategy, the cost and schedule for wind resourcing may be a barrier to timely delivery of new wind megawatts.

To minimize delay, individual Ontario windpower companies commenced their own wind resource inventory programs. The Industry believes that private investment, coupled with a New Business Relationship (NBR) with Government can bridge this schedule gap and allocate the bulk of resourcing costs to the developer, and by extension, to the market.

The Industry suggests that Crown policies applicable to the mining industry might be employed as a template for the release of Crown Lands for wind energy development.

In the mining sector:

- Developers/prospectors start out by staking claims.
- When a potential mineral resource is located, its value and size is quantified (core samples, etc).
- Additional development work, if successful, leads to a mining lease and, hopefully, a mine development.
- This process places the bulk of the "resourcing" responsibility on the developer in exchange for providing "exclusivity" to the claim.
- The Government provides some support through "macro technical surveys" and GIS information, as well as holidays on royalties for the early life of the project.

Finding Ontario's high value wind sites, in some respects, is similar to finding an ore body. Unlike North Dakota and Texas, Ontario's wind resource is not widely distributed or easily sampled. Considerable expense is required to find the pockets of high value wind lands.

Because of this, the Industry proposes that the Government adopt a "mining claim" approach for Crown Land wind energy development.

Generally, the Crown wants optimum and fair value for the use of resource lands, however, when these lands serve a public policy objective for energy, environmental and economic priorities, then special measures should be adopted.

The Industry submits that, in the case of wind energy development, these special considerations should address the following:

- **A "quick start"** is required to establish the wind generation industry in time to meet Government emission reduction targets.
- **A clear regulatory framework** for Crown Land disposition for wind is required in order to instill investor confidence and permit long-term financing of wind park development.
- **Development rules** should require the developer to carry the major burden of wind resourcing costs and in return, receive "wind land" tenure benefits.
- **Charges** (royalties and rentals) for Crown Land should recognize: the public and environmental benefit of wind energy, that wind energy is a capital intensive investment, and that developer debt load in early years is heavy.
- **Long-term leases** are required to provide investor security.

RECOMMENDATION # 3

3a) The Crown should adopt a Crown Land disposition policy for wind energy development. The Industry has been working with MNR on framework for this policy and will continue this co-operative effort to refine details.
Proposed timeline for action – February 2002.

3b) The Crown should structure Crown Leases for wind lands to provide a royalty holiday for a period of 15 years. The lease period should be at least 30 years with renewable options.
Proposed timeline for action – February 2002.

3c) The Crown should adopt a land rental charge policy for Crown Lands leased for wind parks. This charge should not be more than the charge for "general use" Crown Land in the area.
Proposed timeline for action – February 2002.

3.1.3 GOVERNMENT AND INDUSTRY CO-OPERATION TO BUILD A CRITICAL MASS FOR THE "WIND ENERGY BUSINESS"

Context

The main committee of the WPTF recognized that the growth of a "whole" Ontario-based wind industry required a business climate for investment (markets, regulation, incentives) and a domestic supply of competitively priced/high quality wind equipment and services. The components of this "critical mass" were examined by Sub-Committee #3, **Manufacturing and Human Resource Development.** The sub-committee summary report and recommendations are presented below. (See Section 10 for supporting reports.)

Summary of Findings and Recommendations

The mandate was to examine two issues:

1. The potential of Ontario companies to create products and supply services to support the growth and operation of:
    - wind parks in Ontario and
    - an export market to other jurisdictions.
2. Identify human resource issues that will augment or impede these growth and facility operations.

Method of investigation:

1. Examine existing operators and suppliers in the Ontario and Canadian marketplace.
2. Utilize the information and resources supplied by members of the Task Force and organizations such as CanWEA, IPPSO, AWEA and OWA.
3. Field investigation through visits to manufacturers, existing wind farms and trade shows.
4. Internet searches.

Participation

Sub-Committee #3 was formed from members of the main committee and augmented by other participants from the manufacturing industry, Government, service providers, education sector and power producers.

Findings

- The underlying assumption was that Canada would act to achieve CanWEA's stated objective of 10,000 megawatts by 2010.
- Information presented to the sub-committee indicated that the Ontario wind industry could contribute at least 2,000 to 3,000 MW to CanWEA's goal.
- Ontario has all the necessary infrastructure and skill sets required to design, manufacture and maintain both the components and entire assemblies.
- There is an absence of educational information about wind energy.
- Educational resources, especially engineering resources for wind energy is severely lacking in Ontario and Canada. (See Section 8 — Wind Resource Report.)

Observations

1. Two of the largest turbine manufacturers in the world, NEG Micon and Vestas, have stated that Canada needs to have sustainable demand of at least 100 megawatts annually before their companies will commit to domestic assembly/manufacturing. Investment will come as the demand for turbines increases. Components will first be purchased in Ontario before any full-scale assembly will take place by a major manufacturer.

2. The growth and promotion of wind generation in North American and European jurisdictions has followed deregulation and promotion of renewable energy by Governments. This has been done through fixed purchase price agreements, renewable portfolio standards being established and flow-through production tax credits to investors/producers. These policies led to an increase in installations and investment in technology improvements.

3. An active trading market environment in renewable energy credits, verifiable emissions credits and green tags has also accelerated investment in installations through the creation of a source of predictable cash flow outside of the sale of energy.

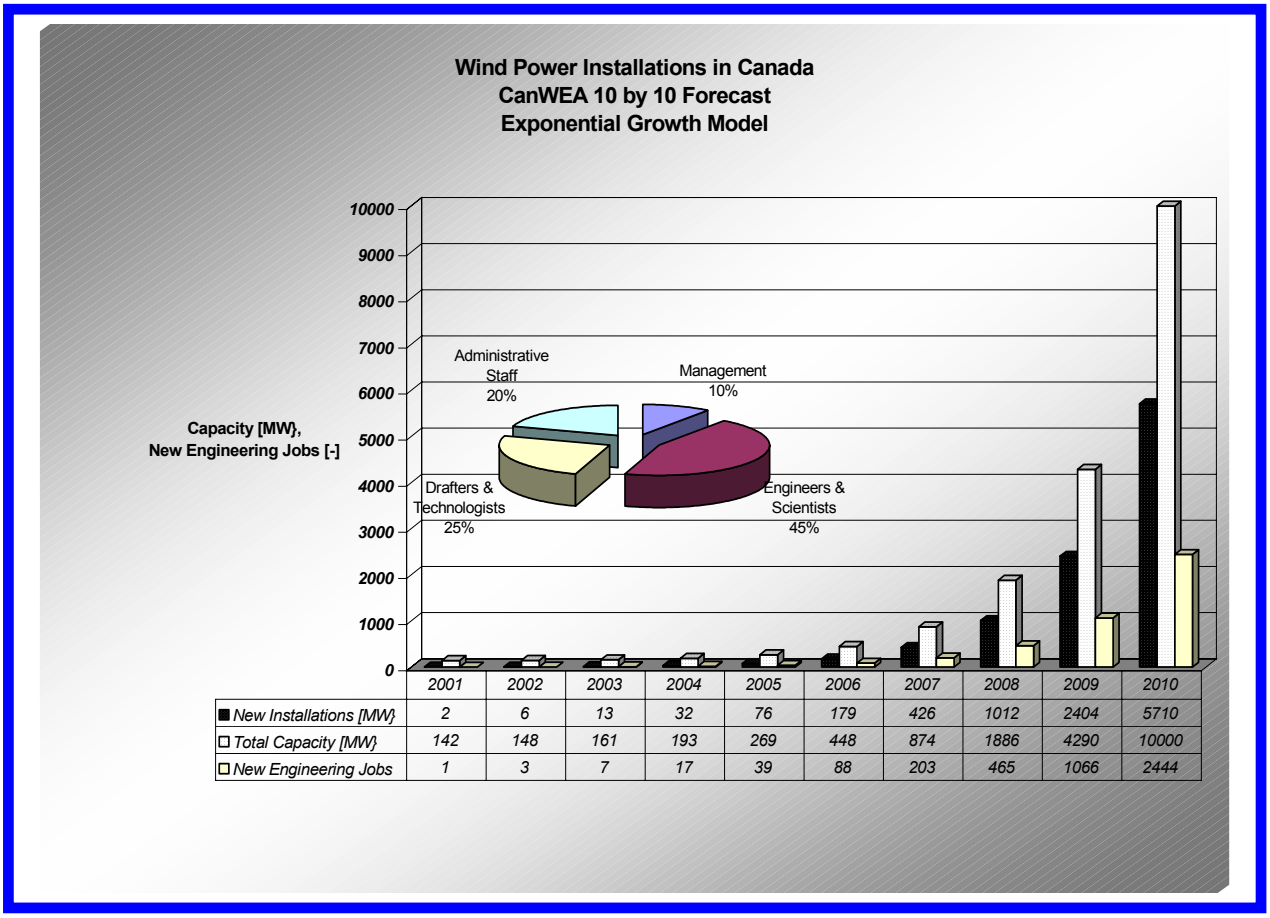
4. Promotion of R&D activities in wind generation technology has been done by U.S. and European government agencies. These research agencies have partnered with technology stakeholders and educational institutions. To date, most of this activity has been concentrated in Canada at NRCan.

5. Significant resource assessment has been undertaken by governments in the U.S. and Europe in the form of wind mapping and GIS data. Information exists for the entire country down to the 50-metre scale. Canada and Ontario lag behind severely in this type of meteorological information. Initial site assessment for investment requires at least this basic data. The existing Ontario Government GIS data should be more readily available to the public and Industry at an affordable cost.

6. Regarding wind resource assessment, Canada has made significant past investment in computer modelling of wind resource but recently has fallen behind the U.S. and Europe in its research. Some of the initial investment has been utilized by other countries to develop marketable product based on these earlier Canadian models.

   The committee noted that:

   - there is a severe shortage of Canadians educated in the wind energy field of study.
   - there are presently no Ontario manufacturers or secondary suppliers of wind measurement equipment.
   - Micro-scale and Meso-scale models are missing for Ontario.
   - there is no domestic version of wind park modelling software.
   - there are significant opportunities for data warehousing, data transfer and data generation for resale.
     - Most of the existing data is collected by various provincial and federal agencies working in isolation from one another.
     - There is the potential to collect all of this data and warehouse it at a single resource centre. York University and Guelph University have some experience in this area.
   - there is “limited” capacity, from a Human Resource Development (HRD) perspective, for growth in this service industry opportunity.
   - engineering resource from an HRD perspective is also lacking.
     - The wind energy generation business is the fastest growing sector in the power industry worldwide.
     - Engineers are required in every aspect, from pre-feasibility to trouble-shooting, during operations and maintenance.
     - Engineering design is sourced almost entirely from U.S. and European companies.
     - To achieve the goal of 10,000 megawatts by year 2010, Canada will need to utilize the services of approximately 2,000 new engineers, technologists and management staff.
     - See the following graph and Section 10.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
New Installations [MW]	2	6	13	32	76	179	426	1012	2404	5710
Total Capacity [MW]	142	148	161	193	269	448	874	1886	4290	10000
New Engineering Jobs	1	3	7	17	39	88	203	465	1066	2444

Source: WPTF Sub-Committee #3

This is a 10–year, $3 billion job creation program (based on an average cost of $25,000 for an engineer engaged by an engineering firm, assuming that all engineering work is done in Canada). The growth curve predicted in Canada is one that has actually occurred in both Germany and the U.S. To date, there are no universities or colleges in Canada engaged in comprehensive programs devoted to wind generation engineering. (Apparently the University of Rimouski in Quebec has recently offered some windsmith courses). Investment in research, training and education will promote expansion of power generation from wind in Ontario.

7. Manufacturing of components for wind turbines exists in Ontario. Presently there are firms engaged in blade manufacture, performance monitoring, tower fabrication, control panel design and fabrication; e.g., Wenver-Vergnet manufactures small turbines up to 65 kW. The example of Wenver-Vergnet is interesting. A European manufacturer partnered with Wenver-Vergnet outsources all of its components to Ontario firms. As a result, this company has been able to supply its own needs as well as certain components to Europe. The conversion of the European technology to Canada's cold climate and lower wind speeds was partially supported by NRCan. The single biggest market for this type of unit is the United States.

8. The infrastructure for the manufacture of electrical components, steel products, wire products and resin/polycarbonate products exists in Ontario. Ontario is ideally suited and situated to produce and compete in the entire Canadian marketplace and the U.S., particularly the Northeastern states.

9. If the average turbine costs approximately C$1.5 million dollars for 1 megawatt, then the **direct investment to achieve the 10,000 megawatt goal would be $15 billion dollars.** Based on the project breakdowns studied by Sub-Committee #3, for materials and labour contribution, there are 9,980 man-hours for the engineering, production and construction per megawatt installed. **This represents almost 50,000 person-years of production** to meet the Canadian objective. The economic multipliers are staggering. It should be noted that the numbers are skewed by the larger projects where cost savings of up to 20% might be achieved through economies of scale.

10. In addition to manufacturing and construction employment, Industry sources indicate that for every 100 megawatts of installed wind power, ten new full-time operation and maintenance (O&M) positions are created (direct and subcontracted). This is a good employment factor in the power sector and represents a total of 1,000 full-time O&M positions to achieve CanWEA's objective. **Since April 2001, two European manufacturers have made commitments to build plants in the Maritimes.**

11. It is significant that corporate Canada has recognized the strategic importance of investment in renewable energy in general and wind energy in particular. This is evidenced by commitments to renewable generation projects and purchases of renewable energy by companies like OPG, Suncor, Shell and British Energy.

12. Since wind generation is a renewable and sustainable form of power generation, an active and substantial wind industry would offset considerable CO_2, NO_x and SO_2 pollutants and help Ontario and Canada meet emission reduction targets and commitments to the Kyoto protocols.

13. Opportunities exist in every sector of the wind business, but one of the most sizeable is tower fabrication. Tower costs represent up to 20% of the total capital required for each installed turbine. Modern tubular turbine towers have up to 100 metric tonnes of steel. Given the size and nature of the steel industry and the issue of financial viability of Ontario steel mills, the sub-committee saw a significant opportunity for the steel industry to develop steel plate product and tubing for large utility grade turbines. Towers are the single biggest outsourced item for turbine manufacturers and are the most difficult structures to get to the site. Given Ontario's proximity to water and road transportation to the U.S. and the rest of Canada, this is an area the committee strongly suggests be investigated as an economic opportunity for Ontario industry. (See Section 10 — *Manufacturing and Human Resource Development Report*.)

RECOMMENDATION # 4

4a) It is recommended that a fifth Centre of Excellence be established and funded at an Ontario university and/or college to spearhead research and education on wind generation. Brock University, Niagara College and St. Lawrence College have expressed an interest in housing such a Centre and designing a program to suit the development of the wind industry. One area of concentration for the Centre should include wind generation engineering from a low temperature/low speed aspect. Existing programs like MEDT's Strategic Skills Investment and the Prosperity Demonstration Fund might be considered as vehicles for this investment.
Proposed timeline for action – prior to market opening.

4b) Six ministries within the Provincial Government contributed resources to the Wind Power Task Force. It has become apparent to all participants that these ministries and others have a significant role to play in linking up with Industry to create conditions required to "kick start" and sustain a viable wind industry in Ontario.

It is recommended that the Ministries appoint from existing senior staff, a wind liaison person. These officers would liaise with a newly designated "wind energy lead" within Government from MNR or MEST. The "wind energy leader" would be a full-time position with a mandate and new resources sufficient to co-ordinate the predictable growth and development of wind generation and its supporting industries in Ontario.

This newly created post would have sufficient ministerial authority to effectively guide the efforts of Government, Educators and Industry. The primary effort should be to merge the adopted recommendations of this Task Force with the Government's renewable energy/emission reduction strategy.
Proposed timeline for action – December 2001.

4c) Because of its large land base and abundance of renewable resources, Ontario has a unique opportunity to diversify its energy supply, keep electricity prices competitive, expand its manufacturing base and significantly reduce emissions.

The WPTF, OWA, IPPSO, CanWEA and other major stakeholders should work with the Ontario Government to develop a RENEWABLE ENERGY STRATEGY that will be used a guideline for policy development at various levels of provincial administration.
Proposed timeline for action – prior to market opening.

3.2 OTHER KEY RECOMMENDATIONS

3.2.1 EDUCATION, INFORMATION AND PARTICIPATION

There is a need to educate the public and regulators on the features, benefits and impacts associated with wind energy development. Sub-Committee #2 prepared an information pamphlet that could be modified for Ontario and distributed to the public, Government agencies and other interested audiences. (See Section 9.)

As well, there is a need for all WPTF members to become fully engaged in the organizations that represent wind energy at the Federal and Provincial levels. This participation facilitates information exchange and promotes the type of business relationship necessary to the development of a "critical mass" for the wind business in Ontario.

RECOMMENDATION # 5

5a) Interested Industry participants on the WPTF together with MEST, MNR, MNDM, OMAFRA, MEDT and MOE, should develop and fund an "Ontario Wind Information Booklet" for early and broad distribution across Ontario. Ontario Industry and Government should also work together to develop an Ontario Wind Energy information web site.
Proposed timeline for action – December 2001.

5b) Industry and Government representatives on the WPTF should attend the annual CanWEA conferences. Industry participants and the "lead Government agency" for wind in Ontario should take up a membership in CanWEA and IPPSO. All Industry participants should belong to IPPSO and attend the annual IPPSO conferences and companion Green Power Trade Shows in Toronto and participate in Ontario wind issues through the IPPSO Environment Committee.
Proposed timeline for action – immediate.

3.2.2 WIND RESOURCE INVENTORY

Task Force discussions on the status of wind resourcing confirmed that in the absence of wind energy data from Government, developers have already embarked on privately funded wind resource studies and modelling. This information is considered proprietary and it is unlikely to be shared. The cost of a complete wind inventory for Ontario was benchmarked at $ 2+ million. It is believed that a comprehensive program would take 3+ years.

As discussed in Section 3.1.2 and Section 8, Governments (Federal and Provincial) do have a role in resource identification. For example, in the mid-1980's, the Province of Ontario undertook a program to identify the potential waterpower sites in Ontario.

The Industry acknowledges that, while desirable, it is probably not practical, from a budget and schedule perspective, for Government to now embark on a comprehensive inventory. However, there are low-cost wind resource **support programs** that would greatly assist Industry (particularly new entrants) in identifying high value wind lands.

Wind energy resourcing also requires the gathering of wind data from tall towers. Tower erection regulations fall under Transport Canada jurisdiction. The Ontario wind Industry has been frustrated with serious delays (2 to 4 months) in receiving approval for "standard" tower proposals. The Federal Government regulations for tower height, lighting and painting are much more restrictive than the regulations in the U.S. These compliance rules, coupled with approval bottlenecks, have delayed and burdened wind energy resourcing efforts in Ontario. By default, the Ontario wind industry is competitively disadvantaged.

RECOMMENDATION # 6

6a) With Industry participation, the Crown should establish five (5) tall tower data collection platforms in Ontario and provide real time "public" access to this data. This data will assist existing developers and new entrants in the development of "macro" modelling studies. This data will also support future wind energy production forecasts for competitive market participants. The cost of this program can be minimized if existing towers are used. See Section 8 for recommended locations.
Proposed timeline for action – December 2001.

6b) The Crown should support wind resourcing initiatives by providing existing GIS data to the wind industry at nominal cost.
Proposed timeline for action – immediate.

6c) With Industry support and participation, the Ontario Government should encourage the Federal Government to adopt tower erection rules that fully respect the safety requirements of air navigation, and at the same time, address the emerging needs of the wind energy industry (increasing taller towers may require wind industry-specific regulation). Ontario should also encourage the Federal Government to pursue conformity of wind tower regulations within North America.
Proposed timeline for action – February 2002.

6d) With Industry participation, the Crown should initiate an offshore wind resource assessment for the Great Lakes with particular emphasis on Lake Erie.
Proposed timeline for action – 2002.

3.2.3 Rural Development

Wind turbines will be built primarily in rural areas, and in the north. They will contribute lease revenue and property tax income to areas of the province that need a boost. In the U.S. and Europe, farm owners of good wind lands are reaping a new "cash crop" from wind energy. This new income is in addition to food crop income. This is because wind parks typically occupy less than 5% of the planted acreage. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is working with farm groups and the WPTF to explore opportunities for Ontario farmers. As well, the wind industry is working with MNDM to identify wind energy opportunities in northern Ontario. (For additional information see **www.windustry.org**)

RECOMMENDATION # 7

Industry and OMAFRA should investigate and report on the income benefits that U.S. and European farmers enjoy from wind energy. Industry should assist OMAFRA in education and consultation efforts with farm owners. Industry, MNDM and MNR should investigate and report on the northern development benefits associated with wind energy development on northern Crown Lands.
Proposed timeline for action – January 2002 and ongoing.

3.2.4 Environmental Assessment

Under the new EA regulations, wind development of > 2 MW will need to go through an Environmental Assessment (EA) screening process, which may lead to a full EA. The EA process is costly, time-consuming and is viewed by the Industry as a barrier to investment in small projects, especially before precedents are set. It was noted that the principal purpose of the EA is to assess issues like visuals, impact on neighbours, etc. The WPTF found that in Southern Ontario, these issues are covered by existing municipal planning processes that are managed locally, where the impacts may be felt. In these areas, there is also a defined Ontario Municipal Board appeal process.

In the case of Crown Lands, MNR is responsible for land use planning. Prior to the introduction of the EA Regulation for Electricity Projects, if an application was received for wind power development on Crown Land, it would be subject to a review process set out in what is known as Exemption Order MNR-26/7, which is a regulation under the Environmental Assessment Act. Following the review process, the local MNR District Manager would consider the "environmental impacts" of the proposed disposition, including social, ecological and economic factors (positive and negative). He/she would decide whether to approve the disposition (often with conditions), deny the disposition, or refer the application to MOE for a full EA.

The Industry needs to be assured that regulatory requirements are harmonized; e.g., Public Lands Act.

The 2 MW limit needs to be reviewed, since today's market has many 1.3-1.8 MW windmills available. As it stands, this limit means that any installation of more than one windmill needs an EA screening.

There is also an inherent inequity in the current EA regulation. For example, a 2MW+ wind installation requires screening but the threshold for natural gas generation is 5 MW+. On the basis of typical capacity factor, it takes between 10 to15 MW of wind (at 30% capacity) to equal the annual energy output of 5 MW of natural gas generation (capacity factor of up to 90%). The regulation seems to encourage a fossil technology that is a known emitter of CO_2, NO_x and SO_2, while at the same time, disadvantage a renewable technology that has no operating emissions.

It is worth noting that in Quebec (where there is 100 MW of wind), the screening threshold is 10 MW.

In Alberta, the fastest growing wind energy market in Canada, there currently are no formal screening threshold requirements. However, environmental information is required for the municipal and provincial permitting processes.

The WPTF submits that, rather than penalizing wind, there should be preferential consideration for non-emitting sources. At the same time, the WPTF recognizes that the Government established the 2 MW threshold in an effort to provide a measure of comfort to communities, that large-scale wind projects would not proceed without appropriate consideration of all stakeholders. This is a worthwhile objective, but as indicated above, the use of both Crown and private lands is already subject to a process that protects the public interest.

RECOMMENDATION # 8

For a trial period, Ontario should raise the screening threshold for wind to 10 MW. This should be reviewed after 2 years to confirm whether that level or another best serves the public interest.
Proposed timeline for action – December 2001.

3.2.5 Emission Set Aside for Renewables

The emission Set Aside for renewables is an important issue as it may provide modest supplemental income to wind energy companies. However, it is important to note that the Set Aside is for NO_x and SO_2 only and does not address the greenhouse gas benefits associated with the RPS proposal. **A RPS policy remains the priority method for encouraging investment in renewables.** However, there is a need to understand how RPS and Set Asides will work together.

The Industry participants in the WPTF submit that the emission Set Aside for renewables requires adjustment in order to meet the intent of the program.

For example, a future RPS that increases annually translates directly into incremental decreases in emissions – a concept that is not reflected in the current draft regulatory framework.

A Set Aside of 1Kt for both $N0_x$ and SO_2 does not reflect the proportional contribution that renewable energy will make to emission reduction objectives. The 1:1 ratio of SO_2:NO_x is disproportionate to emissions. Typically, fossil-generated electricity produces 4 to 6 times more of SO_2 than NO_x.

It is worth noting that IPPSO has recommended a 5% Set Aside for renewables.

The Industry together with MOE and MEST should work to examine the relationship between the "Emissions Trading and Limits" proposal and the introduction of a renewable portfolio standard (RPS) in the competitive market. This review might indicate that a higher Set Aside for renewables is appropriate.

RECOMMENDATION # 9

The wind power industry recommends that representing renewable energy companies organizations (e.g., OWA, IPPSO, WPTF) work with MOE and MEST to analyze a Set Aside based on an appropriate percentage of emissions incrementally increased annually to reflect any RPS additions.
Proposed timeline for action – before market opening.

3.2.6 Property Assessment for Windparks

The assessment burden for wind parks is not expected to be high due to the fact that the majority of the investment in wind is in machinery and foundation — items that are exempt from assessment. At this time, it is unclear whether towers would be deemed to be structure or machinery. This is because the purpose of the tower is to place the machinery at a high elevation where wind velocities are higher. It is also unclear how land values will be impacted by wind park development, except that property tax increases associated with "higher and better use" would be a pass-through and an additional burden to windpark owners. Many U.S. jurisdictions have adopted measures to set assessment for wind parks that encourages investment and helps farm incomes.

The wind industry is making great progress with ever larger machines and taller towers. As the weight and height of turbines increases, the percentage of the capital invested in towers will increase.

The Industry is concerned that assessment rules might disadvantage technology improvements and, by default, diminish Ontario's opportunity to be a leader in emission reduction. At the same time, the wind industry recognizes that a fair contribution to the municipal tax base is desirable.

The wind industry believes that wind park assessment values should be at least 50% lower than the assessment for a similar sized gas-fired generating plant. The reason for this is that Ontario wind power capacity factors are expected to be 30% - 35%, while the capacity factor for gas-fired generation is typically 60% - 90%.

Investor confidence and fair treatment of the municipal/public/environmental interest is reflected in the recommendations below.

RECOMMENDATION # 10

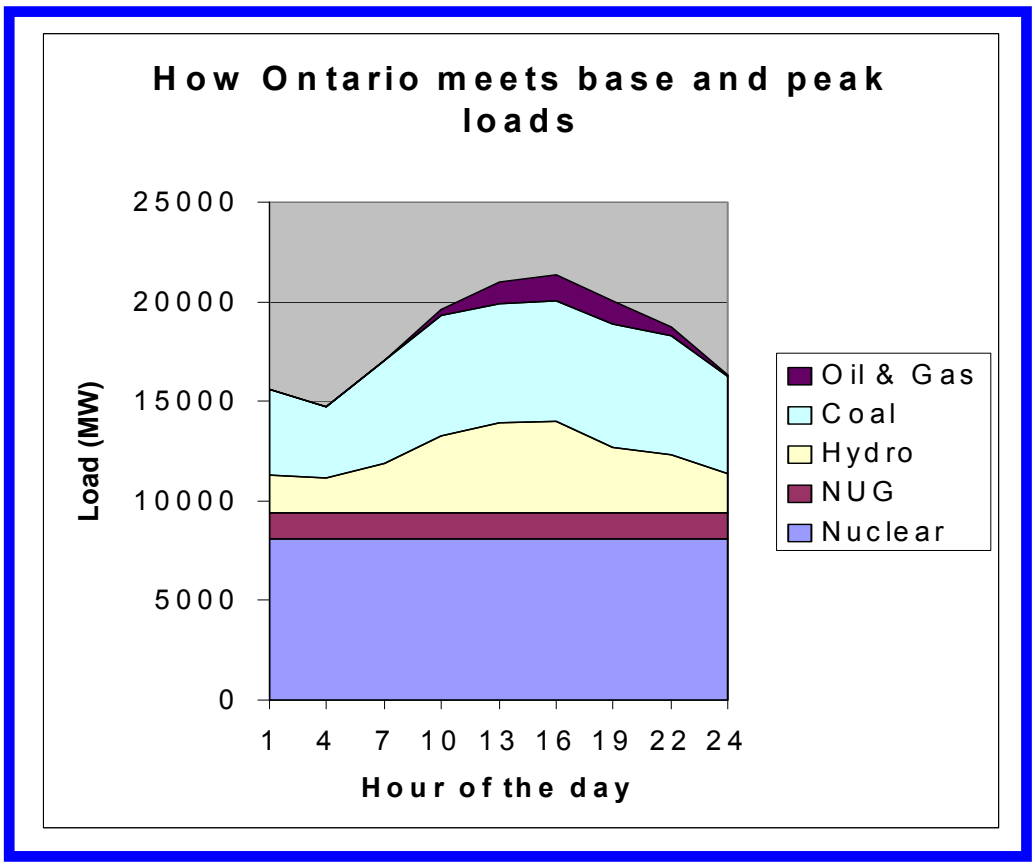
10a) Windpark assessment values in organized municipalities should be set at a fixed value ($20,000 to $40,000 per megawatt adjusted to 2002 $). This includes operations and maintenance buildings, substations transmission lines and other improvements directly related to the wind energy production.
Proposed timeline for action – immediate.

10b) The land associated with the development of a wind park should continue to be assessed under the same category as its prior use.
Proposed timeline for action – immediate.

3.2.7 Synergies with Waterpower

In the development of a Renewable Energy Strategy for Ontario, the Government and Industry will want to consider policy measures and incentives that will encourage energy storage to meet peak demand. Wind is highly compatible with storage-based waterpower or pumped storage systems. In a competitive market, generators and marketers may have an opportunity to hedge hydrological and wind risks through bilateral contracts, and/or intra-company transfer strategies. When the wind is blowing, the water might be conserved in reservoirs. And when the wind is calm, the water may be released if sufficient capacity is available. Ontario's substantial storage-based waterpower resources, and that of its neighbours, makes Ontario an ideal location for wind power development. Existing reservoirs and new pump storage reservoirs could accommodate a substantial portion of power from wind, with minimum added costs to other forms of generation. As well, reduced reliance on hot standby boilers helps to lower emissions. The Government needs to examine market and tax policy incentives that might encourage additional investment in energy storage facilities.

The following graph shows the role of waterpower and fossil in meeting peak system demand for July 18, 2001.



Apparently part of the reason for the success of the Danish wind industry is that they have negotiated backup contracts with Norwegian waterpower generators. This should be investigated further as a favourable economic and logistical argument for supporting wind on the Ontario grid, considering Ontario's abundance of existing waterpower and future pump storage development opportunities.

For access to a detailed study on this subject, see Lafrance, G. 1999: *Are Hydro and Wind Friends*, Proceedings of the 15th Conference of the Canadian Wind Energy Association, pp. 20-29; CanWEA, 3553-31 STREET NW, SUITE 100, CALGARY, AB T2L 2K7, (www.canwea.ca)

RECOMMENDATION # 11

The wind industry, the Ontario Waterpower Association and the Ontario Government should examine constraints, opportunities and practical means of incenting investment in energy storage.
Proposed timeline for action – before market opening.

3.2.8 Distributed Generation and Net Metering

The WPTF has not examined in detail the opportunities/constraints for wind powered distributed generation/net metering in the grid. However, with declining costs for wind generation and improvements in supply protection and isolation, it is anticipated that some individuals, as well as commercial and industrial enterprises with an appropriate zoning and land base, may want to install wind turbines for self-supply and/or sale to the market.

This raises two issues with respect to the Retail Settlement Code and the Debt Reduction Charge (DRC). Both the legality of connection and the burden of the DRC may act as a constraint on the wind industry and impair Ontario's efforts to reduce emissions.

RECOMMENDATION # 12

12a) The WPTF recommends that the Government ask the Ontario Energy Board to review the Retail Settlement Code to ensure that Local Distribution Companies can legally accommodate net metering.
Proposed timeline for action – before market opening.

12b) To promote small business and support emission reductions, the Government should consider a DRC exemption for new self-generated renewables with a capacity under 5 MW.
Proposed timeline for action – before market opening.

3.2.9 Capital Tax and Sales Tax

The Industry supports the Ontario Government's policy objective of reducing the capital tax on investment. The wind industry is particularly sensitive to the current 0.3% capital tax. Wind projects have a capital cost that is approximately three times higher per installed kilowatt than competing technologies like natural gas. The burden is further exacerbated by the capacity factor of wind that is typically 30% versus 90% for gas.

Having tripled the tax burden, coupled with significantly lower annual revenue, means that wind, from a capital tax perspective, is seriously disadvantaged when compared to natural gas generation. This tax anomaly is not consistent with the Government's objective of encouraging investment that will reduce greenhouse and acid gas emissions.

Provincial Sales Tax is also a large burden during the O&M phase. Again, the wind industry suggests that an exemption from sales tax would be consistent with the Government's commitment to reducing emissions.

RECOMMENDATION # 13

13a) The Ontario Government should consider interim capital tax exemptions for wind power. This could be one policy element of a "Renewable Energy Strategy for Ontario."
Proposed timeline for action – Ontario Budget 2002.

13b) For investors' certainty, MOF should clarify the applicability of PST to wind park development and to operations.
Proposed timeline for action – immediate.

13c) Industry recommends that the Ontario Government should exempt all phases of wind power development and operations from PST.
Proposed timeline for action – Ontario Budget 2002.

3.2.10 Private and Municipal Land Use

Most of southern Ontario and the shores of Lake Erie, Lake Ontario and the southeastern shore of Lake Huron are private or municipal lands. These areas represent a significant portion of the developable wind energy resource in Ontario.

The major challenges to wind power development on private lands will arise from both the real and perceived conflicts with existing and future activities on surrounding lands. Concerns about aesthetic impacts and sound will likely be the most prominent. These will be exacerbated, especially during the early years of wind energy development in the province, by two factors:

- First, the relatively small size of private land parcels in Ontario will present a challenge for developers due to the number of stakeholders that may perceive impacts. Windpark development may become uneconomical if municipal setbacks created to address these "perceived" concerns reduce the useable land area, thus eliminating the economics of scale necessary to develop a project. Also, as rural areas are further populated by residential developments and not "the family farm," the tendency towards a NIMBY attitude may become stronger.

- Second, the sheer lack of awareness and the perceived concerns about wind energy will cause many adjacent landowners and possibly municipal Governments to oppose wind energy developments. For developers who are already on the ground in Ontario, this lack of awareness is creating significant challenges.

RECOMMENDATION # 14

14a) That Industry partner with the Ontario Government and environmental organizations to provide municipalities and citizens with more information about the benefits and impacts of wind energy development. This will go a long way towards reducing the current concerns about the technology and the barriers that may result. (See Recommendation #6.)
Proposed timeline for action – January 2002.

14b) The Industry recommends that any incentive used to encourage the development of wind energy in the province, such as special property assessment considerations, be structured in such a way as not to undermine the support of municipalities for wind energy developments.

14c) The Industry does not recommend that a set of standard bylaws be adopted with respect to setbacks or other municipal zoning issues. Each municipality will have circumstances that will affect its approach to regulating wind energy development. However, good, unbiased information about sound and aesthetic issues associated with wind energy development will help municipalities and citizens to make informed planning decisions.

3.2.11 Transmission Issues

The future impact of large-scale wind generation on transmission capacity is not well understood by the Industry or the regulators. Wind energy will compete for transmission space with other generators that have a higher capacity factor. These "other generators" will have the ability to contract for priority consideration in transmission constraint situations that will surely develop in the open market. The Ontario Government will need to consider the merit of transmission system regulations that encourage access for "must run" wind parks. The Utility Wind Industry Group (UWIG) in the U.S. is currently conducting a study of interconnection issues related to large scale wind development. (See FERC report *Interactions of Wind Farms with Bulk-Power Operations and Markets* — September 2001 – posting pending on www.ferc.fed.us or reports on the following sites www.UWIG.org and www.nationalwind.org/pubs/trans/casestudies.pdf)

Most of the electricity transmission system was built during the era of public ownership of Ontario's electrical utility. Detailed information on the disposition of the components of this system (maps, tables, descriptions, blueprints, etc.) ought to be available to the public at little or no charge. In particular, this information is essential to wind energy developers in planning wind generation facilities that will maximize the available resources and minimize the cost to access transmission for their electricity.

RECOMMENDATION # 15

15a) MEST should require OEB or the IMO to make available to the Industry information with respect to transmission and distribution capability that will assist the Industry in the prioritization and planning of potential wind energy facilities.
Proposed timeline for action – December 2001.

15b) The Industry, together with MEST, IMO and Hydro One should work to streamline and expedite the process for interconnection of wind energy facilities to the grid. This co-operative effort should include a review of electrical system capacity, and opportunities and constraints for greater distributed generation on the grid. It should also include a review of the impact of market rules; e.g., interconnection.
Proposed timeline for action – February 2002.

4.0 RECOMMENDATION AND POLICY IMPLEMENTATION ISSUES

4.1 CONSULTATION WITH GOVERNMENT AND OTHER STAKEHOLDERS

The WPTF "Report and Recommendations" is the first comprehensive review of wind power in Ontario and perhaps Canada. Participants acknowledge that many other stakeholders have an interest in these recommendations and there is merit in soliciting comment from these parties after the report and recommendations are presented to the participating Ontario Ministries.

Presentations to Ministry staff and Ministers will be completed before November 30, 2001. After this phase, the WPTF will discuss the preferred methods of distributing of this report to other stakeholders; e.g., web posting.

4.2 IMPLEMENTATION TARGETS

The Industry believes that the priority recommendations and the bulk of the other recommendations, can and should be adopted prior to market opening. The Ontario Government's commitment to emission reduction will be advanced and investors in wind power will be ready to take up a significant role in providing clean renewable power at competitive prices.

5.0 RECOMMENDATIONS SUMMARY

The following is a summary of the recommendations. For background information, please see Section 3.

RECOMMENDATION # 1

1a) The Ontario Government should adopt the proposed RPS that will, by 2010, result in 8% of total provincial electrical consumption being met by qualifying renewable energy sources.
Proposed timeline for action – prior to market opening.

1b) The Ontario Government should adopt a renewable power procurement commitment for its own electricity needs using the same "Eligible renewable energy resource" criteria recommended in the RPS rules.
Proposed timeline for action – December 2001.

RECOMMENDATION # 2

Following the acceptance of an Ontario-based RPS, the Ontario Government should challenge the Federal Government to follow Ontario's lead by adopting a Production Tax Credit for sustainable renewable energy production.
Proposed timeline for action – prior to market opening.

RECOMMENDATION # 3

3a) The Crown should adopt a Crown Land disposition policy for wind energy development. The Industry has been working with MNR on framework for this policy and will continue this co-operative effort to refine details.
Proposed timeline for action – February 2002.

3b) The Crown should structure Crown Leases for wind lands to provide a royalty holiday for a period of 15 years. The lease period should be at least 30 years with renewable options.
Proposed timeline for action – February 2002.

3c) The Crown should adopt a land rental charge policy for Crown Lands leased for wind parks. This charge should not be more than the charge for "general use" Crown Land in the area.
Proposed timeline for action – February 2002.

RECOMMENDATION # 4

4a) It is recommended that a fifth Centre of Excellence be established and funded at an Ontario university and/or college to spearhead research and education on wind generation. Brock University, Niagara College and St. Lawrence College have expressed an interest in housing such a Centre and designing a program to suit the development of the wind industry. One area of concentration for the Centre should include wind generation engineering from a low temperature/low speed aspect. Existing programs like MEDT's Strategic Skills Investment and the Prosperity Demonstration Fund might be considered as vehicles for this investment.
Proposed timeline for action – prior to market opening.

4b) Six ministries within the Provincial Government contributed resources to the Wind Power Task Force. It has become apparent to all participants that these ministries and others have a significant role to play in linking up with Industry to create conditions required to "kick start" and sustain a viable wind industry in Ontario.

It is recommended that the Ministries appoint from existing senior staff, a wind liaison person. These officers would liaise with a newly designated "wind energy lead" within Government from MNR or MEST. The "wind energy leader" would be a full-time position with a mandate and new resources sufficient to co-ordinate the predictable growth and development of wind generation and its supporting industries in Ontario.

This newly created post would have sufficient ministerial authority to effectively guide the efforts of Government, Educators and Industry. The primary effort should be to merge the adopted recommendations of this Task Force with the Government's renewable energy/emission reduction strategy.
Proposed timeline for action – December 2001.

4c) Because of its large land base and abundance of renewable resources, Ontario has a unique opportunity to diversify its energy supply, keep electricity prices competitive, expand its manufacturing base and significantly reduce emissions.

The WPTF, OWA, IPPSO, CanWEA and other major stakeholders should work with the Ontario Government to develop a RENEWABLE ENERGY STRATEGY that will be used a guideline for policy development at various levels of provincial administration.
Proposed timeline for action – prior to market opening.

RECOMMENDATION # 5

5a) Interested Industry participants on the WPTF together with MEST, MNR, MNDM, OMAFRA, MEDT and MOE, should develop and fund an "Ontario Wind Information Booklet" for early and broad distribution across Ontario. Ontario Industry and Government should also work together to develop an Ontario Wind Energy information web site.
Proposed timeline for action – December 2001.

5b) Industry and Government representatives on the WPTF should attend the annual CanWEA conferences. Industry participants and the "lead Government agency" for wind in Ontario should take up a membership in CanWEA and IPPSO. All Industry participants should belong to IPPSO and attend the annual IPPSO conferences and companion Green Power Trade Shows in Toronto and participate in Ontario wind issues through the IPPSO Environment Committee.
Proposed timeline for action – immediate.

RECOMMENDATION # 6

6a) With Industry participation, the Crown should establish five (5) tall tower data collection platforms in Ontario and provide real time "public" access to this data. This data will assist existing developers and new entrants in the development of "macro" modelling studies. This data will also support future wind energy production forecasts for competitive market participants. The cost of this program can be minimized if existing towers are used. See Section 8 for recommended locations.
Proposed timeline for action – December 2001.

6b) The Crown should support wind resourcing initiatives by providing existing GIS data to the wind industry at nominal cost.
Proposed timeline for action – immediate.

6c) With Industry support and participation, the Ontario Government should encourage the Federal Government to adopt tower erection rules that fully respect the safety requirements of air navigation, and at the same time, address the emerging needs of the wind energy industry (increasing taller towers may require wind industry-specific regulation). Ontario should also encourage the Federal Government to pursue conformity of wind tower regulations within North America.
Proposed timeline for action – February 2002.

6d) With Industry participation, the Crown should initiate an offshore wind resource assessment for the Great Lakes with particular emphasis on Lake Erie.
Proposed timeline for action – 2002.

RECOMMENDATION # 7

Industry and OMAFRA should investigate and report on the income benefits that U.S. and European farmers enjoy from wind energy. Industry should assist OMAFRA in education and consultation efforts with farm owners. Industry, MNDM and MNR should investigate and report on the northern development benefits associated with wind energy development on northern Crown Lands.
Proposed timeline for action – January 2002 and ongoing.

RECOMMENDATION # 8

For a trial period, Ontario should raise the screening threshold for wind to 10 MW. This should be reviewed after 2 years to confirm whether that level or another best serves the public interest.
Proposed timeline for action – December 2001.

RECOMMENDATION # 9

The wind power industry recommends that representing renewable energy companies organizations (e.g., OWA, IPPSO, WPTF) work with MOE and MEST to analyze a Set Aside based on an appropriate percentage of emissions incrementally increased annually to reflect any RPS additions.
Proposed timeline for action – before market opening.

RECOMMENDATION # 10

10a) Windpark assessment values in organized municipalities should be set at a fixed value ($20,000 to $40,000 per megawatt adjusted to 2002 $). This includes operations and maintenance buildings, substations transmission lines and other improvements directly related to the wind energy production.
Proposed timeline for action – immediate.

10b) The land associated with the development of a wind park should continue to be assessed under the same category as its prior use.
Proposed timeline for action – immediate.

RECOMMENDATION # 11

The wind industry, the Ontario Waterpower Association and the Ontario Government should examine constraints, opportunities and practical means of incenting investment in energy storage.
Proposed timeline for action – before market opening.

RECOMMENDATION # 12

12a) The WPTF recommends that the Government ask the Ontario Energy Board to review the Retail Settlement Code to ensure that Local Distribution Companies can legally accommodate net metering.
Proposed timeline for action – before market opening.

12b) To promote small business and support emission reductions, the Government should consider a DRC exemption for new self-generated renewables with a capacity under 5 MW.
Proposed timeline for action – before market opening.

RECOMMENDATION # 13

13a) The Ontario Government should consider interim capital tax exemptions for wind power. This could be one policy element of a "Renewable Energy Strategy for Ontario."
Proposed timeline for action – Ontario Budget 2002.

13b) For investors' certainty, MOF should clarify the applicability of PST to wind park development and to operations.
Proposed timeline for action – immediate.

13c) Industry recommends that the Ontario Government should exempt all phases of wind power development and operations from PST.
Proposed timeline for action – Ontario Budget 2002.

RECOMMENDATION # 14

14a) That Industry partner with the Ontario Government and environmental organizations to provide municipalities and citizens with more information about the benefits and impacts of wind energy development. This will go a long way towards reducing the current concerns about the technology and the barriers that may result. (See Recommendation #6.)
Proposed timeline for action – January 2002.

14b) The Industry recommends that any incentive used to encourage the development of wind energy in the province, such as special property assessment considerations, be structured in such a way as not to undermine the support of municipalities for wind energy developments.

14c) The Industry does not recommend that a set of standard bylaws be adopted with respect to setbacks or other municipal zoning issues. Each municipality will have circumstances that will affect its approach to regulating wind energy development. However, good, unbiased information about sound and aesthetic issues associated with wind energy development will help municipalities and citizens to make informed planning decisions.

RECOMMENDATION # 15

15a) MEST should require OEB or the IMO to make available to the Industry information with respect to transmission and distribution capability that will assist the Industry in the prioritization and planning of potential wind energy facilities.
Proposed timeline for action – December 2001.

15b) The Industry, together with MEST, IMO and Hydro One should work to streamline and expedite the process for interconnection of wind energy facilities to the grid. This co-operative effort should include a review of electrical system capacity, and opportunities and constraints for greater distributed generation on the grid. It should also include a review of the impact of market rules; e.g., interconnection.
Proposed timeline for action – February 2002.

6.0 RENEWABLES PORTFOLIO STANDARD (RPS) DRAFT RULES (October 10, 2001)

1. Definitions

a) “Board” means the Ontario Energy Board.

b) "Eligible renewable energy credit" means a tradeable certificate of proof, certified by the Board or by the approved credit administrator working within the rules set by the Government or Board, that one kilowatt hour of electricity was generated by an eligible renewable energy resource on or after the implementation of RPS legislation (target — April 2002.).

c) “Eligible renewable energy resource” means an electricity generating facility certified by the Board that:

i. uses as its fuel: wind, solar, biomass, landfill gas or water. Facilities that use both eligible and ineligible fuels shall be eligible only for the portion of electricity generated by eligible fuels unless the use of ineligible fuels is below 2%;

ii. is certified by the Environmental Choice Program™ program (November 1999 version), excepting Clauses 9c, 9e and 12;

iii. is located either (a) within the Province of Ontario, or (b) in a jurisdiction that, as determined by the Board, has a comparable RPS requirement in effect under which Ontario generators are eligible to participate, and which jurisdiction has a credit accounting system that is compatible and co-ordinated with the Board’s credit accounting system (the co-ordination has to be sufficient to ensure that the attributes of any kWh are sold only once.);

iv. was first entered into service after December 31, 1990, or was upgraded after December 31, 1990, in which case, eligibility shall be limited to the incremental production that results from such upgrade; and

v. is connected to the IMO-controlled grid or is embedded generation within an Ontario LDC pursuant to the Act.

d) "Obligated entity" means an entity:
   i. engaged in the retail sale of electricity to end-use customers, including, but not limited to, local distribution companies selling SSS and licensed retailers;
   ii. purchasing electricity for its own use as a market participant in the IMO-administered energy market;
   iii. generating electricity for its own use, where this self-generation is greater than 20 GWh/year.

e) "The credit administrator" means the entity charged by the Board with administering the regulations required under the rule.

f) "Renewables Portfolio Standard" means the specified percentage of electricity generated by eligible renewable energy resources that an obligated entity is required to purchase in any given year, as established by the Board pursuant to section 2(a).

g) "Eligible Generator" is a generating company including subsidiaries that has its generating facilities registered with the IMO.

2. Renewables Portfolio Standard

a) Each obligated entity shall annually demonstrate to the Board that it has acquired and permanently withdrawn from circulation a number of eligible renewable energy credits equal to a specified percentage of the total kilowatt hours sold to its retail customers in the province, or in the case of self-generators that self-produce more than 20 GWh/year, the total kilowatt hours generated and consumed, during the preceding year. Beginning in 2003, the specified percentage shall be equal to 1.5 percent of 2002 electricity sales or consumption of obligated entities as determined by the Board. The specified percentage shall be 2% in 2004, and 3% in 2005 and rise by 1% each subsequent year until it reaches 8% in 2010 and shall remain at a minimum of 8% until 2020. See Table below:

Year	Percentage	Comments
2003	1.5%	Includes post 1991 ECP
2004	2%	
2005	3%	
2006	4%	
2007	5%	
2008	6%	
2009	7%	
2010	8%	Minimum to 2020

b) In any year that a single qualifying renewable energy project contributes energy that represents more than xx% of the RPS mandated addition for that year, then the overall RPS target may be increased by the Board. *(This item requires additional review at a subsequent stage to determine need, impacts and benefits.)*

c) No single "eligible generator" can accredit or purchase RECs in excess of xx% of the total REC quota for any given year. *(This item requires additional review at a subsequent stage to determine need, impacts and benefits.)*

d) An obligated entity that sells electricity at retail shall include the specified percentage in each product sold to its customers and shall not represent to any customer or prospective customer that any of its products contain more than the specified percentage of eligible renewable resources unless the entity has acquired and withdrawn from circulation an equivalent number of eligible renewable resource credits.

e) The renewable energy fuel attributes associated with an eligible renewable energy resource shall initially be vested in the owner of the eligible renewable energy resource and shall be sold or transferred only through the eligible renewable energy credit, and the credit shall be used only once for the purpose of complying with the renewables portfolio standard or verifying retail product claims in Ontario or any other jurisdiction.

3. Penalties

a) Any obligated entity that fails to acquire and withdraw from circulation a sufficient number of eligible renewable energy credits pursuant to implementing regulations, or any person who acquires eligible renewable energy credits in violation of implementing regulations, shall pay a penalty of at least twice the market value of such credits, as estimated by the Board.

b) Any penalties assessed by the Board shall not diminish the liability of violators of this provision for the same violation under any other applicable provision of law.

4. Powers and Duties of the Board

The Board, in consultation with the credit administrator and any other relevant agencies, shall:

a) establish or ensure the establishment of a single, central, electronic credit-accounting system, in which any entity that wishes to own an eligible

renewable energy resource credit shall establish an account. The credit-accounting system shall serve to verify compliance with the Renewables Portfolio Standard and to verify any claims made by obligated entities regarding the fuel source attributes of their products, notwithstanding any other provision of law. The Board may impose or authorize a fee on users of the credit system in an amount equal to the reasonable administrative costs of issuing and tracking such credits and related services. Such fees, if applied, shall be structured so as to encourage, and not penalize, small renewable generators, by charging flat rates based on kWh produced.

b) adjust the specified RPS percentages in accordance the provisions of Section 2(a); or

c) certify, directly or through delegation, eligible renewable energy resources;

d) issue, directly or through delegation, renewable energy credits to the credit accounts of owners of eligible renewable energy resources upon verification of delivery to the IMO or Ontario LDC or use in self-generation;

e) assess and collect, directly or through delegation, penalties, and use any proceeds from any penalty payments to purchase and withdraw from circulation the least-cost credits available in the market;

f) adopt final implementing regulations by April 30, 2002;

g) promulgate such rules, including reasonable compliance flexibility measures as may be necessary to effectively and efficiently implement this provision. Such flexibility measures shall include the ability to use credits for compliance purposes during any year, after the year in which the credits were issued;

h) make available to obligated entities “proxy” renewable energy credits at a price equivalent to $0.05 per credit in 2003 dollars, adjusted each year for inflation, which may use be used to satisfy the entity’s obligation, and use any proceeds from the sale of proxy credits to purchase the least-cost eligible renewable energy credits available in the market. Beginning in 2005, the price of the “proxy” renewable energy credits will be reduced by $0.005 per credit each year until the end of 2009, at which time the proxy price will be the market clearing price;

i) **or Alternate #1** to (h) above — no price cap;

j) **or Alternate #2** to (h) above — Note: this alternative to the “proxy credit cost cap” method is being considered in some U.S. markets and was offered by Nancy Rader. The renewable energy industries here may prefer

it because it encourages contracts between obligated entities and renewable energy generators, rather than diverting obligated entities toward the Government's proxy credits. The provision reads as follows:

For the definitions section: `Maximum compliance cost' means aggregate average annual procurement costs per kWh associated with the Renewables Portfolio Standard that exceed the costs of procuring alternative non-renewable resources by five cents ($0.05) per kWh in 2001 dollars."

Replacement for proxy credit section 4(h): "notwithstanding any other requirement of this section, allow any obligated entity to request a reduction in the Renewables Portfolio Standard subject to the following terms:

i. The Board may authorize a deferral in the Renewables Portfolio Standard if an obligated entity demonstrates that procurement of eligible renewable energy resources in a given year would exceed the maximum compliance cost. Prior to granting such a request in full or in part, the Board shall conduct a public hearing and require the obligated entity to demonstrate reasonable efforts to fully comply with the Renewables Portfolio Standard.

ii. If the obligated entity successfully demonstrates an inability to comply with the standard at or below the maximum compliance cost, the Board may partially or fully defer the Renewables Portfolio Standard on the obligated entity in a given year, so long as the obligated entity remains obligated to spend no less than the maximum compliance cost on the procurement of eligible renewable energy resources."

iii. "Notwithstanding the reduction authorized by the Board in any given year, the obligated entity shall be required to carry forward to the following year, the requirement to acquire and withdraw from circulation the deferred REC obligation."

Revision to penalty provision Section 3(a): "Any obligated entity that fails to acquire and withdraw from circulation a sufficient number of eligible renewable energy credits pursuant to implementing regulations, or any person who acquires eligible renewable energy credits in violation of implementing regulations, shall pay a penalty of at least twice the market value of such credits, as estimated by the Board. A obligated entity receiving approval to meet a reduced Renewables Portfolio Standard

requirement under section 4(j), and satisfying the modified requirement, shall not be liable for penalty payments.";

k) provide a mechanism for input and advice from the Industry and other stakeholders (Advisory Committee).

5. Duties of Other Entities

a) Each LDC supplying SSS to customers shall provide information to the Board on its own retail sales volume and that of each licensed retailer as required by the Board.

b) Eligible generators shall ensure that the credit administrator is provided with certified data specifying energy volumes metered and delivered sufficient to allow the credit administrator to carry out its function.

c) Each LDC shall provide to the Board, on a quarterly basis, the number of kilowatt hours metered and delivered to the LDC by each eligible renewable energy resource as identified by the Board and as authorized by the resource.

d) Each LDC shall acquire eligible renewable energy credits in the market through long-term contracts or any other means deemed least-cost by the LDC as approved by the Board.

e) Wholesale buyers in the IMO-administered energy market shall ensure that the credit administrator is provided with certified data specifying metered energy volumes sufficient to allow the credit administrator to carry out its function.

7.0 COST OF RENEWABLES PORTFOLIO STANDARD (RPS)

7.1 FACTORS THAT INFLUENCE THE PRICE OF RECs

The RPS recommendation is detailed in the WPTF report appendix. The recommendation calls for a graduated RPS starting with 1.5% in 2003 and reaching 8% in 2010.

The RPS policy proposal anticipates that Renewable Energy Credits (RECs) will be the market vehicle for value determination and trading associated with the production of qualifying RPS energy. It is important to understand the factors that influence the price of RECs, since:

- developers will make investment decisions based on their assessment of REC prices
- Government and ratepayers will want to quantify the impact of RPS on electricity prices
- all stakeholders will need to develop confidence that the final RPS policy will, in fact, achieve the objectives outlined in the RPS draft. (See Section 6.)

7.2 COST AND SUPPLY OF RENEWABLES

One of the key issues in determining the cost of the RPS is the quantification of the available supply of renewables, as well as estimates of the respective price required to attract development investment. Below is an Industry review of the potential supply from major renewable energy sources. Due to time constraints, solar and some other renewables were not assessed. The estimates below do not consider the environmental/social constraints associated with the potential addition of renewable generation.

7.2.1 Waterpower

The waterpower industry estimates new capacity potential at up to 2,000 MW[4]. This capacity could generate up to 6,000 GWh annually, or approximately 3% to 4% of Ontario's current 144 TWh annual demand. The breakdown is as follows:

[4] OWA – preliminary estimate August 2001

Source	Capacity (MW)	Energy (GWh/yr)
New Developments	200 to 300	1,000 to 1,500
Re-developments	600 to 1,300 (equivalent)	2,000 to 3,000
Upgrades	200 to 400	1,000 to 1,500
Total	**1000 to 2000**	**4,000 to 6,000**

OWA – preliminary estimate August 2001

The estimate is highly dependent on the market price for power and available grid capacity. It includes only projects where considerable assessment has taken place. This estimate **excludes** the bulk of far northern waterways that are currently well outside the grid-serviced area. It is worth noting that new/re-developed/upgraded waterpower projects generally require a timeline of between 2 and 5 years.

7.2.2 Municipal Waste Anaerobic Digestion, Landfill Gas, and Biomass

Municipal waste can generate power in several ways. Wood waste can be burned using combustion technology, generating power. Landfill methane gas can be collected, and the methane can be burned, driving a generator. New technologies, like the SUBBOR system piloted at Guelph at a cost of $30M, generates methane from the organic components of the waste stream, yielding electricity, a peat material and recyclables.

SUBBOR estimates the power potential of the waste stream from the City of Toronto at 150 continuous Megawatts[5]. Since Toronto has about 20% of the province's population, it is assumed that the practical provincial potential may be 500 MW. Additional sources of feedstock for anaerobic digestion could include farm waste, pulp and paper waste and other biomass.

Traditional landfill gas collection is not as efficient as anaerobic digestion processes, but can still offer considerable production. SUBBOR's parent company, Eastern Power currently produces 40 to 50 MW from methane extracted at the Keele Valley and Brock West landfill sites. There are many landfills across the province that can be developed. These sites offer the advantage of producing methane from garbage that was discarded years ago.

The cost of electricity from anaerobic digestion of municipal waste can be competitive when combined with tipping fees, selling recyclables and peat. Many developments will proceed with a price of power between 6 and 9 cents/kWh.

[5] From conversations with SUBBOR, August 2001

It should be noted that some of these renewable technologies are co-fired with natural gas. Only the portion attributable to the "eligible renewable energy resource" would qualify under the RPS rules.

7.2.3 Wind

As discussed in Section 4.2, Ontario has abundant wind resources that could easily support 2,000 to 6,000 MW in an initial build-up and more during the maturing stage of this sector.

Windmills in Ontario must be located close to the grid, in Southern Ontario, and parts of Northern Ontario. The grid-accessible portion of the province is estimated to have a geographic area of over 300,000 sq. km. The grid-accessible area of the province is about the same size as Germany where there is over 7,500 MW of installed capacity.

Private developers have indicated that in the early stages of Ontario's wind energy development, a business case for investment is unlikely to be made until the net present realized price of wind energy is 8 to 10 cents/kWh.

Below is a table that summarizes the Industry estimates of the capacity/energy available from renewables and the market prices required to attract investment. The market price indicated in the column below includes the contribution from PTC, the sale of RECs and emission credits.

Generation Source	Capacity (MW)	Production (GWh)	% of Ontario Energy Demand	Market price/kWh
Waterpower	1,000 – 2,000	4,000 – 6,000	2.8% - 4.2%	6 - 8 cents
Municipal Waste AD, Landfill, Biomass	200 – 500	2,000 – 4,000	1.4% - 2.8%	6 - 9 cents
Wind Power	2,000 – 6,000	5,000 – 16,000	3.5% -11%	8 -10 cents
Total	3,200 – 8500	11,000 – 26,000	7.6% -18%	6 -10 cents

7.3 EXPECTED VALUE OF RENEWABLE ENERGY CREDIT (REC)

The market value of the Renewable Energy Credit is important, since this is the amount of premium (if any) that users of electricity will be required to pay for RPS energy. The value of the REC is a function of the cost of the renewable energy and the market price for energy. If the market price rises, the value of the REC goes down because the higher price for regular power will attract new renewable supply[6].

It is worth noting that, even with a RPS policy, some consumers will be willing to pay a premium for retail portfolios that contain more renewable energy than the mandated RPS requirements. If the value of this additional green premium is high, then the cost of the REC will decrease.

Developers will undertake projects whenever the expected price of power is high enough to cover their cost and required profit. In the case of renewable generation projects, if a RPS is in place, the developer will obtain income from the following sources:

- the wholesale price of power sold into the market or the price paid under long-term contracts
- the value of the REC
- the sale of emission credits for NO_x and SO_2
- federal production tax credits (PTC) if implemented

Generators selling direct to loads and retailers of RPS energy will receive revenue from:

- the pass through to loads of the REC cost
- any additional green premium that may be available for marketing the power as green

Where the sum of these values is higher than the cost (including profit) of a project, the project will proceed. When enough such projects proceed, supply of green power increases, and the value of the REC decreases.

[6] An interesting angle on this would be advertising of Green Power options. If the Government, or NGOs, were to undertake extensive advertising of Green Power, the amount of power sold for a green premium would increase, thus increasing the supply of Green Power, and driving down the cost of the REC. It may pay for major users to engage in this activity, simply to reduce the cost of the REC to the system.

7.3.1 Wholesale Price of Power and Natural Gas Prices

The impact of the wholesale price of power is critical to the value of the REC. For example, if the generation cost of power rises to 8 cents/kWh, then many renewable projects would be drawn to the market, and the value of a REC would be close to zero. Ontario consumers would pay nothing extra for renewable power. The most efficient natural gas generating stations use 6,000 BTU's/kWh. With gas at $4.5/million BTU's, the cost of fuel alone is 2.8 cents/kWh for natural gas generated power. However, if gas rises to $15/million BTU's, as it did last winter, then the cost of gas alone rises to 9.3 cents/kWh. Of course a gas plant operator would want to cover other costs as well, so the selling price of power from the plant could be 11-12 cents.

The IMO 10-Year Outlook, announced new gas proposals in the province totalled 5,800 MW, or almost 20% of today's capacity[7]. Increasing renewables in the system offers a potent counterweight to the uncontrollable fluctuations of a commodity like natural gas. If gas is $10/mm BTU's, the value of RECs will be zero. The RPS, which will have increased the supply of electricity, could actually lower average electricity costs in Ontario. (See graph in Section 2.2.3 – Natural Gas.)

7.3.2 Emission Set Asides for Renewables

The impact of emission Set Asides could provide a modest incentive for, and hence lower the cost of the RECs. Under Ontario's proposed Emission Trading Code, the Set Aside for renewables opens an opportunity for additional revenue. At this time the quantity of the Set Aside and the ratio of NO_x/SO_2 has not been finalized. The value of these credits today could be worth a between $0.001 and $0.003/KWh depending on the final rules and anticipated market conditions over the next decade. In any event, the small, but positive impacts of emission Set Asides for renewables, will help to suppress the cost of RECs.

7.3.3 Emission Caps

The effect of emission caps is to increase the cost of fossil generation. The resulting upward pressure on market prices will reduce the cost of RECs as the gap between fossil and renewables costs decreases.

7.3.4 Federal Production Tax Credits

In the United States, the Federal Government offers a tax credit to wind amounting to 2.6 cents/kWh. The Clean Air Renewable Energy coalition (CARE), an alliance of energy companies and NGOs, has been actively promoting a similar federal program in

[7] IMO 10 Year Outlook, page 12

Canada for the Fall 2001 budget. If such a program were to be adopted in Canada, the cost of wind power would decline, as would the value of the RECs.

7.4 CONCLUSION

The capacity for renewables in the province is considerable, and supply of 8% by 2010 of the province's power is certainly achievable.

A RPS is expected to have a minor impact on electricity rates in Ontario. However, this can be mitigated by limiting and reducing over time, the price of "proxy" RECs which is one of the alternatives outlined in the draft RPS recommendation. (See Section 6.)

As well, the graduated amounts of power from a RPS, rising from 2% to 8% of total power consumed will ensure that the impact is felt only gradually.

The cost of the RPS, as represented by the price of RECs, will depend on many factors, and will be low if:

- the wholesale price of power is high,
- the price of natural gas is high,
- Federal tax incentives are introduced,
- the green premium that consumers will pay for green power is high (or if there is a consumer tax credit program) or if emissions trading benefits renewables.

There are many factors that can make the cost of an RPS low. And, indeed, a scenario exists where an RPS will lower the cost of electricity in the province. The probable impact on blended wholesale prices is < 1% for the first years and < 2% by 2010.

8.0 ONTARIO WIND RESOURCE REPORT

8.1 WIND RESOURCE ASSESSMENT – ACTIVITY AREAS

Wind resource assessment (WRA) can be broken down into six activity areas:

1. Analysis of existing historical data
2. Field monitoring
3. Micro-scale computer modelling
4. Meso-scale computer modelling (new activity)
5. Wind farm design
6. Synthesis

8.1.1 Ontario Status/Capabilities

1. Publicly available data includes:
   - one national overview (Meteorological Service of Canada)
   - one provincial assessment (technical) for Ontario Hydro Demand/Supply Plan
   - one partial provincial WRA (southwestern Ontario only) funded by NRCan
   - one partial provincial WRA (eastern Ontario only) funded by NRCan — in progress

   The data from the above studies is limited in scope and outdated. New technology (higher towers) requires that new, detailed studies be undertaken.

2. There are limited WRA capabilities — only one full-time, full-service WRA company; some secondary capability.

3. In WRA, Ontario lags Europe, USA, India and others.

The following tables summarize capability, status, source and opportunities/constraints for WRA in Ontario.

WRA General

Capability	Status	Who/Where	Opportunities
1. Analysis of historical data.	• most data warehoused by Meteorological Service of Canada (MSC) • few other reliable sources	• Meteorological Service of Canada (Federal, Toronto) • Natural Resources Canada (NRCan, Federal, Ottawa) • Zephyr North (Burlington)	• Software development/ sales • data transfer; data warehousing • data creation (merchant data)
2. Field monitoring	• no Ontario equipment manufacturers • no primary suppliers • some secondary suppliers • equipment is all off-shore		• mast manufacturing • (50m present maximum) • anemometer development/ manufacturing • datalogger/ communications development/ manufacturing
3. Micro-scale computer modelling	• MSC / Zephyr North supply world-class micro-scale model but not specifically designed for wind resource assessment • no other sources	Zephyr North	• premier world model was co-developed in Canada in 1980's; Canada did not follow up; others now lead • some opportunities for model development/ sales for northern climates (Zephyr North; York U)
4. Meso-scale computer modelling	• no primary capability • limited secondary capability	York U; Ortech/CREC	• model development/ sales/technology transfer
5. Wind farm design	• no domestic models		• limited — possibly in concert with micro-scale model development
6. Synthesis	• no domestic software		• model development/ sales

Human Resource Development Issues

Capability	Status	Who/Where	Opportunities
1. Analysis of historical data.	• limited primary capability • limited secondary capability	• Zephyr North (Burlington); Meteorological Service of Canada (Federal, Toronto); York U (Prof. Taylor group, Toronto)	• software development/sales • data transfer; data warehousing (transfer from MSC; NRCan) • development of skilled data analysts
2. Field monitoring	• limited primary capability • limited secondary capability	Zephyr North; York U; U of Guelph (Prof. Gillespie, Guelph)	• significant opportunities for: development of domestic capability • requirements: skilled field workers, skilled bench technicians (maintenance) skilled data analysts, managers
3. Micro-scale computer modelling	• limited primary capability • limited secondary capability	Zephyr North; York U	• model development • premier model was co-developed in Canada in 1980's; Canada did not follow up; others now lead • some opportunities for model development / sales for northern climates • additional development for skilled computer modelling technicians
4. Meso-scale computer modelling	• no primary capability • limited secondary capability	York U; Ortech/CREC	• model development/sales/ technology transfer • possible future requirement for skilled computer modelling technicians
5. Wind farm design	• some primary capability • no secondary capability	Zephyr North; Vestas American	• limited — possibly in concert with micro-scale model development • requirement: skilled computer modelling technicians
6. Synthesis	• some primary capability • some secondary capability	Zephyr North; York U; U of Guelph	• opportunities for centre of excellence/hub/teaching — higher level (MSc, PhD) skills opportunities

Specific Issues

Capability	Federal Capabilities/Resources/ Services	Provincial Capabilities/Resources/ Services
1. Analysis of historical data.	• MSC has most of the data • no capabilities	• limited — OME has some air quality monitoring stations but data quality is questionable and availability is unknown • (old) Ontario Hydro has some monitoring stations - limited data, quality, no longer available (due to deregulation) • other ministries (Natural Resources, Agriculture) have some monitoring/data but quality is questionable
2. Field monitoring	• no capabilities	• some capabilities in various ministries — data quality is always an issue • no easily accessible data archive
3. Micro-scale computer modelling	• no capabilities • NTS maps — many available digitally (costly)	• no capabilities • Ontario Base Map system — many available digitally (costly)
4. Meso-scale computer modelling	• MSC - significant capabilities in modelling but not specifically directed to WRA — ongoing project towards this goal	• no capabilities • Ontario Base Map system — many available digitally (costly)
5. Wind farm design	• no capabilities • NTS maps — many available digitally	• no capabilities • Ontario Base Map system — many available digitally (costly)
6. Synthesis	• no capabilities • NTS maps — many available digitally	• no capabilities • Ontario Base Map system — many available digitally (costly)

8.2 RECOMMENDATIONS FOR WIND MONITORING REFERENCE STATIONS IN ONTARIO

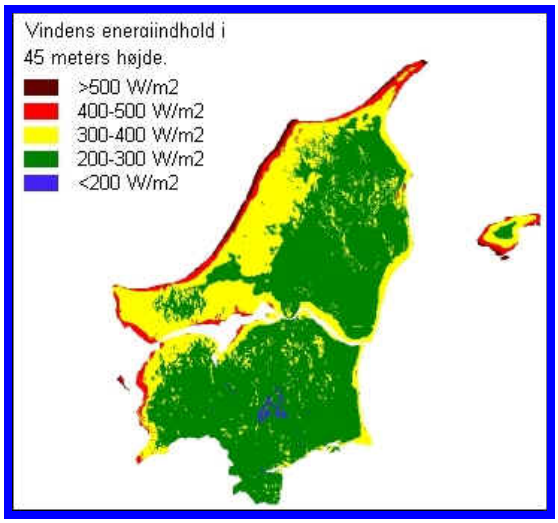
It is likely that there are a number of "wind regions" in the province of Ontario, each with its own particular characteristics. There would be significant benefit derived from the installation of dedicated, high-quality wind monitoring instrumentation located 100 m or higher above the ground, supplying near real-time data that could be used as a reference for Government and any member of the public. As well, the data from these locations would undoubtedly find far wider application than wind resource assessment (e.g., pollutant dispersion calculations, forecast meteorology, winter storm warnings, etc.). The WPTF proposes that these stations be established in the following regions:

- Central Lake Huron eastern shore
- Central Lake Erie northern shore
- Central Lake Ontario northern shore
- Ontario Highlands
- Eastern Lake Superior Northern Shore

A monitoring program could be initiated immediately at these five locations and would provide valuable winter season data for the 2001-2002 season in anticipation of the opening of Ontario's electricity market to full competition in the spring of 2002. By late 2002, a full year of data would have been collected in anticipation of the spring/summer/fall 2003 turbine installation season. It is proposed that the monitoring stations remain in operation for a minimum of 3 full years. This period allows the calculation of meaningful statistics at each of the sites. However a longer operation of these reference sites would continue to provide wind developers with a data resource unique to Ontario.

(See Section 2.2.2. — Recommendation #6a.)

8.3 DANISH WIND MAP AND RESOURCING



The *Wind Resource Map for Denmark* contains GIS data on countrywide wind resources in Denmark at a level of detail which permits its use in site-specific wind project planning. The map is downloadable from the web site of EMD Denmark at: www.emd.dk

The main sections of the web site are in English. However, the data specifications for the *Wind Resource Map for Denmark* are in Danish at the EMD web site.

EMD Denmark (Energi-og Miljodata) is a private company which specializes in software and other information products for energy projects planning and design, including wind energy development.

Per Nielsen, Manager and Head of the Wind Department at EMD Denmark, worked on development of the *Wind Resource Map for Denmark*. He may be contacted by e-mail at pn@emd.dk or by phone at: 011-45-9635-4444 (or 4450).

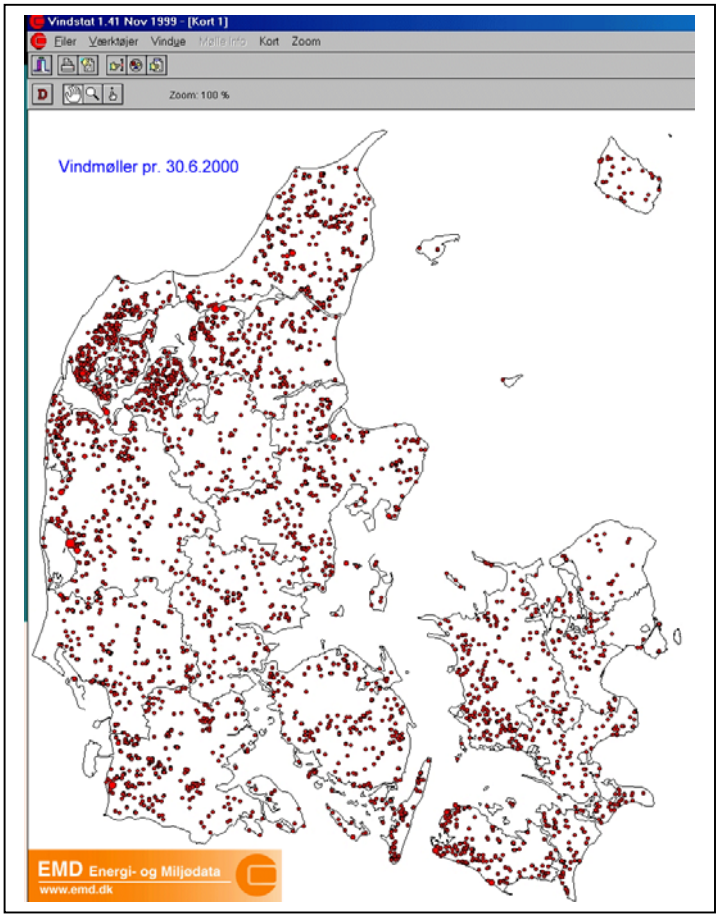
The total budget for development of the map was close to 2 million Danish Kroner, or about $343,200 Canadian (based on July 5/01 *Toronto Star* foreign exchange rate of 1 Danish Kroner = $0.1716 Canadian).

The map was a joint project conducted by the Danish National Research Laboratory and EMD Denmark. The total project budget was split in half between the two organizations. The Danish National Research Laboratory was responsible for collecting the wind resource data, including Meso-scale mapping. EMD Denmark compiled the terrain data, including roughness. It took 1.5 years to gather the information required for the map.

Per Nielsen of EMD Denmark noted that the wind resource data collected by the Danish National Research Laboratory was not of satisfactory quality for the following reasons:

- It failed to replicate data produced from existing wind turbines in the country.
- The data was based on 10 m measurement towers only; higher towers would have been more accurate.

Consequently, EMD Denmark decided not to use the Danish National Research Laboratory wind data for the map. Instead, they used data from the many wind turbines already operating in Denmark.



Because of the availability of this data, the overall cost of the *Wind Resource Map for Denmark* was significantly lower than it would be for the Province of Ontario or Canada as a whole, both of which have a much greater land mass than Denmark and far fewer existing wind test towers and wind turbines.

Denmark has a total area of 43,094 km^2 (including the island of Bornholm in the Baltic Sea and the rest of metropolitan Denmark, but excluding the Faeroe Islands and Greenland). Ontario has a total area of 1,070,000 km^2.

Per Nielsen also offered the following information:

- In his view, good wind resource mapping requires at least 2 years of measurements for all wind data. He recommends using Meso-scale mapping to obtain a general sense of desirable regions for possible wind energy development, followed by more specific data collection, including height contour lines.

- He noted that the U.S. Geographical Survey recently completed aerial data collection for height contour lines worldwide. This information would be helpful if Ontario or Canada were to embark on development of a detailed wind resource atlas.

The international height contour lines data from the U.S. Geographical Survey to which Per referred is an update of the Surveys GTOPO30 DEM (Digital Elevation Model) data base. The new version should be available by the end of the summer or early fall of 2001. It will be free for File Transfer Protocol (FTP) download from the USGS web site at: http://edcdaac.usgs.gov/gtopo30/gtopo30.html

Alternatively, the data may be purchased on CD-ROM at $10 per CD or $50 for all 5 CDs for the complete worldwide data set of height contour lines.

The existing GTOPO30 DEM (completed in late 1996) is a global digital elevation data set covering the full extent of latitude from 90 degrees south to 90 degrees north, and the full extent of longitude from 180 degrees west to 180 degrees east.

The data have a horizontal grid spacing of 30 arc seconds (approximately 1 kilometre). The vertical units represent elevation in metres above mean sea level. The elevation values range from -407 to 8,752 metres. Additional detailed specifications about the existing version of GTOPO30 DEM may be obtained from the USGS web site referenced above.

The updated version of GTOPO30 DEM is expected to have a vertical resolution around 60 metres (vertical resolution for the current version is within 70 metres). Horizontal resolution will remain the same for the updated version of GTOPO30 at 1,000 metres.

Further information on the updated GTOPO30 DEM may be obtained from:

Ms. Brandy Adams
EDC DAAC User Services, EROS Data Centre
U.S. Geographical Survey
Sioux Falls, South Dakota 57198 U.S.A.
Phone - (605) 594-6116, ext. 2008 (8 a.m. to 4 p.m. Central time zone)
Fax - (605) 594-6963 E-mail - bradams@usgs.gov

Prepared by Jill Pritchard-Scott, September 10, 2001
Ontario Ministry of Energy, Science and Technology
416-325-6711 jill.pritchard-scott@est.gov.on.ca

9.0 WIND POWER EDUCATION PAMPHLET

10.0 MANUFACTURING AND HUMAN RESOURCES REPORT

Ontario Wind Power Task Force
Subcommittee #3 Manufacturing and HRD

Potential Impact of Wind Power on Jobs in Canada
Engineering

Michael Morgenroth, Acres International - May, 2001

The wind power industry is the fastest growing power sector worldwide. This offers a significant growth market for engineering sector services. Typical services an engineering firm would provide include (ordered in the sequence of a typical project evolution):

- pre-feasibility and feasibility study including wind resource assessment
- pre-qualification of bidders, tender preparation and evaluation for generating and auxiliary equipment
- infrastructure design; e.g., electrical grid connection and road access
- shop inspection and witness testing
- tower foundation design
- construction management, field testing and commissioning
- operation & maintenance and troubleshooting

The typical percentage value for combined feasibility and engineering work is between 2% and 12%[8]. The larger number applies to smaller projects and vice versa because wind turbines are a modular technology where a wide range of capacity may be installed simply by varying the number of turbines added to an installation. A significant portion of the engineering services are site-specific rather than being related to the capital value of the equipment.

- From experience in other power engineering sectors, average revenue of about $125,000 in service fees is turned over per person-year of work.

[8] *From RETScreen pre-feasibility software tools published by Natural Resources Canada (NRCan)*

The Canadian Wind Energy Association (CanWEA) targets total installed capacity in wind energy to be 10,000 MW by the year 2010, known as the 10 by 10 goal.

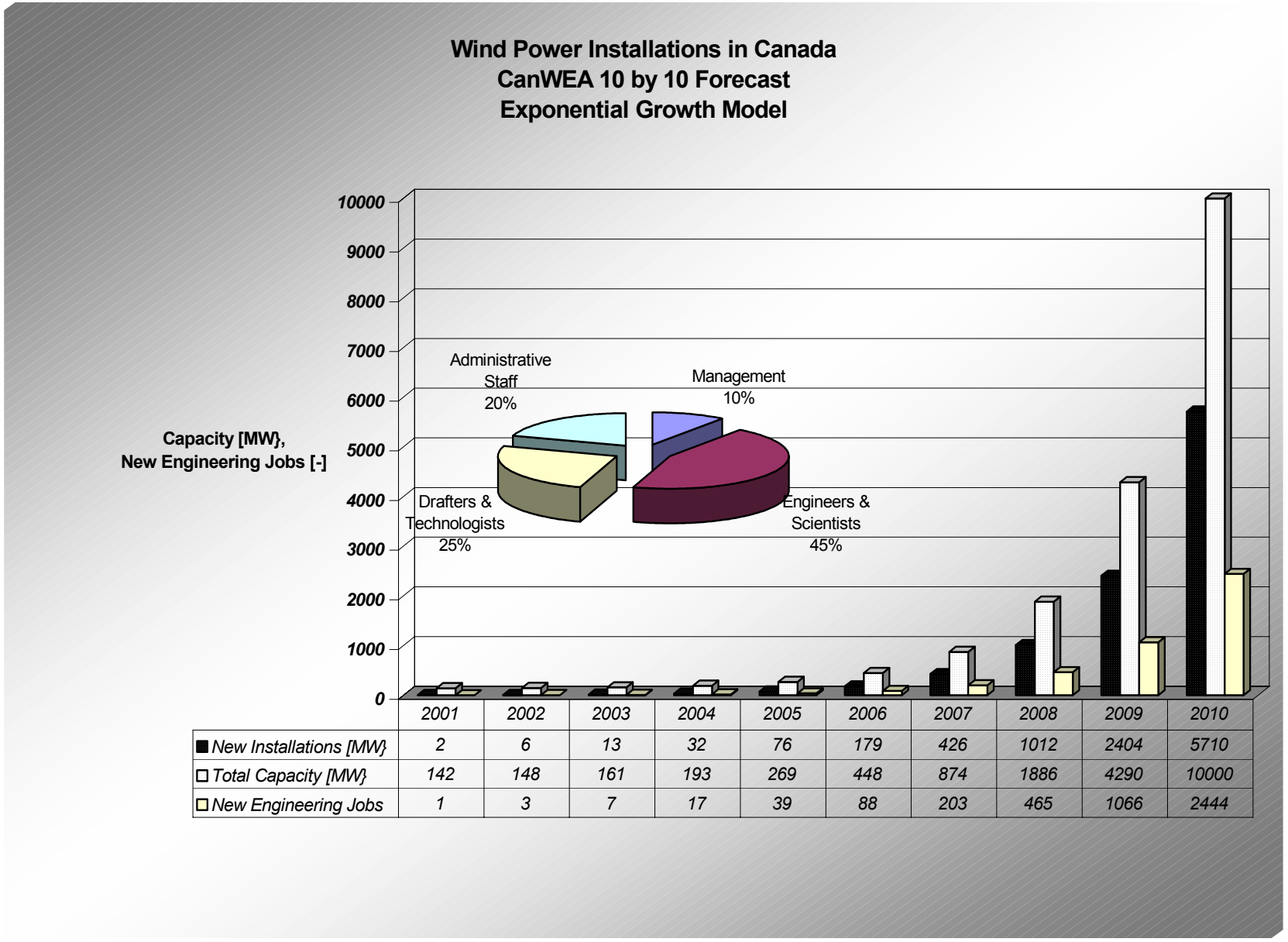
Combining this forecast and a model for the development over time, the following assumptions[9] permit an estimate of the impact on the job requirements Canada-wide.

- The total average cost of wind energy in 2000 amounts to approximately $1,500 per kW installed capacity.
- The average size of wind farms between 2000 and 2005 doubles.
- A doubling of size reduces the total cost per installed capacity by about 10%.
- Inflation of salary and therefore revenue/person/year is 2.5%.
- About 5% of project costs are consumed in engineering services outside the equipment manufacturing.

In addition to these assumptions, an exponential growth model for the time span of the 10 by 10 forecast has been used for assessing the impact on the engineering industry. It has also been assumed that the Canadian market is served by Canadian engineering firms.

Below is a graph that summarizes the potential growth of capacity and engineering employment. The composition of positions within an engineering firm is also illustrated. It is worth noting that the model starts with a 2 MW addition in 2001. In fact, over 50 MW of new capacity will be installed in Canada this year.

[9] *Supported by statements in Renewable Energy Technology Characterizations - TR-109496, Topical Report, U.S. Department of Energy and EPRI, December 1997*



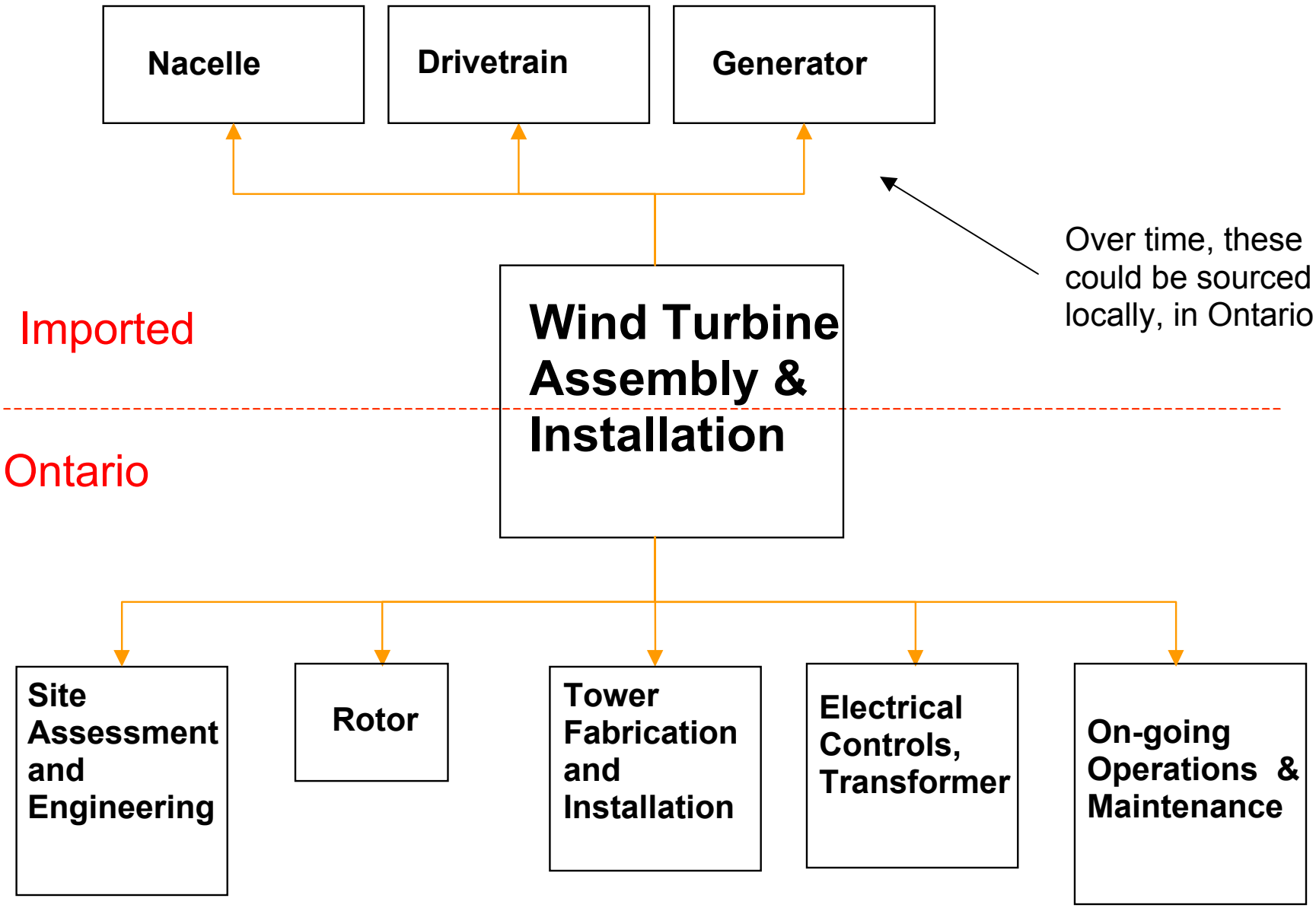
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
New Installations [MW}	2	6	13	32	76	179	426	1012	2404	5710
Total Capacity [MW}	142	148	161	193	269	448	874	1886	4290	10000
New Engineering Jobs	1	3	7	17	39	88	203	465	1066	2444

COST INPUTS FOR A 1 MW TURBINE COST ITEM	% OF TOTAL	CURRENT ONTARIO CAPABILITY ($CDN)		IMPORTED ($CDN)	
		Materials	Labour	Materials	Labour
Pre Development Engineering, Site Assessment and Land Acquisition	9	61,900	81,900		
Site Engineering and Equipment Selection and Order	5	21,900	65,700		
Blade Procurement	16	150,672	100,448		
Turbine/Generator/Nacelle Procurement	21			199,728	133,152
Tower Fabrication and Delivery	18	175,200	116,800		
Electrical Control Panels	3	26,280	17,520		
Unit Transformer	4	30,660	20,440		
Site Works including Switchyard	13	109,500	109,500		
Foundation for Tower including Reinforcing	4	43,800	29,200		
Crane Service and Turbine Erection Cost	1		14,600		
Commissioning, Warranty and Interest During Construction	6	75,550	25,550		
TOTAL	**100**	**695,462**	**581,658**	**199,728**	**133,152**

Total - all costs, imported and domestic, for 1 MW Windpark is $1,610,000.

COST ITEM	% OF TOTAL	CURRENT ONTARIO CAPABILITY ($CDN)		IMPORTED ($CDN)	
		Materials	**Labour**	**Materials**	**Labour**
Pre Development Engineering, Site Assessment and Land Acquisition	5	5,000,000	1,971,000		
Site Engineering and Equipment Selection and Order	6	1,971,000	5,913,000		
Blade Procurement	17	13,560,480	9,040,320		
Turbine/Generator/Nacelle Procurement	22			17,975,520	11,983,680
Tower Fabrication and Delivery	20	15,768,000	10,512,000		
Electrical Control Panels	2	2,365,200	1,576,800		
Unit Transformer	3	2,759,400	1,839,600		
Site Works including Switchyard	15	9,855,000	9,855,000		
Foundation for Tower including Reinforcing	5	3,942,000	2,628,000		
Crane Service and Turbine Erection Cost	1		1,314,000		
Commissioning, Warranty and Interest During Construction	4	2,899,500	2,299,500		
Sub-TOTAL	**100**	**58,120,580**	**46,949,220**	**17,975,520**	**11,983,680**
TOTAL			**105,069,800**		**29,959,200**
Total - all costs, imported and domestic, for 100 MW Windpark is $135,029,000.					

Note: 77% of project is sourced in Ontario
100% of Operations and Maintenance can be sourced in Ontario
Costs are reduced by 10% for projects 10MW or greater


Nacelle
Drivetrain
Generator
Over time, these could be sourced locally, in Ontario
Imported
Wind Turbine Assembly & Installation
Ontario
Site Assessment and Engineering
Rotor
Tower Fabrication and Installation
Electrical Controls, Transformer
On-going Operations & Maintenance

11.0 PARTICIPANT LIST AND REPORT CONTACT INFORMATION

Attached is a detailed contact list of the WPTF committee members and others who participated in this effort.

12.0 ABBREVIATION INDEX

ABB	Asea Brown Boveri
AWEA	American Wind Energy Association
$C0_2$	Carbon Dioxide
CanWEA	Canadian Wind Energy Association
CARE Coalition	Clean Air Renewable Energy Coalition
DRC	Debt Reduction Charge
EA	Environmental Assessment
ECP	Environmental Choice Program
GWh	Gigawatt Hours
HRD	Human Resource Development
IMO	Independent Electricity Market Operator
IPPSO	Independent Power Producers Society of Ontario
Kt	Kilotonne
kWh	Kilowatt Hour
LDC	Local Distribution Centres
MEDT	Ministry of Economic Development and Trade
MEST	Ministry of Energy, Science and Technology
MNDM	Ministry of Northern Development and Mines
MNR	Ministry of Natural Resources
MOE	Ministry of the Environment
MOF	Ministry of Finance
MW	Megawatts
NBR	New Business Relationship
NIMBY	Not In My Back Yard
NO_x	Nitrogen oxide
NRCan	Natural Resources Canada
NWCC	National Wind Co-ordinating Committee
O&M	Operations and Maintenance
OEB	Ontario Energy Board
OMAFRA	Ministry of Agriculture and Food and Rural Affairs
OPG	Ontario Power Generation
OWA	Ontario Waterpower Association
PTC	Federal Production Tax Credit
RECs	Renewable Energy Credits
RPS	Renewables Portfolio Standard
$S0_2$	Sulphur Dioxide
SSS	Standard Supply Service
TWh	Terawatt Hour
USGS	United States Geological Survey
UWIG	Utility Wind Industry Group
WPTF	Wind Power Task Force
WRA	Wind Resource Assessment

13.0 CANWEA 10 X 10

Attached is the publication from CanWEA that outlines the proposed goal for wind energy in Canada by the year 2010.