An Overview of Renewable Energy in Ontario

Prepared for

Lawrence National Centre for Policy Management
at the Richard Ivey School of Business

London, Ontario

Authors:

Ryan G. Little, MBA, partner, StormFisher
Bas C. van Berkel, MSc, MBA, partner, StormFisher

Revised Version
December 2006

Table of Contents

1. Introduction

This paper was prepared as a background document for the *Building Paths to a Low-Carbon Society Workshop Series* held at the Richard Ivey School of Business, Lawrence National Centre for Policy Management, on October 22-24, 2006. It was updated December 12, 2006 to reflect the unveiling of Ontario's Standard Offer Program for renewable energy (p. 8).

The purpose of this paper is to provide an overview of the renewable energy landscape in Ontario. It puts renewable energy into context as part of the province's energy supply mix both today and through the next twenty years, and identifies trends, incentives, and challenges that affect the development of new projects. A comprehensive analysis of each of these issues warrants far more than can be provided in a document that has been intentionally kept to a readable length. As a background document, this paper does not purport to make recommendations for changes to policy. Rather, it aims to provide conference participants and other readers with sufficient knowledge of the current situation and key issues related to renewable energy in Ontario to facilitate a discussion that will lead to new insights that will shape policy.

2. Renewable Energy in Ontario: The Picture Today

With the province of Ontario in need of new energy infrastructure, commercial development of clean energy technologies, and public demand for cleaner energy solutions, renewable energy has become a focal policy issue for the province. With its abundance of natural resources, Ontario has an opportunity to include energy from renewables as a substantial part of its supply mix.

The Players: A Snapshot

The energy industry in Ontario is administered by a number of different parties. The Ministry of Energy is the overarching body which is responsible for setting the province's energy policy. The Ontario Energy Board (OEB) is the province's regulator for the energy industry, and often consults with a wide variety of stakeholders through public hearings. It advises the Ministry of Energy on regulatory matters and reports to the legislature through the Ministry. The Ontario Power Authority (OPA) is the group that has been tasked with planning the province's energy system for the next twenty years. Following the approval of its plan by the Ministry of Energy, it will play a major role in the plan's implementation.

Several other government organizations are involved in the province's energy industry. The Independent Electricity System Operator (IESO) ensures that electricity is matched with demand throughout the grid; it is the 'traffic cop' of Ontario's electricity system. Ontario Power Generation (OPG) is by far the largest power generator in Ontario with over 22,000 MW of installed capacity. Now a corporation owned by the province of Ontario, it was a public utility until

1999, operating as Ontario Hydro. The Ministry of Natural Resources plays a role in assisting the province and developers to use government land and waterways for energy generation projects without unnecessarily causing harm to the province's environment. The Ministry of the Environment is responsible for enforcement, ensuring that renewable energy developments are operating within legal and permitted parameters. Finally, and importantly, the province's many Local Distribution Companies (LDCs) are the retailers of most of the energy produced in the province.

What is Renewable Energy?

While language varies from source to source, most definitions of renewable energy adhere to the same basic principles, namely that:

- The source of energy generates electricity from existing flows of energy (e.g. wind, moving water) or ongoing natural processes (e.g. gasification of biological compounds);

- The source of energy can be replaced at the same rate at which it is used, if not faster; and,

- Inputs for the energy are: water, wind, geothermal, biomass, biogas, bio-fuels, landfill gas, hydrogen, solar, geothermal and thermal waste.

The degree to which each of these sources of energy is 'green' is a matter of greater contention. For example, while small run-of-river (i.e. no, or low-impact reservoir) hydroelectric projects are commonly viewed as sources of green renewable energy, hydroelectric projects that involve large dams, and therefore the flooding of their environs to create a reservoir, fit the definition of renewable but are generally not considered environmentally-friendly.

Renewable Energy Potential in Ontario

Renewable energy in Ontario is garnering a large amount of attention from energy developers and their financiers today. This is because the province has a natural resources regime conducive to the development of renewable energy, and because the Ministry of Energy has made renewable energy a priority for the province as its supply mix changes. A June 13, 2006 Ministry of Energy directive to the Ontario Power Authority (OPA) instructed the OPA to recommend an optimal supply mix for the province's energy needs. The directive included a provision that the new supply mix propose prominent roles for renewable energy and conservation. The OPA responded with a recommendation to the province to increase the supply of renewable energy by 3,000 MW by 2015, 5,000 MW by 2020, up to a total of 14,700 MW by 2025.[1]

[1] OPA: *Power System Planning: Supply Mix Advice and Recommendations, December 9, 2005*

The implementation trajectory of this target was accelerated in the OPA's follow-up document, *Integrated Power Supply Plan (IPSP): Scope and Overview*[2], and its production target increased by 1,000 MW (Figure 1).

The IPSP, which is expected in its final form in early 2007, will constitute the province's first comprehensive power system plan in 15 years. It will spell out the province's energy policy and supply mix for the next twenty years, and will be reviewed and revised every three years as circumstances change.[3] Figure 2 shows the current supply mix, and the supply mix target for 2025. Once approved, this plan will effectively mark the transition of capacity planning and demand management from the OEB to the OPA.

The David Suzuki Foundation identified a total of 7,413 MW minimum technical potential for new renewable projects in Ontario, as of 2004 (Figure 3).[4] As more government incentives become available and, importantly, as the cost per kWh of renewable energy becomes less expensive, the goal of reaching the target of 15,700 MW of installed capacity by 2025—which is approximately twice the available capacity that was identified as viable in 2004—may be possible. For a resource like wind, which has a relatively constant speed across the province with a few notable exceptions, the possibility exists for a technological innovation that decreases production costs or a production price incentive to radically increase the viability of wind as an energy resource. At the time of writing, Ontario had an installed capacity of 413 MW from wind.[5] There is 8,150 MW of total installed hydro capacity in Ontario, however most of this capacity is large-scale, and therefore not generally considered renewable energy. While no reliable numbers for installed capacity of hydro under 10 MW could be found, the number of facilities under 10 MW is 55% but represents less than 20% of generating capacity.[6]. The OPA has used the 2005 number for aggregate installed hydro, 7,768 MW, in its figures for current installed renewable capacity.[7] As such, the majority of the installed capacity the OPA reports consists of hydro greater than 10 MW. Consistent figures for many of the less-prevalent forms of renewable energy in Ontario, such as solar, biogas and biomass are generally not available, except as figures denoting their future potential.

3. The Drive Towards Renewable Energy

Several factors are behind Ontario's commitment to substantially raise the proportion of renewable energy content in the province's supply mix.[8] These include an ageing infrastructure in need of replacement or refurbishment,

[2] OPA: *IPSP, Scope and Overview, June 29, 2006*

[3] ibid.

[4] David Suzuki Foundation: *Green Power Opportunities For Ontario, 2002*

[5] Canadian Wind Energy Association

[6] Ontario Waterpower Association

[7] OPA: *IPSP, Supply Resources, November 9, 2006*

[8] OPA: *IPSP, Scope and Overview, June 29, 2006*

recognition of the real costs of conventional power supplies, as well as a convergence of environmental, technological and economic developments. Following are some of these factors:

The province's energy infrastructure is ageing. Over the next 15 years Ontario has to refurbish or replace nearly 25,000 MW of generating capacity. This amount represents about 80% of the province's installed capacity, and the cost is anticipated to total between $15-$20 billion.[9] In the face of such a major undertaking, the province has an opportunity to fundamentally change the nature of its energy generation sources. It did so, by announcing the complete elimination of coal-powered generation from the province at the earliest possible timeframe.[10] No firm date has been adhered to, although the IPSP accounts for zero coal-powered generation in its supply mix targets for 2025.

Conventional sources of energy have hidden costs. Several sources of conventional energy, including coal, incur substantial public costs in their usage which are only now becoming understood. Damage to natural resources as a consequence of pollution, the health effects of poor air and water quality on human beings—especially those working in the mining industry–and the contribution to global warming through the creation of greenhouse gases are all real public costs that are not factored into the price of these energy sources. The International Institute of Sustainable Development puts the hidden public health costs of one kWh of natural gas at 0.01 cents and at 1.7 cents per kWh of coal-based generation.[11]

Decentralized energy distributes loads. Most renewable energy production is decentralized since its sources are often pockets of land or water scattered across the province. Ideally, this means that renewable energy project development can be optimized to be built near load centres, thereby minimizing the distance electricity needs to travel along transmission lines. Such a situation is extremely beneficial as the province's transmission grid is currently under strain since there have been no significant additions to the long distance transmission system since the 1980s while loads have increased year over year.[12] Moreover, when energy production and energy consumption can be more closely matched from a geographic standpoint, energy losses resulting from the transmission over long distances can be reduced. In practice, however, the distributed nature of renewable energy is as much a challenge to the province's power system as it is a benefit. The fact is that high wind regimes and sites with substantial hydroelectric potential have no correlation to load centres, and so the need to rely on long distance transmission is inescapable**.**

9 Ministry of Energy: *Notes to speech of Minister Donna Cansfield, December 1, 2005*
10 Ministry of Energy: *Press Release, McGuinty Government Delivers A Balanced Plan For Ontario's Electricity Future, June 13, 2006*
11 Venema, Henry David and Barg, Stephan: *The Full Costs of Thermal Power Production in Eastern Canada. International Institute of Sustainable Development, Winnipeg, July 2003*
12 OPA: *IPSP, Scope and Overview, June 29, 2006*

Incremental development is cost efficient. Projecting the province's future energy demand has historically been a challenge. The Pembina Institute, in its response to the OPA's proposed supply mix, notes that the OPA's current estimate for annual electricity growth of 0.9% is double the actual growth in electricity demand in Ontario from 1990 to 2003, and that the rate of electricity growth has been in decline since the 1950s.[13] Pembina attributes Ontario's shift from a manufacturing economy to a services economy as the primary contributor to this phenomenon.[14] Should future demand estimates be equally as difficult to forecast, the development of small renewable projects, which can typically be commissioned in timeframes of one to five years, to meet incremental demand is a more cost-effective strategy than undertaking large conventional energy developments with extended commissioning timeframes.

Renewable energy is a natural hedge against fuel prices. As sources of renewable energy like wind, water and solar use inputs that are abundant and free, the price of renewable energy is not exposed to the same kind of political and economic risks to which natural gas and uranium, for example, are subject. The prices of both uranium and natural gas have fluctuated significantly in the past five years (Figures 4 & 5). Renewable energy therefore provides a hedge to a supply mix that contains conventional sources of energy that are exposed to these risks.

Renewable energy creates jobs. According to a study by the California Public Interest Research Group, renewable electricity generates four times as many jobs per megawatt of installed capacity as natural gas.[15] In Germany, the wind power industry has already generated 45,000 jobs. The David Suzuki Foundation estimates that, if the province were to install 12,000 MW of renewable energy by 2020—which is approximately consistent with the OPA's targets—Ontario will have created 77,000 jobs.[16]

4. Programs for New Renewable Energy Generation in Ontario

As renewable energy has evolved from a niche market to a part of any economy's energy supply mix, incentives have typically been provided to encourage new developers to enter the market, and to assure these developers and their financiers that the development of renewable energy projects will be economically viable in the long term. These incentives generally take one of two forms:

---

[13] Pembina Institute: *The Ontario Power Authority Supply mix report; a review and response, February 2006*

[14] ibid.

15 The Apollo Alliance: *For Good Jobs and Energy Independence. The Apollo job reports, January 2004*

16 David Suzuki Foundation: Press Release: Renewable energy will create thousands of jobs and add billions to Ontario economy, October 20, 2004

- **Fixed Price Systems**. The government sets electricity prices or price premiums paid to the producer, and demand is determined by the market. The four principal varieties of this incentive are investment subsidies, fixed feed-in tariffs, fixed premium systems and tax credits.[17] The Standard Offer Program, which will be elaborated upon in this section, is an example of a feed-in-tariff as the province has fixed the price per kWh of generated energy it will pay.

- **Renewable Quota Systems**. The government determines the quantity of renewable energy in the supply mix and lets the market determine the price. This system is in place in some states in the USA, as well as in the UK, Sweden, Belgium and Italy.[18]

To compare the attractiveness, from a developer's standpoint, of the renewable energy environments from country to country, or even jurisdiction to jurisdiction, is an extremely complex exercise given the large number of variables beyond just price paid per kWh of energy. Key factors that vary widely across geographical and political boundaries include availability and accessibility of natural resources, particularly when the project's fuel is wind, water or the sun; length of permitting and regulatory processes, as well as the number of agencies involved; availability and types of tax incentives; grid connection and transmission costs; degree of local awareness and support for projects; and availability of financing, to name a few. Each of these factors plays an integral role in determining the economic value of a project and can be difficult to assess for comparative purposes until a project actually enters the feasibility, or even development phase.

The Standard Offer Program (Provincial). The most prominent program in place today in Ontario in support of new renewable energy development is the Standard Offer Program.[19] Announced on March 21, 2006 and implemented on November 22, 2006, the Standard Offer Program is North America's first feed-in tariff, also known as Advanced Renewable Tariffs and European feed laws.[20] The province pays generators of renewable energy a base of $0.11 per kWh with an on-peak premium of $0.0352 to providers who can produce energy at peak hours at least 80% of the time. Solar photovoltaic (PV) is the sole exception to the base rate, as developers are paid $0.42 per kWh for energy produced from this source. Table 1 shows base prices and on-peak premium eligibility of various sources of renewable energy.

The program was developed with input from a number of stakeholders, including municipalities, First Nations, developers, NGOs (and especially the Ontario

[17] European Wind Force Association: *Windforce Report 2005, 2005*

[18] ibid.

[19] P. Gipe, B. Chabot: *North America's First Electricity Feed Law; Standard Offer Contracts in Ontario, Canada, DEWI Magazine Nr. 29, August 2006*

[20] ibid.

Sustainable Energy Association),[21] financiers and interested members of the public. The program rules spell out a number of salient features of the program:

- **10 MW or less**. While there is no maximum number of projects any one party can undertake as part of the program, each project (defined as having its own separate connection to the electricity grid) must not be capable of producing more than 10 MW if it were running at full capacity. This proviso was included to stimulate new growth in Ontario's renewable energy industry by 'leveling the playing field' so new and small companies, as well as some landowners, can enter the market. The program was designed to minimize the cost, complexity and administrative burden faced by small developers.[22]

- **No cap**. There is no stated maximum number of electricity the province will buy and developers may propose as many projects as they like.

- **20 Years**. The contract is guaranteed for 20 years with an increase in the base rate per kWh (but not the on-peak incentive, and not for the base rate for solar projects) of 20% of the Consumer Price Index (CPI) per year, to adjust for increased operation and maintenance costs.

- **Within Three Years**. Except for waterpower projects, which have a longer development cycle, all projects must be commissioned within three years of signing of the Power Purchase Agreement (PPA).

- **Assignation of Related Products**. Any related products, such as green certificates that may accrue as a result of renewable energy production, become the property of the province.

Prior to the unveiling of the Standard Offer Program, the province solicited renewable energy projects primarily through two consecutive programs:

- **"Renewables I" RFP** procured 395 MW of wind, small hydro and landfill gas, 216 MW of which was in commercial operation as of mid-summer, 2006;

- **"Renewables II"RFP** procured 975 MW, mostly wind energy, the majority of which is to be connected between mid-2007 and late 2008.[23]

The OPA is requesting proposals for new renewable generation totaling 200 MW under a "Renewables III" Program. This Program was postponed in March, 2006 and no new information is available at the time of writing.

[21] ibid.
[22] OPA: *Standard Offer Program Rules, Draft Rules, September 2006*
[23] OPA: *IPSP, Scope and Overview, June 29, 2006*

In addition to the Standard Offer Program and the OPA RFPs, a number of programs are available through the provincial and federal governments to provide a variety of incentives to developers of renewable energy projects and energy technology developers. These programs are:

Innovation Demonstration Fund (Provincial). A program of the Ministry of Research and Innovation, the IDF provides up to 50% to a limit of $4 million to fund the development from concept to commercialization of best-of-class technologies. Preference is given to bio-based, environmental and alternative energy projects, although the program does fund projects not related to these fields.[24]

Research Excellence Program (Provincial). Supported by the Ministry of Research and Innovation, the ORF-RE program funds research activities undertaken on behalf of colleges and universities, hospitals, and NGOs and gives priority to certain sectors, including environmental technologies and conservation and renewable energy technologies.[25]

Ontario Centre of Excellence (OCE) in Energy (Provincial). Another program of the Ministry of Research and Innovation, the OCE Centre for Energy was founded in January, 2005 and focuses on helping to bring emerging energy technologies to market by supporting initiatives with venture capital funding, business planning and a variety of other services. The Centre had funded 27 energy-related projects at the time of writing.

CANMET Energy Technology Centres (Federal). A division of Natural Resources Canada, three centres in Alberta, Ontario and Quebec operate with a mandate to develop and implement technologies in the areas of energy efficiency, renewable energy and alternative energy. Examples of funding programs include:

- **Bioenergy Development Program**. CANMET will share R&D costs related to development of biomass energy projects and will participate in potential projects by supporting feasibility studies, process analysis, modeling and information dissemination, to name a few. CANMET, at its discretion, secures royalties from revenue-generating projects.[26]

- **Emerging Technologies Program.** ETP will fund up to 50% of costs incurred by businesses to improve energy efficiency. The program has funded the pulp and paper, iron and steel, cement, oil and gas, and food and beverage sectors to-date, although all industrial sectors are eligible.[27]

---

24 Ministry of Research and Innovation*: Innovation Demonstration Fund (IDF) Program Guidelines. March 2, 2006*
25 Ministry of Research and Innovation: *Research excellence Program, March 2, 2006*
26 Natural Resources Canada: *Bio-Energy Development Program, January 18, 2006*
27 Natural Resources Canada: Emerging Technologies Program, CETC, January 20, 2006

Canadian Renewable and Conservation Expenses (CRCE) Allowance (Federal). CRCE allows for the deduction of 100% of intangible costs related to the development of renewable energy projects. These costs include feasibility studies, resource audits and environmental assessments. Moreover, the allowance allows for accelerated depreciation—up to 30% per year—of certain generation equipment (that qualify as Class 43.1 under the Income Tax Act).[28]

Corporate Income Tax Write-off and Capital Tax Emption (Provincial). Assets used to generate renewable energy are subject to a 100% corporate income tax write-off and capital tax exemption. Applicable to assets acquired before January 1, 2008.[29]

Gross Revenue Charge (GRC) – Waterpower (Provincial). Effective January 1, 2001, waterpower facilities are no longer assessed property taxes or water rental fees. Instead, waterpower facilities are taxed at a rate of 9.5% of gross revenue.[30]

Emissions Reduction Trading (Provincial). This program establishes Ontario as a participant in the emerging 'green credit' market, whereby generators of renewable energy earn credits that have cash value and can be bought and sold in a manner similar to stock and bonds. As part of this program, new producers of renewable energy (except participants of the Standard Offer Program) can access credits based on the amount of energy they have displaced from coal or oil-generated sources. Trading of credits can currently take place between Ontario and the twelve American states whose power production affects Ontario's air the most.[31]

Government Purchase of Electricity from Renewable Resources (PERR) (Federal). In 2000 and 2001, the government of Canada, through Natural Resources Canada, signed ten-year contracts to purchase 32,000 MW hours and 13,000 MW hours respectively to provide electricity from renewable sources for government usage. The government anticipates purchasing an additional 40,000 MW hours of renewable energy through this program.[32]

Net Metering (Provincial). Although not targeted at developers of renewable energy projects, the net metering program is a step forward for the decentralization of energy production in the province. Through net metering, businesses and households can install capacity of up to 500 kW to generate their

---

[28] Ontario Ministry of Energy: *Renewable Energy Development Ontario (REDO) , 2006*

29 Ontario Government: *http://www.e-laws.gov.on.ca/DBLaws/Source/Regs/English/2003/R03283_e.htm, July 26, 2003*

[30] Ministry of Finance: *Gross Revenue Charge, August 20, 2006*

31 Ministry of the Environment: *Ontario's Emissions Trading Registration Introduction, August 28, 2006*

[32] Natural Resources Canada: *Government Purchase of Electricity from Renewable Resources September 27, 2006*

own power through renewable resources, and use power generated as credits against electricity bills. To take part in the net metering program, a participant must purchase one of two types of meters, depending on amount of capacity installed, capable of measuring both the inflows and outflows of power. The participant's credit for energy produced is reflected in his/her electricity bill, and in the event that more power was generated than was used in a given month, the credit is applied against future months.

5. Development of Renewable Energy Projects in Ontario

There is a myriad of different stakeholders who all have an interest in seeing new renewable energy projects come online in Ontario. Renewable energy represents a public good and an integral part of the present and future energy supply mix to the federal and provincial governments; a means of securing a local and reliable supply source for municipalities and remote communities; a path to a greener and healthier Canada for environmental and health NGOs; and new economic opportunities for developers, financiers, landowners and First Nations communities. These diverse parties have created a large base of shared knowledge through industry and community associations to facilitate the process of new development. These organizations are compiled in Appendix B.

This base of knowledge includes an array of pre-feasibility assessment tools developed both by government and industry associations. Two outstanding examples are:

> **Ontario Wind Atlas** – www.ontariowindatlas.ca. A program of the Ministry of Natural Resources, the Ontario Wind Atlas details the wind speed and power density at five heights ranging from 10 to 100 metres at a resolution of one square kilometre. The parts of the province shaded green have the lowest average wind speeds at around five metres per second, while areas shaded red and purple have the highest average wind speeds, at over eight metres per second. The Atlas exists to provide developers with an overview of wind regimes across the province and to aid in the selection of potential sites for feasibility testing.
>
> **RETScreen** – www.retscreen.net. A package of software, user manuals and potential sites for renewable energy development, RETScreen is a powerful pre-feasibility project modeling tool. Using real data from Natural Resources Canada, potential developers can assess the financial viability of renewable energy projects across the country. The software contains a financial model that prompts the developer to enter a number of variables related to a potential site from which it calculates the costs, return on investment, and other important financial metrics. The software can be used for multiple types of renewable energy projects.

A wind farm developer, for example, would begin by using the Ontario Wind Atlas to assess which areas of the province have a wind regime most conducive to

wind power generation. Once an area is identified, the developer may visit the region and offer to pay landowners to erect wind measuring devices on their property and secure the right to develop a wind farm if the results are favourable. This stage is called 'optioning'. For all projects greater than 2 MW, a provincial Enivronmental Assessment (EA) is required, and this process takes place during the optioning phase. The EA is typically carried out in conjunction with a professional consulting firm and will anticipate a project's impact on wildlife, hydrology, agriculture, archaeology & culture, community, and visual and audible impact. As Ontario's power transmission system is constrained, new projects of a commercial scale are subject to connection impact assessments as well. At the time of writing, one part of Ontario—Grey Bruce region—is not accepting any new generation (other than farm-based projects under 250 kW) because the grid is at full capacity. Following the completion of these reports, and if the results are favourable, the developer will secure a Power Purchase Agreement (PPA) from the OPA. The PPA is the lynchpin of the Standard Offer Program (see section 4) and guarantees the purchase of energy for 20 years.

Once a PPA is executed, the developer can raise project financing. Many renewable energy projects are heavily debt-financed—typically around 80%—since they are asset-based projects. In Ontario, a small number of financing firms specialize in energy project financing and are increasingly focusing on the renewables segment.

With the permitting and consultation process complete, a PPA signed and financing secured, the project is ready to be built. In the case of a wind farm, often the turbine manufacturer will manage the installation of the turbines as part of a 'turnkey' package. The actual construction of a small wind farm, from ground-breaking to commissioning, may take no more than a few months.

The process of developing a successful renewable energy project is a matter of mitigating risk. By leveraging the base of knowledge that already exists in the context of renewable energy in Ontario, preparing and accounting for contingencies insofar as is possible from the beginning, and using proven technologies and partners, developers can materially reduce risk and financing costs. Table 2 shows a typical development pathway for a renewable energy project.

6. Challenges for Renewable Energy in Ontario

There are two overarching types of challenges that affect the development of renewable energy projects in Ontario. The first relates to the infrastructure, natural environment and attitudes of the population, and can be termed environmental challenges. The second includes all the risks borne by the developer, such as financing and construction risks, and can be termed development challenges.

Environmental Challenges

As was mentioned in Section 3, "The Drive Towards Renewable Energy," the province's electrical grid faces significant load constraints. With so many of the available sites for new renewable energy development distantly situated from major load centres, major investments will be needed in transmission infrastructure. Currently, the OPA is identifying a series of 'Restricted Sub-Zones' which will limit or prohibit the addition of incremental power from new sources until the transmission system is strengthened. Similarly, many remote sites with excellent potential resources of renewable energy are not adequately connected to the grid to facilitate transmission of power, were such sites to be developed. This poses a 'chicken-and-egg' quandary: investments in transmission should only be made if there is near certainty that remote sites will be developed, and remote sites will only be developed if there is near certainty that transmission access will be installed. Some level of coordination for these investments is being considered as part of the IPSP.[33]

Specific goals to improve Ontario's infrastructure are primarily centered on transmission issues, and include:

- Increasing transfer capacity between Thunder Bay and Sault Ste. Marie or Sudbury so that energy produced by renewable sources in Northwestern Ontario can be connected to the grid in the Northeast.

- Ameliorating the transmission system north of Sudbury to facilitate transmission from new hydro sites from rivers that flow into James Bay.

- Ensuring that new wind power from the Bruce region can be reliably transferred to the GTA and the Golden Horseshoe.

- Reinforcing transmission east of the GTA to facilitate the transfer of new renewable energy.[34]

Many renewable energy projects have an impact on their surroundings. As wind energy gains purchase in Ontario, for example, the notion of what constitutes a stakeholder is evolving. Whereas development agreements have typically been between landowners and developers, new models that more fully account for externalities such as 'turbine envy' are now emerging. For example, a pooled landowner land lease provides compensation to neighbouring properties that have no turbines but nevertheless are affected by the development since it affects their landscape and potentially negates their own potential as wind farm sites.[35] Similar solutions are being sought for small waterpower developments, which may affect multiple First Nations communities, for example, downstream of the development.

[33] OPA: *IPSP, Scope and Overview*, June 29, 2006

[34] ibid.

[35] Gipe, Paul and James Murphy*: Ontario Landowner's Guide to Wind Energy. OSEA, 2005*

A more familiar environmental concern for developers is the 'Not In My Back Yard' ('NIMBY') phenomenon, where local residents take exception to potentially unappealing new developments. In the case of renewable energy in Ontario, the NIMBY factor has been largely focused on wind farms, with residents concerned about disruption to line of sight, strobe effects from blades, light pollution from turbine warning lights, noise and bird mortality.[36] Developers can mitigate NIMBY issues by involving community groups in the consultation process early on, and by making a material positive impact locally, such as by contributing a fraction of revenues to the community. It is often not the fact that a renewable energy project is to be built nearby that upsets residents, but rather the inability of the community to have a say in the process. That said, anecdotal evidence suggests that the NIMBY factor is getting worse in Ontario, and a number of wind energy projects are, at the time of writing, delayed for this reason.

One challenge that is often cited by industry professionals and observers in Ontario is the difficulty navigating the regulatory and permitting regime. One small hydro expert spoke of the difficulty in securing water rights from the Ministry of Natural Resources (MNR). Although the MNR is actively promoting the use of crown land to generate energy from wind and water, this small hydro expert remarked that there is a large degree of variance in MNR processes as they relate to the required environmental assessments, permits, and so forth, and that the developer is often faced with additional, unforeseen reporting and permitting requirements mid-development. The expert noted that the MNR, despite its mandate to assist in the development of renewable energy projects, is not properly aligned with the push to roll out new projects. It was this expert's view that the MNR has more to lose from a project that does not turn out well than it does to gain from a project that is successful. This is but one of many examples of anecdotal regulatory challenges the authors heard from a variety of industry participants. It could be argued that the province's natural resources are of more importance than the success of any one renewable energy project, and such an argument certainly does have merit. However, with multiple government agencies involved in renewable energy development, each with differing priorities, the complexity of creating a successful project is increased substantially.

Development Challenges

The report *Best Practices Guide: Economic & Financial Evaluation of Renewable Energy Projects*, prepared by an American NGO-government partnership,[37] identified a number of challenges specific to developers of renewable energy. These challenges include:

[36] ibid.

[37] Owens, Gene*: Best Practices Guide: Economic & Financial Evaluation of Renewable Energy Projects, USAID/Office of Energy, Environment and Technology, June 2002*

High Capital Costs. Relative to conventional sources of energy production, renewable energy projects carry very large upfront costs. These high initial costs add complexity related to financing and amortization.

High Project Development Costs. Renewable energy projects are typically small in scale, geographically dispersed, and do not have access to existing infrastructure such as connection to the grid and access roads. Moreover, renewable resources like water and wind are subject to wide variances that need to be measured, over the course of twelve months at minimum, to inform a reliable business model. Finally, because projects are generally small relative to conventional energy projects, economies of scale are not abundantly available.

Financing Difficulty. Because projects are often small in scale, seeking financing from institutions that typically fund energy projects is more difficult as institutions are, by and large, designed to fund large-scale power production facilities. Because of the lingering perception of renewable energy as a niche or emerging industry, lending institutions tend to assign higher rates of interest on debt financing than may reflect the actual risk involved to the creditor.

Difficulty Guaranteeing Cash flow. Whereas conventional power producers can accurately forecast their output due to the long-term fuel contracts they secure prior to obtaining a power purchase agreement, the 'fuel' of renewable energy projects is subject to environmental factors that can neither be predicted reliably over the long term nor controlled.

Because of all the risks involved in developing renewable energy projects, only a relatively small number of proposed projects will actually be deemed feasible. Figure 6 illustrates the filters through which a proposed project must proceed in order to determine its viability.

7. Off The Grid: Switching to Greener Fuels

A major shift towards efficiency with fuels is underway at the federal level at the time of writing, as the federal government announced a new emissions plan focused on vehicles on October 3, 2006. The plan requires auto makers to produce more fuel-efficient vehicles by 2010.

Ethanol and Biodiesel

In the last year, the provinces and the federal government have collaborated to form the basis of a strategy that would see all gasoline sold in Canada contain 5% renewable fuel by 2010.[38] The standard would see fuels like ethanol, which is derived primarily from corn in North America, from sugar cane in places like Brazil, and from other agricultural crops in other parts of the world, make up part

38 CTV: *Article on www.ctv.ca, May 23, 2006*

of the mix at gasoline pumps. At present, over 1,000 gas stations in Canada offer 'E90', a mixture of 90% gasoline and 10% ethanol.[39]

The proposed federal standard would also include biodiesel, a clean-burning, biodegradable fuel generated from animal fats, recycled cooking oils and restaurant grease, as an eligible renewable fuel. Since 2002, Ontario has provided an exemption from the 14.3 cents per litre fuel tax on the sale of biodiesel. In 2004, Canada produced only 250 million litres of biodiesel, which is a fraction of production compared with the world's two biggest biodiesel producers, namely Brazil, which accounted for 15.4 billion litres, and the United States, which produced 12.9 billion litres in the same year.[40] If the standard is implemented, Canada's level of production would likely increase to 3.1 billion litres by 2010.[41]

In 2004, Ontario had already announced a plan to mandate the inclusion of 5% ethanol to the mix of Ontario's gasoline, with that proportion rising to 10% by 2010.[42] In 2005, the ethanol industry in Ontario saw a $34 million cash inflow from the federal government, under Natural Resources Canada's Ethanol Expansion Program (EEP).[43] In the same year, the province of Ontario, through the Ministry of Agriculture, Food and Rural Affairs, announced the creation of the Ethanol Growth Fund, consisting of $520 million available in the form of capital and operating grants for producers of ethanol, gasoline distributors, and other participants of the bio-based economy.[44]

Viewpoints differ among experts as to whether ethanol helps or hinders the effort to reduce greenhouse gases. Some point out that ethanol produced in Canada, using corn and wheat, can require more energy to produce than is available for use in the finished product, while others argue the fuel can be produced using energy efficient processes and can significantly displace gasoline usage.[45]

Hydrogen Fuel Cells

In the context of transportation, the hydrogen fuel cell is a clean substitute for the internal combustion engine that emits only water and oxygen as byproducts.

Although hydrogen fuel cells have many applications, much of the business focus has been on the replacement of the internal combustion engine in vehicles. The

39 David Suzuki Foundation: *News For Change, the nature challenge newsletter, January, 2006*

40 Canadian Renewable Fuels Association: *How Canada ranks; A comparative study of national biofuels policies world wide, March 2006*

41 ibid.

42 CTV: *Article on www.ctv.ca, November 26, 2006*

43 Natural Resources Canada*: Five Ethanol Plants Receive $46 Million in Government of Canada Funding, July 6, 2005*

44 Ministry of Finance: *Ontario Budget 2006, July 14, 2006*

45 David Suzuki Foundation website: http://www.davidsuzuki.org/wol/challenge/newsletter/jan2006_fuel/page5.asp

federal government has been supporting the hydrogen industry for more than 20 years and has provided over $200 million in support.[46] At present, there are dozens of federal government programs in place to support research and development, production and sales, market demonstration and engineering, and testing and codes in the hydrogen industry.[47] One key program is CANMET's $33 million Canadian Transportation Fuel Alliance, which is providing funding across the country to encourage the adoption of hydrogen-fueled vehicles and demonstrations of hydrogen-fueled vehicles. Notable projects include the Hydrogen Highway, which will see the stretch of highway between Vancouver and Whistler fully outfitted to refuel hydrogen vehicles in time for the 2010 Winter Olympics.[48] Through International Trade Canada, the federal government is supporting the country's hydrogen fuel cell industry abroad by promoting its capabilities through trade commissioners in over 140 cities.[49]

At the provincial level, the Ontario Fuel Cell Innovation Program, administered by the Ministry of Research and Innovation, focuses on assisting small and medium firms in the fuel cell industry to improve upon and commercialize technologies, and to increase public and investment awareness of the technology. Funding is available for up to 50% of project costs to a maximum of $500,000.[50] The Ministry anticipated a $1.5 million expenditure in this program in 2005-2006.[51]

As with ethanol, however, the production of hydrogen requires energy. The use of hydrogen fuel cells is only a clean fuel if the energy used to produce the hydrogen itself is clean.

Natural Gas

Natural gas is viewed as a better alternative to gasoline and traditional diesel, although it does emit greenhouse gases. Natural Resources Canada promoted the use of natural gas in commercial fleet vehicles through an incentive that provided up to $3,000 to convert standard gasoline vehicles into natural gas vehicles. The Natural Gas for Vehicles Market Transformation Pilot Project had a budget of $1.86 million and ran from April 1 2005 to March 31 2006.[52]

One of the major challenges shared by all of these alternative fuels is the ability to distribute them at the retail level. At present, the critical mass does not exist to justify installing facilities for these fuels at the majority of the province's fuelling stations. In the case of hydrogen fuel cell vehicles, without major structural changes in the province, fuelling stations have no impetus to install hydrogen

46 Gov. of Canada: *http://www.hydrogeneconomy.gc.ca/programs_e.html#1, March 24, 2006*
47 ibid.
48 Natural Resources Canada: *Hydrogen Highway, February 1, 2006*
49 Fuel Cells Canada: *Capabilities guide, 2006*
50 Ministry of Research and Innovation: *Ontario Fuel Cells Innovation Program, March 2, 2006*
51 Ministry of Finance: *Economic Development and Trade Program 902 Operating Expenses Summary, 2005*
52 Natural Resources Canada: *news release The Natural Gas for Vehicles Market Transformation Project, July 27, 2005*

refueling facilities, and consumers will be unable to depend on fuel cell-equipped vehicles for everyday transportation needs. Even in the case of ethanol, which is to be required as part of the province's fuel mix in the near future, Ontario Premier McGuinty concedes that it is not practical to transport ethanol for inclusion in gasoline at fuelling stations in Northern Ontario, which has no ethanol production capabilities. To compensate for this, the province has opted to implement a credit trading system, rewarding fuel companies that exceed the target amount of ethanol and penalizing those that do not meet it.

8. Conservation & Efficiency

There are two principal trends in Ontario today related to energy conservation and efficiency. One is the province's goal to build a 'conservation culture' and the second, which is directly related, is to treat conservation and demand side management (DSM) initiatives on par with production. That is, every kWh saved through conservation and DSM efforts is viewed in the same light as a kWh produced. Historically, the task of predicting the impact of energy conservation in Ontario has been difficult and the impact has not always factored into energy demand projections. For example, from 1990-1999—at a time when the province had no formal conservation programs in place—the gap between the predicted increase and the actual increase in electricity demand accounted for 16% of total forecasted demand.[53] The Pembina Institute predicted that, with coordinated conservation programs in place, the province could reduce its energy usage by 30% by 2020.[54]

The drive towards a 'conservation culture' began in 2004 when six of the largest local distribution companies (LDCs) in the province each presented their plans to promote conservation to the OEB. Following the approval of each of the plans, the six LDCs began working to roll out their plans in concert under the banner 'powerWISE'. In 2005, the group collectively set aside $75.5 million to fund three years of programs.[55] In 2005, the first year of program delivery, the group held 159 conservation events, replaced 2,581 energy-inefficient refrigerators, and conserved enough energy to power 12,285 homes.[56] The coalition's goals for 2006 include adding additional LDCs to the powerWISE movement, although at the time of writing no additional LDCs had joined.[57]

The Pembina Institute observed that many of the successful energy efficiency programs in the United States and Europe had six key attributes in common[58]:

---

[53] Pembina Institute: *The Ontario Power Authority Supply mix report; a review and response, February 2006*

[54] The Pembina Institute, cited in David Suzuki Foundation *Smart Generation*, 2004

[55] Powerwise: *Building a Conservation Culture, progress report, 2005*

[56] ibid.

57 ibid.

[58] The Pembina Institute: *Successful Strategies for Energy Efficiency: Review of approaches in other jurisdictions and recommendations for Canada, 2006*

- Leadership in making energy efficiency a priority in energy policy.
- Legally binding targets for energy savings and assignation of full market value to energy efficiency.
- Stable financing and institutional structures for the delivery of efficient energy.
- Comprehensive programs.
- Establishment of measuring and verification programs.
- Research and development.

Ontario's conservation and efficiency efforts have moved in this direction. With the creation of the Conservation Bureau in 2004 and the appointment of a Chief Conservation Officer in 2006, the province signaled that energy efficiency was indeed a priority, and to treat conservation as part of the energy supply mix elevates its importance. In addition, a December 2004 decision by the OEB pays LDCs bonuses equal to 5% of hydro bill savings, making energy efficiency programs more attractive for LDCs.[59] [60]

Moreover, the Conservation Bureau has set forth very specific targets for conservation, including a primary objective of reducing peak demand by 6,300 MW by 2025; of that, 5% (1,350 MW) by 2007, 1,350 MW by 2010, with the remainder 3,600 MW by 2025. [61]

In addition to the funding being made available to the powerWISE coalition, the province announced in its 2006 budget that it will invest $90 million in local conservation efforts with LDCs. Initiatives announced in the 2006 budget include:[62]

- Reforming and broadening the Ontario Strategic Infrastructure Financing Authority's mandate to create funding mechanisms for conservation and energy-efficiency improvements in the municipal, universities, colleges, school boards, and hospitals sectors.
- Allocating $150 million to conservation and cogeneration projects in the forestry sector.
- Establishing new regulations to increase minimum air conditioner efficiency levels to 30%.
- Involving stakeholders in understanding how best to proceed with changes to Ontario's Building Code to increase energy-efficiency requirements.
- Performing energy audits and providing advice on retrofits and DSM through the Ministry of Agriculture, Food and Rural Affairs.

[59] Ontario Clean Air Alliance: *The Role of LDC's in Conservation and Demand Management in 2007, 2006*

[60] ibid.

[61] OPA: *IPSP, Scope and Overview,* June 29, 2006

[62] Ministry of Finance, 2006 Ontario Budget, 2006

9. Conclusion

Ontario's focus on renewable energy is rooted in a variety of principles, both progressive and pragmatic. The province is facing a number of challenges in relation to its energy infrastructure, for which new and innovative solutions make sense. As the OPA points out in its first of a series of discussion papers,[63] the province is facing:

- Increased consumption without an increase in net generation capacity in the past ten years;
- A lack of conservation and demand management programs, as these were shut down in the early 1990s; and,
- No significant additions to the long-distance transmission system since the 1980s.

If these were lingering concerns beforehand, the blackout of August, 2003 will have catapulted the province's energy system to the forefront, crystallizing the need to make changes. The many programs in place today were designed to address these challenges and to strengthen the province's energy system.

The province has set out an ambitious goal of making Ontario North America's "leading renewable energy producer," by reaching its target of 15,700 MW of installed capacity.[64] Renewable energy has many benefits to society, from improved air quality to the creation of jobs, but, just as importantly, renewable energy projects have faster development timelines than conventional energy plants. As such, the creation of incentives to get renewable energy online is an expedient way to add incremental energy capacity and thereby avert future disasters, like blackouts.

63 OPA: *IPSP, Scope and Overview,* June 29, 2006

64 The Globe Foundation of Canada: *Seeking a Balance in Ontario's Energy Equation, July 14, 2006*

Appendix A: Government Agencies Involved in Renewable Energy in Ontario (excerpted from government sources)

Ministry of Energy

The Ministry of Energy's responsibility is to ensure that Ontario's electricity system functions at the highest level of reliability and productivity. Our electricity system lies at the heart of our economy and way of life and by ensuring our system remains reliable, efficient and secure, we are making sure this province remains one of the best places in the world in which to live, work, invest and raise a family.

The Ministry of Energy is also focused on promoting ingenuity and innovation in the energy sector. By encouraging the development of new ideas and technologies we are helping to make Ontario a world leader in the global energy market.

Protecting our environment is also a top priority for the Ministry. Developing renewable sources of energy, cleaner forms of fuel, as well as fostering a conservation culture, are all cornerstones of the Ministry's vision for Ontario's electricity future.[65]

Ontario Energy Board (OEB)

The Ontario Energy Board is responsible for regulating natural gas and electricity utilities. This includes setting just and reasonable rates. The OEB also licenses all participants in the electricity sector as well as natural gas marketers who sell to low volume customers. The OEB is governed by the ministry of energy.

To ensure an adequate level of consumer protection in the energy markets, the OEB developed codes of conduct for gas marketers and electricity retailers, and established a complaint resolution process for energy consumers. The OEB also provides a broad range of information to energy consumers about electricity and natural gas in Ontario.

The Board is responsible for electricity market oversight and ensuring that regulated gas and electricity monopoly utilities comply with Board decisions and orders. This includes conducting audits, performing compliance monitoring activities and monitoring various aspects of the gas and electricity utilities' financial operating performance[66].

[65] Ministry of Energy*: http://www.energy.gov.on.ca/index.cfm?fuseaction=english.about, October 16, 2006*

[66] OEB*: http://www.oeb.gov.on.ca/html/en/abouttheoeb/whatwedo.htm, October 16, 2006*

Ontario Power Authority (OPA)

The Ontario Power Authority (OPA) was established by The Electricity Restructuring Act, 2004 which set out the following objectives for the organization:

1) To forecast electricity demand and the adequacy and reliability of electricity resources for Ontario for the medium and long-term.

2) To conduct independent planning for electricity generation, demand management, conservation and transmission and develop integrated power system plans for Ontario.

3) To engage in activities in support of the goal of ensuring adequate, reliable and secure electricity supply and resources in Ontario.

4) To engage in activities to facilitate the diversification of sources of electricity supply by promoting the use of cleaner energy sources and technologies, including alternative energy sources and renewable energy sources.

5) To establish system-wide goals for the amount of electricity to be produced from alternative energy sources and renewable energy sources.

6) To engage in activities that facilitate load management.

7) To engage in activities that promote electricity conservation and the efficient use of electricity.

8) To assist the Ontario Energy Board by facilitating stability in rates for certain types of customers.

9) To collect and provide to the public and the Ontario Energy Board information relating to medium and long term electricity needs of Ontario and the adequacy and reliability of the integrated power system to meet those needs.

To carry out its statutory objectives, the OPA has been organized under four key functions: Power System Planning, Generation Development, Conservation Bureau, and Electricity Sector Development, with a Corporate Affairs service group to provide cross cutting administrative support. [67]

Independent Electricity System Operator (IESO)

The IESO balances the supply of and demand for electricity in Ontario and then directs its flow across the province's transmission lines.

[67] OPA: *http://www.powerauthority.on.ca/Page.asp?PageID=122&ContentID=822&SiteNodeID=119&BL_ExpandID=, October 16, 2006*

The Independent Electricity System Operator (IESO) works at the heart of Ontario's power system, connecting all participants - generators that produce electricity, transmitters that send it across the province, retailers that buy and sell it, industries and businesses that use it in large quantities and local distribution companies that deliver it to people's homes.

Every five minutes, the IESO forecasts consumption throughout the province and collects the best offers from generators to provide the required amount of electricity. This allows customers to see prices fluctuate based on supply and demand. As a result, they can shift consumption away from peaks in demand to times when the price is lower.

The IESO monitors the system and identifies what is required to maintain reliability in the future, reporting on these recommendations through regular publications. In its quarterly 18-month forecasts of the growth in demand for electricity, the IESO assesses whether there will be adequate generation and transmission facilities. In addition, the IESO prepares the semi-annual Ontario Reliability Outlook, which reports on the progress of interrelated generation, transmission and demand-side projects underway to meet Ontario's reliability requirements.

The IESO co-ordinates emergency preparedness for the province's electricity system and played a key role in managing the restoration of power following the August 2003 blackout.

The IESO continues to work with other stakeholders to evolve the market for the benefit of all. Further enhancements will strengthen the market, enhance reliability and provide Ontarians with greater access to information about their power system.

The Independent Electricity System Operator is a not-for-profit corporate entity established in 1998 by the Electricity Act of Ontario. It is governed by an independent Board whose Chair and Directors are appointed by the Government of Ontario. Its fees and licenses to operate are set by the Ontario Energy Board and it operates independently of all other participants in the electricity market.

The IESO has full statute-based authority for establishing, monitoring and enforcing reliability standards in the province. All the companies that make up the power system in Ontario must meet the IESO's standards. An audit by the North American Electricity Reliability Council cited the IESO as a model for system operators, while a peer review showed that its practices in enforcing reliability are exemplary. [68]

[68] IESO*: http://www.ieso.ca/imoweb/siteShared/whoweare.asp?sid=bi, October 16, 2006*

Ontario Power Generation (OPG)

Ontario Power Generation (OPG) is an Ontario-based electricity generation company whose principal business is the generation and sale of electricity in Ontario. Our focus is on the efficient production and sale of electricity from our generation assets, while operating in a safe, open and environmentally responsible manner.

OPG's generating portfolio has a total capacity of over 22,000 megawatts (MW) making us one of the largest power generators in North America. Our generating assets include:

- 3 nuclear generating stations
- 5 fossil generating stations
- 64 hydroelectric generating stations and
- 3 wind generating stations

OPG also owns two other nuclear generating stations which are leased on a long-term basis to Bruce Power L.P.

In 2005, OPG generated 108.5 terawatt-hours (TWh) of electricity. Ontario Power Generation is committed to enhancing the quality of life in the communities where it operates. Through our Corporate Citizenship Program, the company provides financial and in-kind support to registered charities and not-for-profit environmental, educational and community organizations whose initiatives reflect OPG's vision of citizenship and sustainable development.

OPG also annually purchases approximately $1 billion in goods and services from primarily Ontario-based suppliers and contributes to the province in taxes, dividends and other payments. [69]

Ministry of Natural Resources (MNR)

The Ministry of Natural Resources (MNR) is the steward of Ontario's provincial parks, forests, fisheries, wildlife, mineral aggregates, petroleum resources and the Crown lands and waters that make up 87 per cent of the province.

The ministry envisions a healthy environment that is naturally diverse and supports sustainable development. The ministry's mission is to manage the province's natural resources in an ecologically sustainable way. The ministry is committed to conserving biodiversity and using natural resources in a sustainable manner.

MNR’s key areas of responsibility are:

[69] OPG: *http://www.opg.com/about/, October 16, 2006*

- Forest Management
- Ontario Parks
- Fish and Wildlife Management
- Geographic Information
- Lands and Waters Management
- Field Services Support
- Public Safety and Emergency Response
- Ministry Administration.

Ministry of the Environment (MOE)

The Ministry of the Environment (MOE) works to protect, restore and enhance the natural environment through tough legislation and enforcement, innovative programs and initiatives, strong partnerships, and public engagement. The ministry works to provide all Ontarians with safe and clean air, land and water.

The MOE conducts inspections to ensure that businesses are complying with regulations and the conditions of their Certificates of Approval. This section outlines the ministry's compliance activities and cleanup efforts

Since 1998, Ontario has been participating with other jurisdictions across Canada in developing national standards titled “Canada-wide standards” (CWS). Get more information on CWS for: Benzene, Dioxins and furans, Mercury, Particulate Matter and Ozone, and Petroleum Hydrocarbons in Soil.

The Ministry of the Environment approvals program has been designed to ensure that all undertakings requiring approval are carried out in accordance with legislation including the Ontario Water Resources Act, the Environmental Protection Act, the Pesticides Act, the Environmental Assessment Act, the Environmental Bill of Rights, the Safe Drinking Water Act and associated regulations. Certificates of Approval are required for facilities that release emissions to the atmosphere, discharge contaminants to ground and surface water, provide potable water supplies, or store, transport, process or dispose of waste. Proponents of these types of activities are required to obtain Certificates of Approval to ensure that the environment will not be adversely affected.[70]

Natural Resources Canada (NRCan)

Natural Resources Canada (NRCan) works to ensure the responsible development of Canada's natural resources, including energy, forests, minerals and metals. NRCAN also uses its expertise in earth sciences to build and maintain an up-to-date knowledge base of Canada’s landmass and resources.

[70] Ministry of Environment*: http://www.ene.gov.on.ca/general.htm#initiatives, October 16, 2006*

NRCan develops policies and programs that enhance the contribution of the natural resources sector to the economy and improve the quality of life of all Canadians.

NRCAN conducts innovative science in facilities across Canada to generate ideas and transfer technologies and also represents Canada at the international level to meet the country's global commitments related to natural resources.

Electricity Safety Authority (ESA)

The Electrical Safety Authority (ESA) is a stand-alone, financially self-sustaining not-for-profit corporation accountable to a Board of Directors and operating as an Administrative Authority under the Electricity Act 1998 and an Administrative Agreement with the Ministry of Government Services. ESA is responsible for public electrical safety in Ontario as designated by Ontario Regulation 89/99.

ESA is accountable to the public through the Ministry of Government Services for meeting its legislative and contractual obligations in the delivery of its delegated regulatory mandate. At the same time, it is accountable to its regulated sectors for results, sound management, and efficiency.

Appendix B: Associations Supporting Renewable Energy Developers in Ontario

Association	Focus
Ontario Sustainable Energy Association (OSEA) www.ontario-sea.org	Works to develop green energy projects in communities
Ontario Waterpower Association (OWA) www.owa.ca	Industry-driven association representing the interests of waterpower developers
Canadian Wind Energy Association (CanWEA) www.canwea.ca	Industry-driven association representing the interests of wind energy developers
Canadian Solar Industries Association (CanSIA) www.cansia.ca	Industry-driven association representing the interests of solar energy developers
Canadian Renewable Fuels Association (CRFA) www.greenfuels.org	National association promoting the use of ethanol and biodiesel in transportation
Canadian Bio Energy Association (CanBIO) www.canbio.ca	Industry-driven association representing the interests of biomass energy developers
Canadian Association of Renewable Energy (CARE) www.renewables.ca	National association to promote renewable energy
Association of Powers Producers Society Ontario (APPRO) www.appro.ca	Ontario association helping power producers to develop and implement clean technology
Canadian Hydrogen Association (CHA) www.h2.ca	National association promoting the production, transportation, storage and application of hydrogen
Canadian Renewable Energy Alliance (CanREA) www.canrea.ca	An alliance of NGOs advocating for conservation and renewable energy adoption using market instruments, regulation, education and voluntary measures

Figure 1: *OPA's Original and Revised Renewable Energy Supply Targets (interpolated)*[71 & 72]

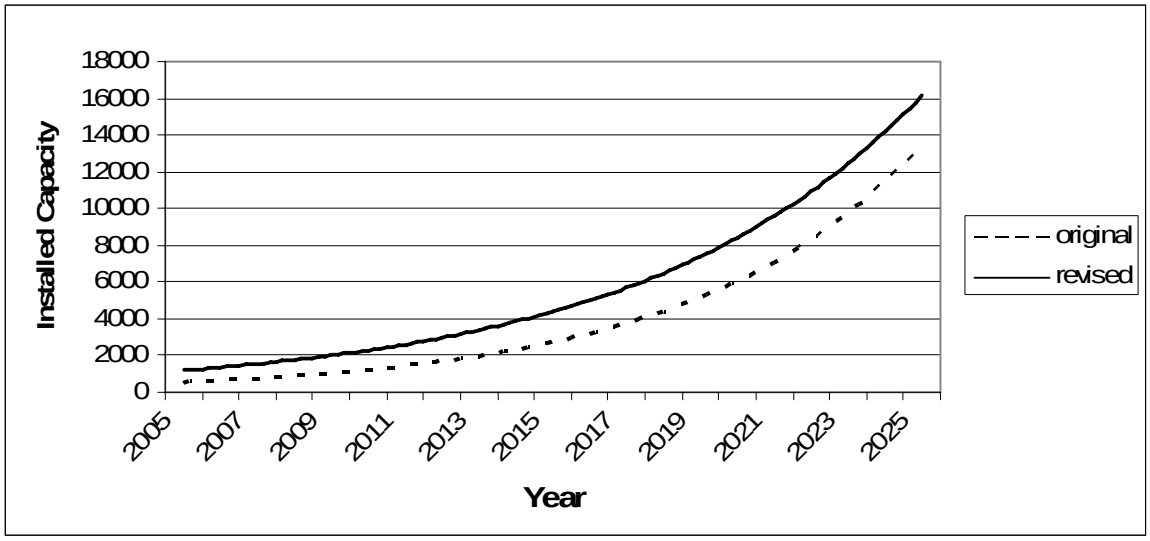
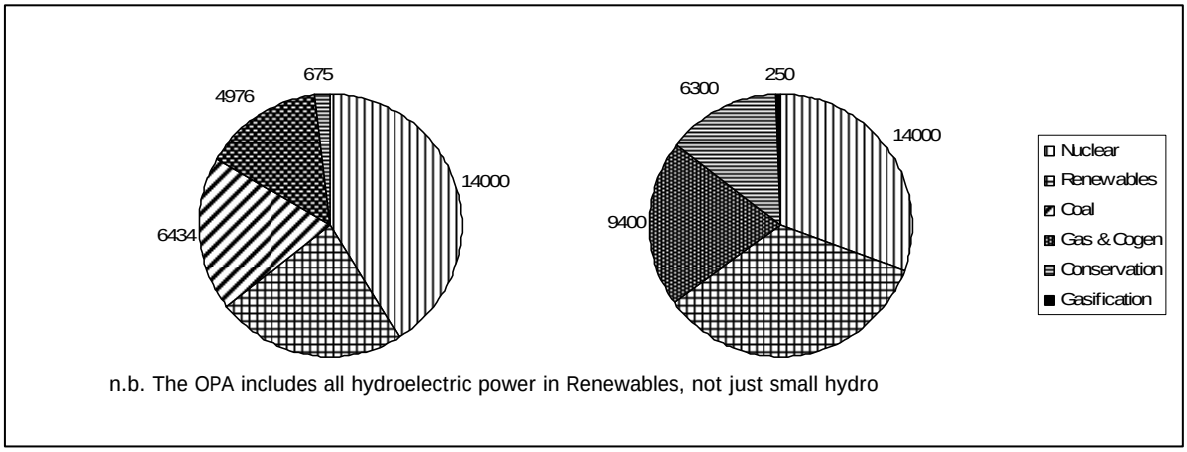


Figure 2: *Ontario's Electricity Supply Mix: 2005 and 2025*[73]



n.b. The OPA includes all hydroelectric power in Renewables, not just small hydro

[71] OPA: *Power System Planning: Supply Mix Advice and Recommendations*, December 9, 2005

[72] OPA: *IPSP, Scope and Overview, June 29, 2006*

[73] Ministry of Energy: *Backgrounder on Ontario's Electricity Supply mix, June 13th 2006*

Figure 3: *Major Sources of Renewables in Ontario*[74,75]

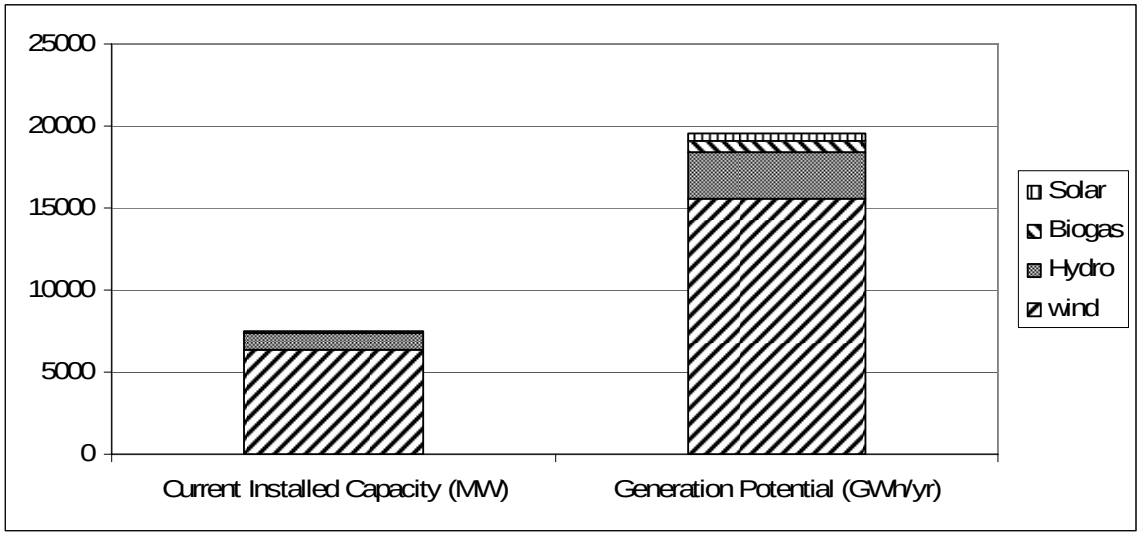


Figure 4: *Historical Spot Price of Uranium*[76]

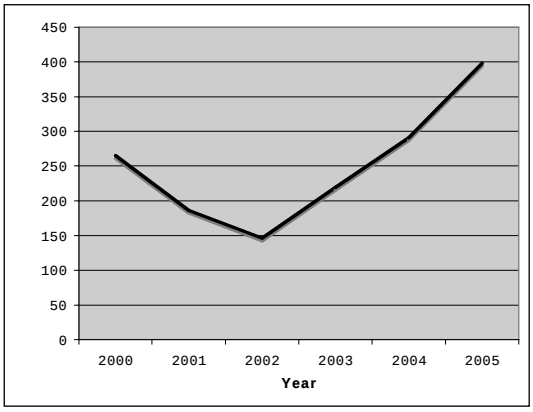
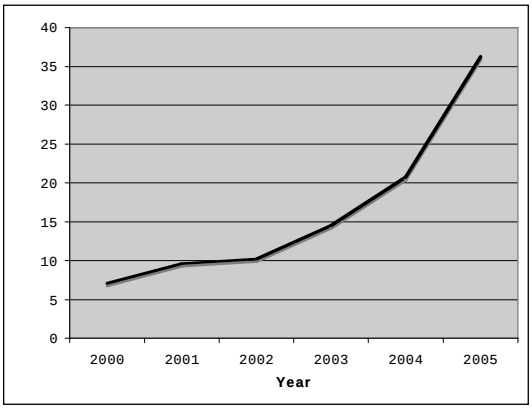


Figure 5: *Historical Price of Gas*[77]



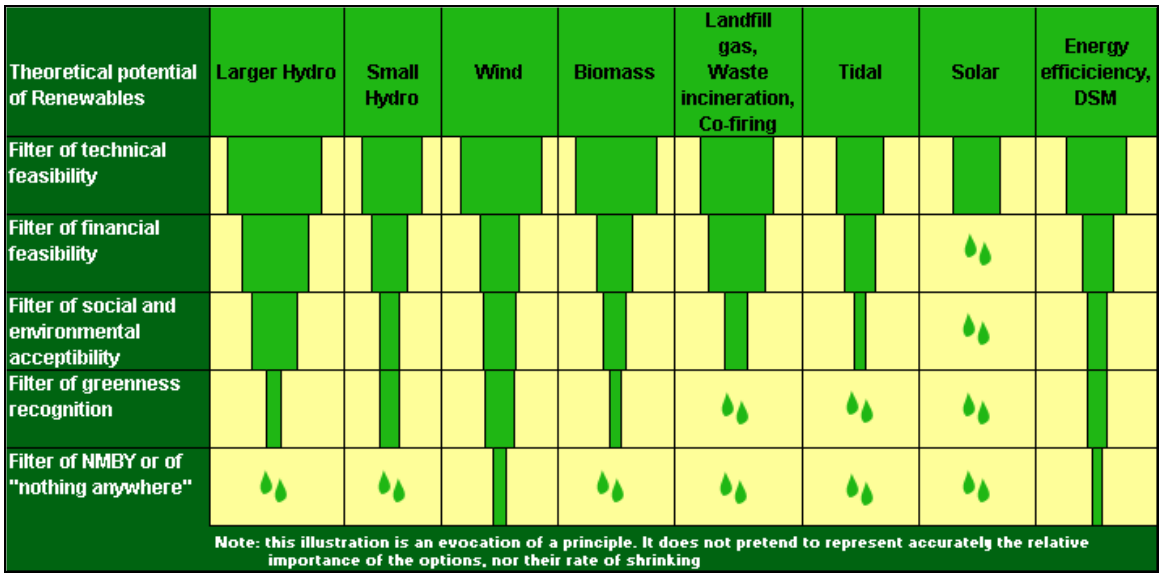
[74] Ontario Ministry of Energy: *Renewable Energy Development Ontario (REDO) , 2006*

[75] David Suzuki Foundation: *Green Power Opportunities For Ontario, 2002*

[76] Ux Consulting: *http://www.uxc.com/review/uxc_g_hist-price.html*

[77] Amex Natural Gas Index on Yahoo Finance: http://finance.yahoo.com/q/hp?s=%5EXNG

Figure 6: *Barriers to Renewable Energy Development and Their Potential Impact on Project Implementation Rates*[78]



[78] Y. Guérard: *Presentation from the Green Power Workshop in Montreal, Hydro-Québec, November 3, 2003*

Table 1: *Standard Offer Prices for Various Renewables*

Type of Renewable	Base Price, Per kWh	On-Peak Premium, Per kWh
Wind	$0.11	Not Eligible
Biomass	$0.11	$0.0352
Bio-Gas	$0.11	$0.0352
Bio-Fuel	$0.11	$0.0352
Landfill Gas	$0.11	$0.0352
Small Hydro	$0.11	$0.0352
Solar Photovoltaic (PV)	$0.42	Not Eligible
Thermal Electric Solar	$0.11	Not Eligible

Table 2: *The Pathway to Project Development*[79]

Phase	Milestones
Pre-Feasibility Phase	Economic Analysis Develop and Application Meet with Stakeholders Apply for Permits and Licenses
Feasibility Phase	Environmental Assessment Source Firm Estimates Form Corporation Engineering Design Work Economic Analysis Secure Financing Obtain Board Approval
Design & Construction Phase	Subcontract Engineering Firm Finalize Contracts Site Preparation Construction
Commissioning	Testing Go Online
Recruit Staff (If Necessary)	

[79] Ontario Water Power Association: *Presentation "Negotiating the Regulatory Environment", February 9, 2006*