PRELIMINARY ASSESSMENT OF THE POTENTIAL FOR A CLEAN ENERGY TRANSFER BETWEEN MANITOBA AND ONTARIO

SEPTEMBER 2004

This report reflects information compiled by the joint Manitoba/Ontario study team. It does not necessarily reflect the positions of the Ontario or Manitoba government, or any of the contributing organizations, including Manitoba Hydro, Hydro One, or the Independent Electricity Market Operator.

The study team wishes to thank National Bank Financial for their assistance in the drafting of this report.

EXECUTIVE SUMMARY

The governments of Ontario and Manitoba signed a Memorandum of Understanding on June 20, 2003 to study the development of some of Manitoba's approximately 5,000 MW of potential new clean energy supply, for delivery to Ontario (the "Clean Energy Transfer Initiative"). Working groups with representatives from the Manitoba Department of Energy, Science and Technology; the Ontario Ministry of Energy; Manitoba Hydro; Hydro One; and the Ontario Independent Electricity Market Operator; evaluated various aspects of a long-term power supply arrangement between Manitoba and Ontario with an incremental 1500 MW of transfer capacity.

The preliminary assessment indicates that the benefits associated with the Clean Energy Transfer Initiative (CETI) could be significant, that there are no insurmountable obstacles, and that while challenges remain, progress has been made in clarifying and resolving a number of potential issues. It is recommended that the project move into its next stage.

The Clean Energy Transfer Initiative would contribute to addressing Ontario's increasing electricity supply needs. Population and economic growth, existing generation facilities reaching the end of their design life, and the planned phase-out of coal fired generation result in a potential supply gap in Ontario as high as 25,000 MW by 2020, in the absence of other initiatives.

The Clean Energy Transfer Initiative is viewed as one of the potential initiatives that could be pursued to help address Ontario's electricity needs. Manitoba has a potential excess of energy supply capacity over and above its domestic needs, including approximately 5,000 MW of economically and environmentally developable hydro sites, as well as other clean energy resources.

Ontario's projected supply-demand "gap" and Manitoba's additional potential clean energy generation sources offer a major opportunity for both provinces, and the country.

New upgraded transmission facilities from Manitoba through Ontario would be required to facilitate a significant new electricity transfer, and is a key focus in the development of this project. The existing East-West Canadian transmission grid limits electricity transferred between Manitoba and Ontario to approximately 200 MW. The preliminary assessment to date has considered three conceptual transmission options, all of which will provide 1500 MW of transfer capability and are technically feasible.

Strengthening the national grid at this critical East-West juncture will not only contribute to Ontario's clean, new energy supplies, but would provide substantial improvements in grid reliability and national energy security, suggesting a possible role for the Federal Government.

The CETI also provides wider benefits for Canada, as well as the two provinces. Specifically, the analysis conducted so far indicates that the project has the potential to:

- **Reduce GHG's by at least 7 million tonnes (Mt) annually by helping Ontario phase out coal-fired generation, making this Canada's largest single CO2-reduction project. This could assist the Federal government in filling some of its unmet obligations under the Kyoto Protocol, and would provide them with savings worth an NPV of up to $1.2 billion. The project would also significantly reduce emissions of SOx, NOx, mercury and particulates – pollutants which create acid rain, smog and wider health concerns.**

- **Contribute to the diversification of Ontario's electricity supply, reducing its exposure to volatile natural gas prices, and help produce a balanced portfolio of energy options.**

- **Generate estimated Canadian GDP of $5.6 billion[1]; tax revenues of $1.6 billion across all levels of government; and 85,000 person-years of direct and indirect employment nation-wide.**

- **Benefit Aboriginal citizens and businesses through significant direct training, employment and business opportunities, including direct employment within Manitoba alone of 3,100 person-years, as well as through direct equity ownership in generating projects; and potentially through wider financial participation tools.**

- **Strengthen the reliability of the National East-West power grid, increase Canada's energy security and independence of supply, and improve Canadians, access to new sources of clean and affordable energy.**

Some of the potential issues reviewed include whether the cost of the CETI's power is comparable to other alternatives; timelines required for regulatory approvals and consultations with Aboriginal communities; and the potential role of the Federal government.

The CETI's Levelized Unit Energy Cost (LUEC), was estimated to be $67 to $78/MWh before environmental credits (consisting of an estimated cost of $45 to $51/MWh at generation; and transmission costs of $22 to $27/MWh). This was found to be comparable to the most likely alternative new supply source, the Combined Cycle Gas Turbine (CCGT), at $65 to $78/MWh, without considering environmental costs.[2] Assuming the CETI displaces existing coal generation in

[1] Economic impact estimates provided by Manitoba.

[2] CETI cost estimates did not include any recognition of adequacy, reliability, price stability or diversity benefits, and thus, no allocation of cost was made to the regulated rate-base. Similarly, no potential

Ontario, the increased environmental benefits (averaging $25/MWh) produce a net LUEC of $42 to $53/MWh for the CETI project.

Multiple economic and environmental regulatory approvals have the potential to stretch for four to five years, delaying the potential delivery of power from the CETI. Cooperation among the different agencies in Manitoba, Ontario and Canada will be important to minimize the regulatory burden.

In addition to discussions and negotiations concerning employment, ownership and other partnership opportunities, Aboriginal communities will be directly consulted in a comprehensive process, and are expected to be key participants and partners in the CETI.

The benefits associated with the Clean Energy Transfer Initiative are significant, and while there are significant challenges remaining for the project, there do not appear to be any insurmountable obstacles. Therefore, the joint Manitoba/Ontario study team recommends that the necessary next steps be undertaken to move the project into its next stage. These will include detailed engineering and cost analysis; the initiation of comprehensive consultations; the beginning of commercial negotiations; and the provision of appropriate policy and political determinations. It is also recommended that the Federal government be more fully engaged, in recognition of the potential national energy, environmental, and economic benefits.

Some of the specific next steps to be taken by the Ontario buyer or buyers, Hydro One, and Manitoba Hydro include:

- **Develop potential business arrangements including appropriate pricing arrangements.**
- **Optimize and select a preferred transmission option to be further evaluated, including the definition of the associated ancillary benefits such as local reliability.**
- **Proponent consultations with aboriginal and other communities.**
- **Detailed comparison of the cost of the CETI versus alternative supply sources, which would require the involvement of the eventual Ontario buyer, or a proxy entity for such a buyer.**
- **Clarify applicable market rules.**
- **Refine the engineering and cost estimates.**

Actions by the Governments of Ontario, Manitoba and Canada should include:

- **Determine the value to the Federal government of developing an expanded East-West electricity grid.**

Federal valuation of reduced greenhouse gas (GHG) tonnages, improved national grid reliability and energy security, or GDP, employment and tax revenue impacts were included.

- **Agree on the quantity, timing, ownership and value of the CO2 credits flowing from the project, as well as the potential for Federal purchases.**
- **Initiate comprehensive consultations, with the assistance of Manitoba Hydro and Hydro One, that engage Aboriginal people.**
- **Action to streamline environmental regulatory processes and economic approvals while meeting the requirements of provincial and Federal legislation.**

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THE CLEAN ENERGY TRANSFER INITIATIVE

The Clean Energy Transfer Initiative (CETI) contemplates the sale of electricity from Manitoba to Ontario on the basis of long-term supply agreements. At the core of this relationship, the CETI requires the development of new clean energy generation capacity in Manitoba, paired with new and upgraded transmission facilities in Manitoba and Ontario.

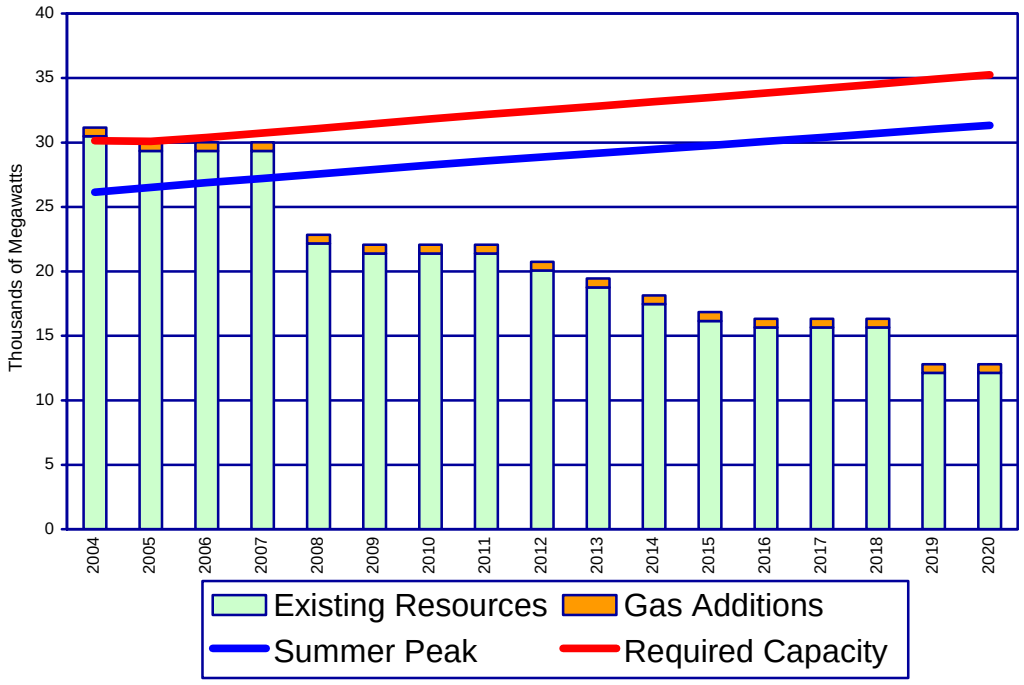
RATIONALE FOR CLEAN ENERGY TRANSFER INITIATIVE

Ontario: Potential Electricity Supply Gap

Ontario has a need for additional electricity supply due to load growth from increasing population and economic growth, existing generation facilities reaching the end of their design life, and the planned phase-out of coal-fired generation. To help address this need for new supply, Ontario is issuing an interim Request for Proposals (RFP) to bring online 2,500 MW of new generation capacity or demand-side management measures. In addition, Ontario is also taking the first step to add 1,350 MW of new supply from renewable sources such as wind by issuing an RFP for 300 MW of supply.

However, while the Ontario Government has taken immediate steps to begin to reduce the supply gap, Figure 1 shows that further initiatives will be required over the longer term. In its most recent ten-year outlook, the Independent Electricity Market Operator ("IMO") forecasts that in ten years Ontario will require an additional 16 TWh of electrical energy annually under median growth assumptions. Peak demand is expected to increase by 3,100 MW over the same period.

FIGURE 1 – PROJECTED ELECTRICITY SUPPLY IN ONTARIO



While demand for electricity in Ontario is increasing, the province's electricity supply may decrease due to nuclear power stations reaching the end of their design life beginning in 2009 and the government's intention to phase out 7,500 MW of coal-fired generation in the province. Under median growth assumptions, the projected gap could, in the absence of other initiatives, be as high as 25,000 MW by 2020.

Manitoba: Potential New Electricity Generation Capacity

Manitoba has potential excess clean energy supply capacity above its domestic requirements. This supply includes approximately 5,000 MW of economically and environmentally developable hydro sites, the largest of which is Conawapa, a 1,250 MW potential hydro development, located on the Nelson River in Northern Manitoba. Other notable potential sources include Wuskwatim (200 MW) and Keeyask (620 MW) hydro sites. Manitoba Hydro has already conducted significant pre-commitment work on all these sites. Substantial additional Manitoba capacity will also be created from the development of wind energy, generating station system enhancements, other emerging renewable energy sources, and from an increased level of demand side management ("DSM") initiatives.

Table 1
Sample List of Manitoba's Potential New Supply Options

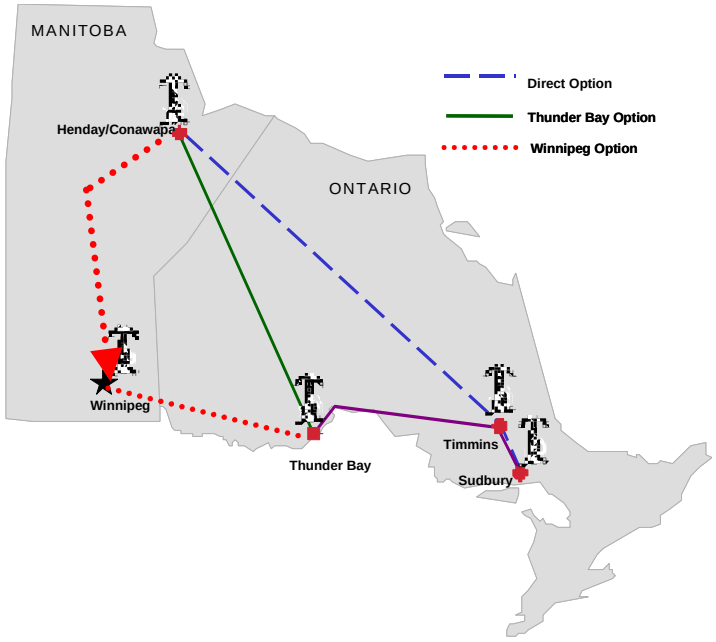
PROJECT DESCRIPTION	PROJECT TYPE	CAPACITY (MW)	AVE. ENERGY (GWh/yr)
Wuskwatim	New Hydro	200	1,500
Gull (Keeyask)	New Hydro	620	4,400
Notigi	New Hydro	100	750
Wind Power	New Wind Power	250	800
Conawapa	New Hydro	1,250	7,000
Redevelop & Re-Runner Point Du Bois & Kelsey	Hydro Efficiency. Improvement	120	600
Brady Landfill Gas Capture	Emission Reductions & Power Generation	6	40
DSM	Consumer Efficiency Improvements	185	700
Total Partial Potential		**>2,700 MW**	**>15,000 GWh**

Canada's Weak East-West Transmission Grid – New Supply Can't Reach Demand

The existing East-West Canadian transmission grid limits electricity transferred between Manitoba and Ontario to a maximum of about 200 MW. In comparison, Manitoba can transfer up to 1850 MW South to the U.S., and Ontario can import at least 3100 MW from the U.S. As a result of the limits within Canada's East-West grid, it would be necessary to augment the existing East-West transmission capacity, in order to provide for the potential transfer of new power.

To date, studies have considered three generic transmission options, without exploring detailed route selection.[3] All three options could provide sufficient transfer capability between Manitoba and Ontario, and preliminary indications are that all of them are technically feasible.

FIGURE 2 – TRANSMISSION OPTIONS



Increased inter-provincial electricity transmission ties can benefit the provinces involved, as well as the nation as whole, through:

- Improved reliability of the transmission grid;
- More efficient use of energy resources;
- Enhanced national energy security;
- Achievement of Kyoto requirements and clean air targets;

[3] The joint Manitoba-Ontario study did not explore possible corridors for transmission options solely within Manitoba - e.g. for a potential Bipole III.

- Increased supply to Canadian consumers;
- Potential benefits to Aboriginal communities;
- More predictable and affordable prices; and,
- Increased access to market for emerging renewables.

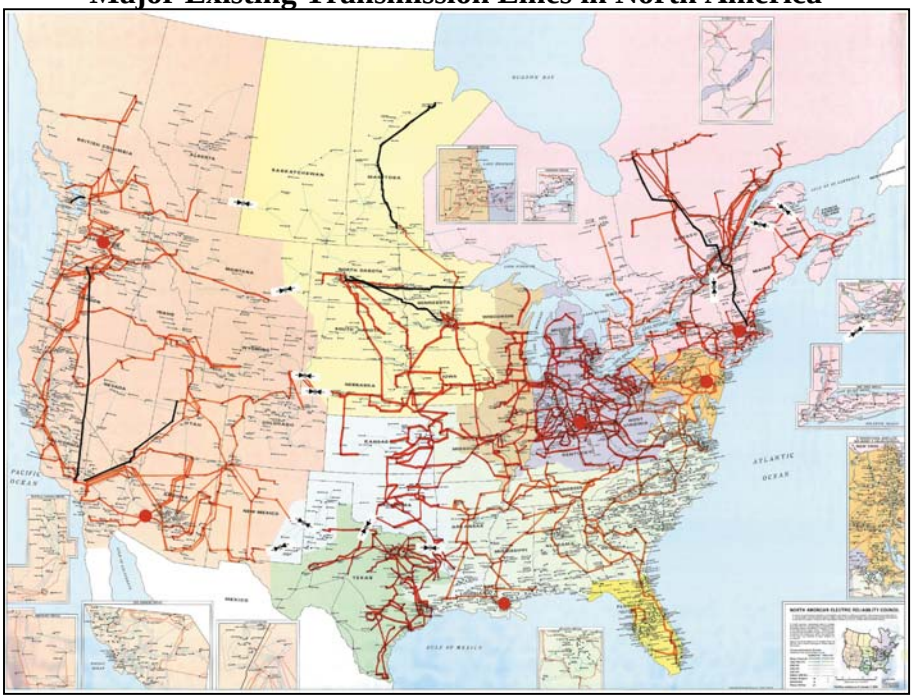
Canada's electrical systems have developed such that most provincial utilities are more closely linked to American utilities than to their neighbouring Canadian provincial utilities, as illustrated in Figure 3 below. This North-South relationship offers the benefits to both sides of a wider mix of generating sources and financially beneficial power exchanges based on seasonal differences in supply and demand. However, events of the past few years, such as the lengthy recovery from the August 2003 Blackout, have highlighted the problems created by under-investment in transmission and the need for Canada to strengthen its own national grid, providing Canadians with the full benefits of its clean, affordable and reliable energy supply.

A weak national grid also has implications beyond Canada's ability to provide its citizens and communities with sufficient power in an emergency. A weak national grid also limits Canada's ability to reduce CO2 emissions, since Canada cannot always control the type of power it imports. For example, Ontario's transmission interconnections enable the province to import twice as much power from U.S. generation, a significant portion of which may be either directly or indirectly based on coal-fired generation, as from Quebec and Manitoba. This despite the fact that both provinces are among the largest exporters of low-cost, stably-priced, clean power on the continent.

As described above, East-West connections have limited capacity to transfer power between provinces. Unless this is changed, increased clean energy generation in Canada can only flow to the U.S., rather than into Canadian markets. These factors could combine to produce the perverse effect of making Canada an exporter of its own clean energy, while increasing imports of power from less desirable sources.

Stronger East-West connections can also ensure Canada's citizens, communities, existing industries as well as future investors, of increased access to new power supplies, drawn from clean sources, and with less fuel-price volatility.

Figure 3
Major Existing Transmission Lines in North America



THE CLEAN ENERGY TRANSFER INITIATIVE
OPPORTUNITIES AND ISSUES

Implementing the CETI will produce several opportunities for each of the parties involved, as well as issues to be resolved, including:

- Environmental benefits;
- Diversity of supply;
- Economic impacts;
- Opportunities for Aboriginal communities;
- Increased energy reliability and security through a stronger national grid; and,
- Project energy costs.

Individual supply options have different benefits and limitations, and therefore it is unlikely that any one of them will provide a single solution to meet all Ontario's electricity needs. Instead, Ontario is pursuing a number of different initiatives to address the province's remaining electricity supply gap.

On that basis, the CETI is not being considered as a complete substitute for any of the other main supply or demand-side options, such as hydro-electric power, combined cycle gas turbines ("CCGT"), nuclear, emerging renewable sources such as wind and solar, and demand-side management and efficiency. The CETI could provide Ontario with access to up to 1,500 MW of additional power at peak, which represents approximately 5% of demand. This would not suffice on its own as a single solution to Ontario's long-term electricity supply gap challenge. Rather, this initiative is viewed as one potential energy asset in a portfolio of solutions to be pursued in the coming years.

The analysis conducted to date is designed to address whether the CETI fares well on a comparative basis with its alternatives, as it relates to the key public policy objectives outlined at the beginning of this section. It shows that the CETI represents a source of clean, renewable, and predictably-priced power, while at the same time having the potential to help meet a series of other key public policy objectives. The analysis also identifies a number of issues which remain for the project proponents, and the Federal government, to resolve.

ENVIRONMENTAL BENEFITS

A number of significant environmental benefits would arise from this project, which raise, in turn, a series of issues which need to be resolved.

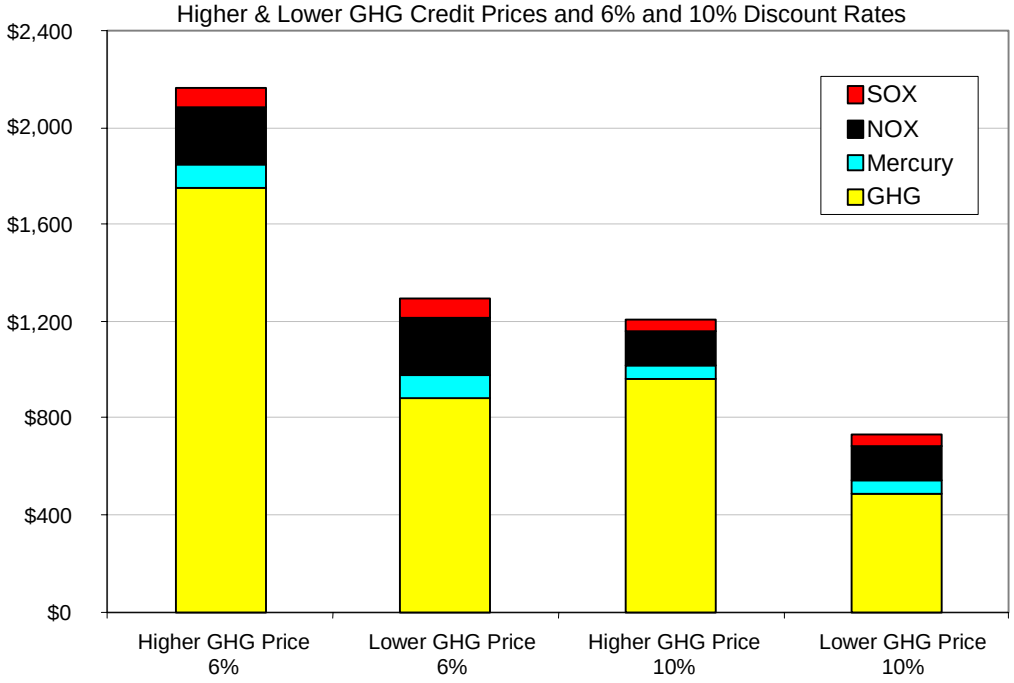
Greenhouse Gas and Other Air Emission Reductions

The Federal government has an obligation to reduce GHG emissions under the Kyoto Protocol to 6% below 1990 levels in the period 2008 to 2012. The amount of the reduction is an estimated 240 Mt in 2010, the mid-point of the period. While proposed initiatives are intended to account for 180 Mt, the remaining balance stands at more than 60 Mt. This reduction would need to be achieved by further domestic actions, purchases of international GHG credits, or by accepting the penalties under the Kyoto Protocol. Ontario's commitment to phase out coal-fired generation offers an opportunity to address part of this gap, and the CETI offers the Federal government an environmentally advantageous project which can help to achieve the long term phase out of coal, while providing greater domestic economic benefits than an international GHG credit purchase.

The CETI concept has been designed to maximize reductions of GHG's and other air pollutants. If the CETI serves to replace coal-fired production, it would reduce GHG's by at least 7 Mt per year, making it Canada's largest single GHG-reduction project. In addition, the project would significantly reduce emissions of SOx, NOx, mercury and particulates – pollutants which create acid rain, smog, and wider human health concerns.

The undiscounted total environmental benefits flowing from the CETI are estimated at $3.5 to $5.9 billion. Discounted (at 6% and 10%), the GHG reductions alone which arise from the displacement of coal by the CETI are estimated to have a net present value of $500 million to $1.8 billion over the period 2005 to 2030. Adding the SOx, NOx and mercury reductions would increase the total net present value of the environmental benefits to $700 million to $2.2 billion, using 6% and 10% discount rates (Figure 4).

Figure 4
Greenhouse Gas & Air Pollutant Reductions From Displacement of Coal
Net Present Value ($2003 Millions)
Higher & Lower GHG Credit Prices and 6% and 10% Discount Rates



The magnitude and value of these GHG reduction benefits have been estimated based on an initial estimate of 7.5 TWh of renewable energy transferred in an average water flow year. The CETI could accommodate a higher transfer potential, and will most likely do so in higher water level years. Two GHG price scenario's were created, as shown in Figure 5: a Low Case with an average value over the life of a 20 year contract of $14/tonne, and a High Case with an average value of $28/tonne. Assumed values for NOx and SOx are shown in Figure 6.

Figure 5
GHG Emission Cost Scenarios

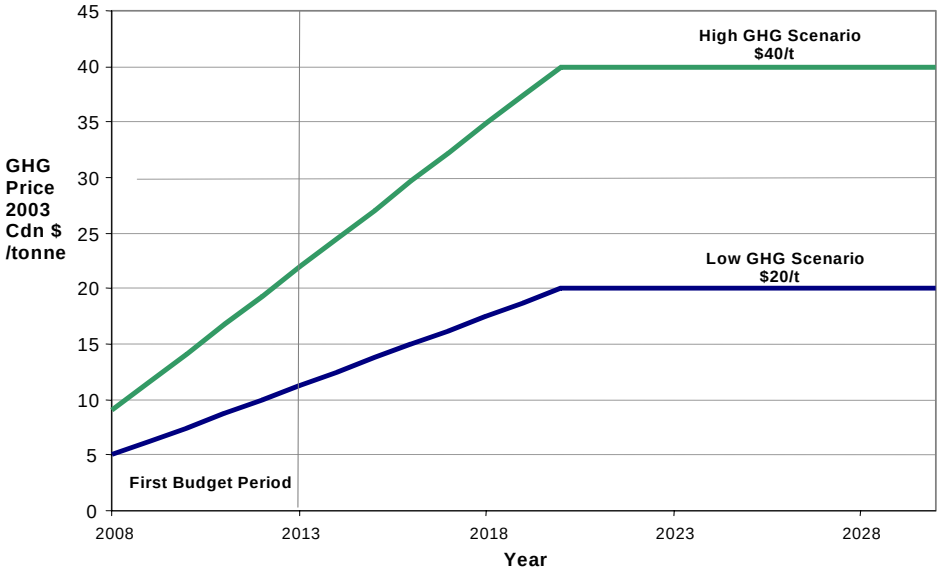
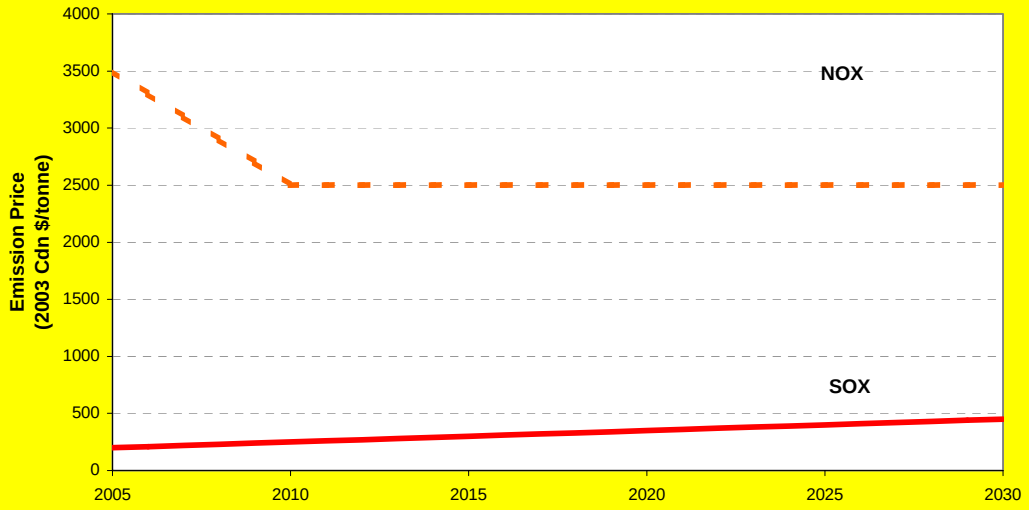


Figure 6
Assumed NOX & SOX Emission Cost



Under the Kyoto Protocol, the Federal government has responsibility for Canada's international obligation to reduce emissions, and bears the financial liabilities associated with this obligation. If reductions are not generated domestically, they must be purchased internationally, with the loss of the associated economic benefits to Canada, as well as wider environmental and social co-benefits. The net present value of the GHG costs that the Federal government can avoid under the CETI is estimated to range from $340 million to $1.2 billion[4].

In early Federal emissions trading plan proposals, Clean Energy sources such as wind and water power received no recognition within the emissions trading system, whereas fossil-fuel producers were offered a series of guarantees and commitments.[5] Recent months have seen substantial progress from the Federal government in recognizing and valuing Clean Energy, including the offer of a case-by-case assessment of such projects. A useful next step would be to proceed to discussions amongst all three governments on the quantity, timing, ownership and value of the credits flowing from this project.

"New Generation Hydro"

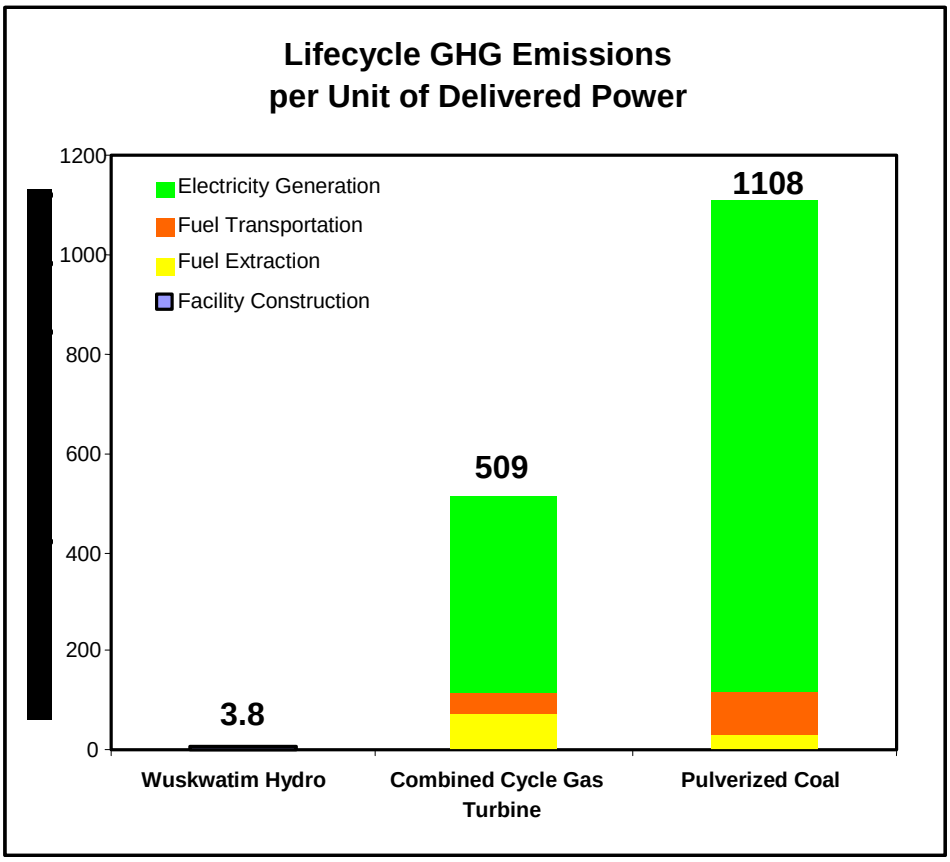
In the 1960s and 1970's, some large-scale hydro projects in Canada resulted in the flooding of thousands of square kilometers of land. Manitoba's "New Generation Hydro" projects have been designed specifically to have minimal flooding. For example, at the proposed Wuskwatim site, Manitoba Hydro worked directly with its Aboriginal partners, the Nisichaywaysikh Cree Nation (NCN) to redesign the project along low-head, run-of-river lines, with the result that earlier expectations of 140 km^2 flooded have been effectively eliminated, with land loss now predicted to be 0.37 km^2 (less area than that of a single, average, Canadian farm). Once finalized, Gull and Conawapa will also be low-impact, run-of-river designs.

The Pembina Institute, one of Canada's leading, independent energy and environmental organizations, calculated that Wuskwatim's total life-cycle GHG emissions, including all generation-related flooding, all transmission lines, all construction and materials, and all operations and maintenance, totalled 3.8 tonnes of GHG per GWh generated. The same lifecycle GHG emissions from a new pulverized coal plant were calculated at 1,108 tonnes/GWh, while those for a combined cycle gas turbine (CCGT) were 509 tonnes/GWh, one hundred and thirty-four times more than Wuskwatim.

[4] Based on the emission factors of 370 tonnes/GWh and 659 tonnes/GWh as used in the Federal government's proposed allocation formulas and Business-as-usual scenarios for Large Final Emitters

[5] Large fossil fuel emitters were provided with a free allocation of emissions allowances; a 15% maximum emission reduction; and a $15/tonne price "cap" – reducing uncertainty for fossil-fired plants, but resulting in the Federal government taking on significant "contingent liabilities."

Figure 7



Source Data: Pembina Institute study, "Life Cycle Evaluation of GHG Emissions and Land Change Related to Selected Power Generation Options in Manitoba."

In addition, both provincial governments have taken action to protect the high value that their citizens place on their Northern Boreal Forest, by ensuring that there are multiple, conceptual transmission options available for consideration from an early stage. A number of Aboriginal communities in Manitoba and Ontario have already shown support for expanded conservation initiatives associated with the Northern Boreal Forest areas. The Manitoba government initiated a broad area planning exercise (now well underway) on the East Side of Lake Winnipeg, and is ensuring that consultations are conducted with Aboriginal communities and stakeholders with respect to any potential future impacts. In Ontario, Hydro One and the Ministry of Energy have already conducted preliminary discussions with Aboriginal organizations regarding the conceptual transmission options.

Environmental Approvals (EA's)

Compared to coal and gas-fired stations, the water, wind and renewably-sourced CETI would significantly reduce CO2 and air emissions, while reducing land loss and forest damage to levels far below those of even CCGT gas plants. Yet the CETI project faces

complex, time-consuming, and costly environmental approvals which are likely to be longer and more costly than for coal or gas-fired projects.

For example, the Wuskwatim facility is a very different system than traditional hydro-electric projects of decades past, in its design, its impacts, and its ownership and direction. Yet it is presently near the end of a five year set of studies, consultations, preparations and approval processes, which will ultimately cost tens of millions of dollars.

At present, Ontario, Manitoba and the Federal government all require formal environmental assessments (under the *Ontario Environmental Assessment Act*, the *Manitoba Environmental Act*, and the *Canadian Environmental Assessment Act).* In May 2000, Canada and Manitoba signed a cooperative agreement to provide for a single EA process, able to meet the requirements of both the Manitoba and Canadian Acts, and are applying this process at the current Wuskwatim hearings. Canada and Ontario are developing a similar cooperative agreement.

While initiatives are underway to further streamline these multiple regulatory approval processes, it is unclear whether and how one EA could meet the requirements of all three jurisdictions. At present, even with the harmonization of the federal and provincial processes, the full process of performing the EA studies, preparing and submitting the project Environmental Impact Statement, plus the regulatory approvals processes themselves may still take four to five years in total. Further work to streamline these three separate Federal and provincial environmental assessment processes is recommended, to address potential regulatory overlap and duplication, and provide for more definitive project timing.

DIVERSITY OF SUPPLY

Ontario is developing a portfolio of actions to stimulate new supply and reduce demand. The CETI is viewed as one potential component of this energy strategy. Diversification of electricity supply is necessary because the successful operation of a modern electrical system requires optimizing numerous variables, including:

- Providing long-term, affordable supply of power;
- Ability to meet peak power needs;
- Minimizing CO2 and air pollutant emissions;
- Minimizing fuel price risk and providing for increased price stability;
- Providing a high level of long-term, technical performance; and
- Maximizing grid reliability.

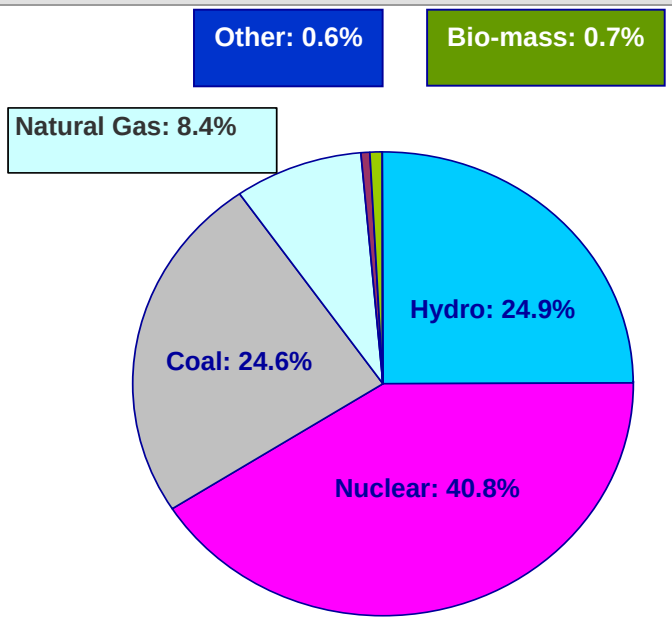
As Table 2 shows, various generation technologies offer specific advantages and disadvantages. For example, CCGT generation can produce peaking power, can have short lead times and low upfront capital costs, and produce moderate air emissions, but has higher fuel costs and risks associated with price volatility and potential supply shortages.

TABLE 2 – CHARACTERISTICS OF GENERATION OPTIONS							
Energy Source	**Prime Use**	**Fuel Cost**	**Capital Cost**	**Plant Life**	**Lead Time**	**Emissions**	**Risks & Limitations**
Combined-Cycle Gas	Peaking/ Inter-mediate	High	Low	20-40 years	Short	Low to moderate air emissions	Supply and price volatility
Coal	Inter-mediate Baseload	Mid	Mid	25-50 years	Medium	High air emissions	Environmental issues (e.g. acid gas, carbon dioxide)
Nuclear	Baseload	Low	High	20-40 years	Long	No air emissions (solid waste issue)	Delays and cost over-runs in the past
Hydro with Reservoir	Peaking/ Inter-mediate	Low	High	100+ years	Long	No air emissions (flooding issue)	Low water years and approvals

A key objective of diversification is to achieve a balanced combination of electricity sources that mitigates the impact of risks associated with various generation technologies.

As Figure 8 illustrates, Ontario's current generation mix is approximately 40% nuclear, 25% coal, 25% hydro and 8% natural gas. Achieving the optimal supply mix will be an important task for Ontario, if coal-fired generation is to be phased out by 2007 along with some nuclear capacity reaching the end of its design life by 2015. If nuclear capacity is extended and additional laid-up nuclear units return to service, Ontario's supply mix in 2015 would be shared among hydro at more than 20%, natural gas at 25%, nuclear at 50% and a rising contribution from emerging renewables plus efficiency and demand-side management reductions. If the life of nuclear plants is not extended and this capacity is replaced by natural gas, the share of gas-fired generation will increase dramatically, to more than 60% of the share. Increasing contributions from renewables and from efficiency and demand-side management reductions will be a factor, but additional new or refurbished supply will be necessary.

Figure 8: Ontario Electricity Supply Mix (2002)



As natural gas takes on a greater share of the generation market, Ontario's electricity supply is expected to be further exposed to the price volatility of natural gas. As the Electricity Conservation and Supply Task Force noted, "recent price volatility suggests that overly heavy reliance on gas-fired generation carries risk for Ontario ratepayers." The purchase from Manitoba would not eliminate exposure to natural gas prices, but it would reduce the exposure of the system to such price volatility and provide a more balanced mix of generation sources.

ECONOMIC IMPACTS

General

The CETI is anticipated to generate additional Canadian GDP of $5.6 billion, while total direct and indirect employment is estimated at 85,000 person-years nation-wide. In addition, increased tax revenues of $1.6 billion are expected to flow to all levels of government. The Federal government will likely receive the largest share of these tax revenues at approximately $700 million.[6]

Manitoba

The initial economic impacts within Manitoba include direct and indirect employment of at least 40,000 person-years. Within Manitoba, Wuskwatim, which is the first generating project planned, will see 19% to 32% of all direct generating station construction jobs held by Aboriginal residents, providing 500 person-years of employment across all Wuskwatim's project components. Larger future projects associated with the CETI will combine to create significant Aboriginal employment with an estimated total within Manitoba of 3,100 direct Aboriginal person years on these projects.

Ontario

Ontario would obtain two major streams of economic benefits from the CETI:

1. The construction of its own transmission line components, triggering investment across Northern Ontario of $1 billion to $1.5 billion. A likely regional impact would be substantial construction-related employment gains across Northern and NorthWestern Ontario. Assuming the economic impacts of an Ontario line are proportional to a Manitoba line, economic impacts in Ontario plus the rest of Canada could include up to $1.1 billion in GDP, tax revenues of $300 million and 17,000 person-years of direct and indirect employment.

2. In addition, Ontario firms, employees and governments will benefit as it is a likely major supplier of equipment and services to the Manitoba-based construction work. This could include equipment such as turbines, generators, transmission components, etc.; engineering, design and financial services. Ontario's supply of goods and services to the Manitoba-based projects alone

[6] Preliminary analysis by Manitoba Hydro estimated the economic impacts of the major CETI components to be built in Manitoba. Certain other major project components were excluded from this preliminary analysis – notably, Ontario-side transmission, resizing converter stations, operating and maintenance, etc. While these components could raise total estimated economic impacts by 25%-50%, the calculations above assumed the more conservative 25%.

would add an estimated $750 million to GDP; create 11,000 person-years of employment; and generate $100 million in Ontario provincial tax revenues.

ABORIGINAL OPPORTUNITIES

Aboriginal communities in Manitoba and Ontario will be key participants in the Clean Energy Transfer Initiative. In addition to their specific rights to consultation under the Constitution Act, Aboriginal groups in Manitoba are already playing a central role in the design phase of the proposed new plants, and are actively engaged in training and employment, as well as financial and business partnership at projects such as Wuskwatim.

In Ontario, Hydro One and the Ministry of Energy have conducted initial information sessions with the Aboriginal Provincial Territorial Organizations regarding areas through which some of the conceptual transmission options might run, including the Nishnawbe Aski Nation (NAN), Grand Council Treaty #3, and the Union of Ontario Indians. In addition, Hydro One has contacted the Chiefs of Ontario, a coordinating body for Aboriginal communities in Ontario. In these sessions, a strong desire has been expressed for lasting benefits for Aboriginal people and an emphasis placed on engaging them at the community level.

Aboriginal communities have expressed a strong desire for substantive involvement in the project at an early stage. A working group of representatives from Aboriginal communities has produced a proposed transmission alternative which will be studied if the project proceeds beyond the feasibility stage. The Ontario members of this working group and many of the potentially affected communities in northwestern Ontario met with Hydro One and the Ministry of Energy to understand and discuss the transmission proposals to facilitate the CETI. They are sufficiently interested that they intend to explore establishing a process to engage affected Aboriginal communities and a Steering Committee to work with Hydro One and the Province on their transmission proposal. Many Aboriginal people have also recognized that a range of associated initiatives has the potential to provide lasting benefits to their communities.

It is clear to all parties that the development of this project will need to respect Section 35 of the *Constitution Act, 1982,* which gives rise to a requirement on governments to conduct meaningful and bona fide consultation with Aboriginal peoples, before taking actions or making decisions (such as resource allocation decisions) on a project that may potentially infringe upon treaty or Aboriginal rights. Manitoba Hydro and Hydro One will also be required to conduct comprehensive public consultation processes with all communities which could be affected.

The historic development of certain hydro-electric projects within Canada imposed significant hardships upon some Aboriginal peoples. In provinces such as Manitoba, this then led to the development of processes for the negotiation and implementation of agreements to compensate for the adverse effects caused by projects constructed in the 1960's and 70's. By the 1990's, relationships amongst governments, utilities and Aboriginal peoples in Manitoba (as in other parts of Canada) began to shift, building upon consultation and compensation processes, and beginning to work toward more direct partnership. For instance, Manitoba now has in place Comprehensive Implementation agreements regarding past adverse effects; Aboriginal people have moved to the heart of Provincial decision-making (with two Cabinet Ministers and the Legislative Speaker); and Manitoba Hydro has now become one of Canada's largest employers of Aboriginal people, with more than 500 employed.

The development of the New Generation Hydro projects will go further in ensuring that the lives and interests of Aboriginal Manitobans are improved. The traditional knowledge and expertise of Aboriginal citizens and communities is being brought into the selection, siting, design and planning of new projects such as Wuskwatim, where this resulted in project design changes which reduced flooding by more than 99%, and the use of traditional knowledge to locate transmission routes. $60 million is being invested in pre-project training for the Wuskwatim and Keeyask projects, to ensure that Aboriginal citizens can reap the full benefits of employment at all stages of project development. Direct construction jobs at Wuskwatim are expected to see 19%-32% employment of Aboriginal residents, with the Wuskwatim, Keeyask and Conawapa projects creating an estimated 3,100 direct person-years of employment for Aboriginal workers.

Perhaps most importantly, Wuskwatim will be a limited partnership between Manitoba Hydro and the Nisichawayasihk Cree Nation (NCN), which has the option of acquiring 1/3 ownership of the project. An Agreement in Principle on this partnership was ratified by the community in 2001, and NCN members will vote on a Project Development Agreement related to their investment. In addition, two of the four First Nations in the vicinity of the Keeyask project have had community votes to ratify Agreements-in-Principle to negotiate a partnership with Manitoba Hydro, while the leadership of the other two First Nations have signed process agreements. Manitoba Hydro is also preparing for initial community consultations on Conawapa with the four First Nations in the vicinity, as well as with fourteen additional communities with interests in the wider region.

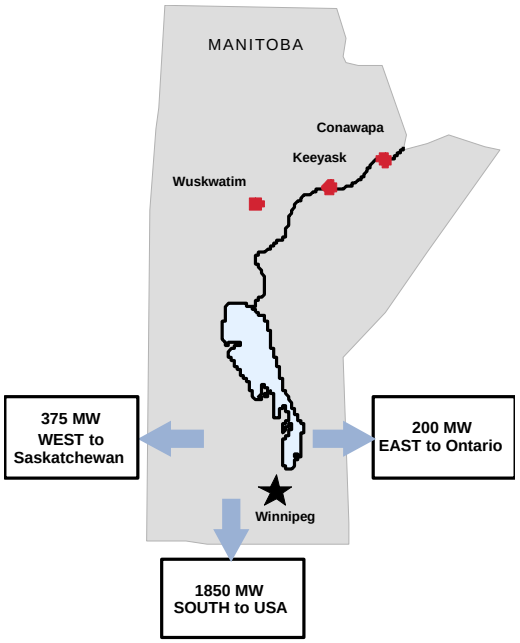
The fulfillment of all requirements for Aboriginal consultation is a central commitment of the CETI proponents. The proponents intend that Aboriginal citizens and communities will have the opportunity to participate fully, including financially, in the short and the long-term benefits of these projects.

NATIONAL GRID - ENERGY RELIABILITY AND SECURITY

The CETI would significantly enhance the historically-weak East-West transmission links within Canada's national grid. Facilitating the sharing of power between Eastern and Western provinces would also strengthen Canada's energy security, and make Canada more independent in electricity supply. Recent years have seen volatile Canada-U.S. events, such as the Blackout, exchange rate shifts and environmental divergence on Kyoto – events which have re-emphasized the need for Canada to ensure its own national grid is in order.

For example, when the August 2003 Blackout struck, the national grid's existing East-West limitations meant that Manitoba could only have supplied a maximum of 200 MW to Southern Ontario. Meanwhile, as illustrated in Figure 9, Manitoba's transmission connections to the US enables the province to deliver up to 1850 MW of power South daily. While the Blackout is unlikely to have been avoided with stronger East-West links, a high-capacity link from Manitoba to Ontario's 500 kV system might have accelerated recovery from this emergency.[7]

FIGURE 9 – MAXIMUM TRANSMISSION CAPACITY FROM MANITOBA

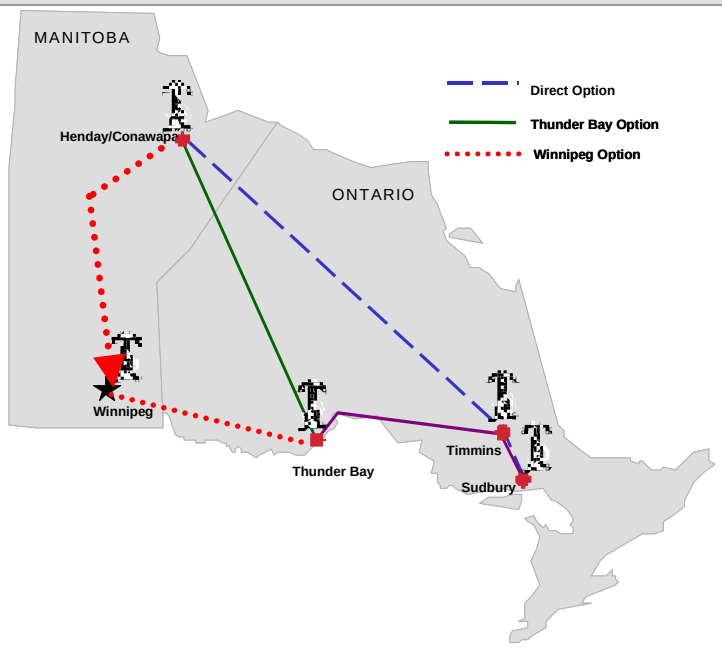


[7] OPG reported that its hydro-electric plants were back online within minutes or hours, rather than days.

As part of the CETI, Ontario and Manitoba reviewed three preliminary conceptual transmission options between and through each province (See Figure 10). Any one of these transmission options will provide an additional transfer capability of up to 1500 MW. These options are intended solely to illustrate the range of possible approaches. A decision on an actual route would only be taken after consultation with affected Aboriginal and other communities and following more detailed technical analysis. The conceptual options were:

i. An HVDC line direct from Northern Manitoba to Sudbury, with improvements and reinforcements to the system from Sudbury to Southern Ontario (the "Direct Option");
ii. An HVDC line direct to Thunder Bay, with an AC line carrying power to Sudbury as well as system improvements and reinforcements South of Sudbury (the "Thunder Bay Option"); and
iii. An HVDC line from Northern Manitoba to Winnipeg combined with a high capacity AC line which would then follow a Southern route to Thunder Bay, and Sudbury, as well as system improvements and reinforcements from Sudbury to Southern Ontario (the "Winnipeg Option").

FIGURE 10 – TRANSMISSION OPTIONS



While all three transmission options would be expected to improve Ontario's adequacy and reliability of electricity supply, the Winnipeg Option and Thunder Bay Option provide additional potential to improve and upgrade service in NorthWestern Ontario and along the route to Southern Ontario's markets.

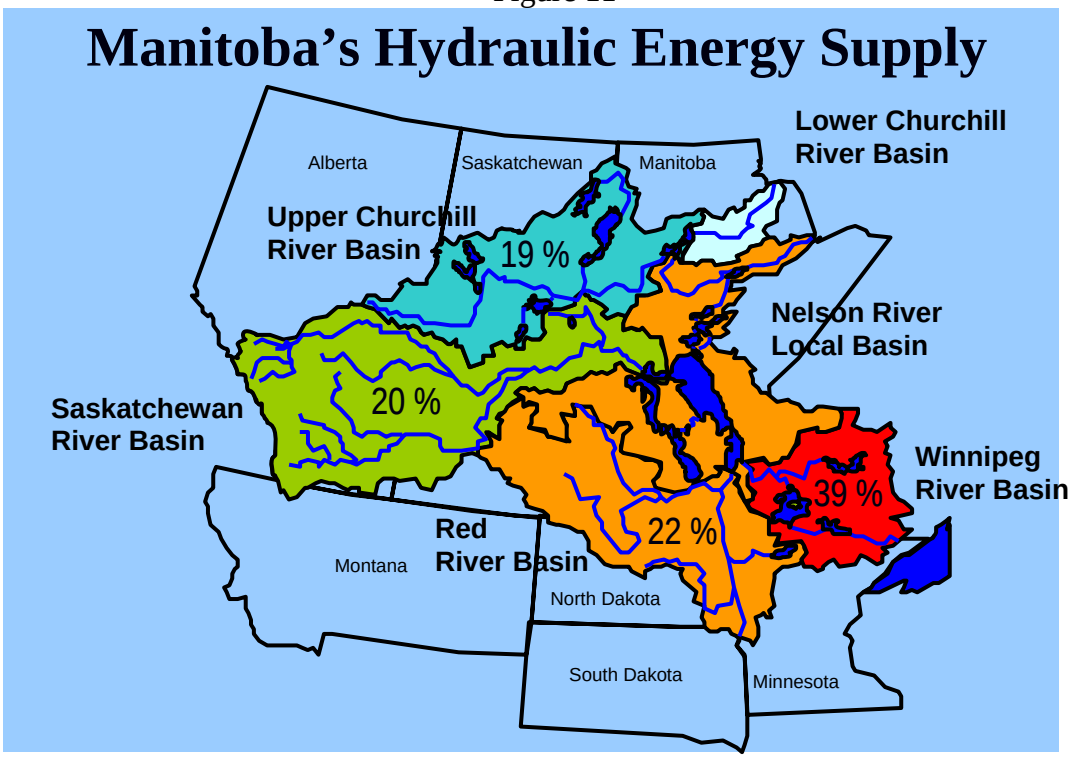
The Winnipeg Option's bi-directional capability could also provide increased system reliability for Manitoba, since it would allow Ontario to provide supply required by Manitoba Hydro in the event of an emergency. In addition, this Option could also allow Ontario to sell Manitoba excess power at off-peak hours, allowing Manitoba to store water temporarily, to be released in order to generate power for Ontario during peak times.

Strengthening the national grid would also further the development of Canada's new clean energy supplies, by potentially improving grid access for renewable resources in regions such as NorthWestern Ontario.

In sum, the CETI would set in place the most significant extension and enhancement of the East-West Canadian Grid in many years.

With respect to the reliability of supply, Manitoba's hydraulic system is supplied by perhaps the continent's most geographically comprehensive and diverse range of watersheds - the Red and Assiniboine Rivers flow into Manitoba from the South and West, the Winnipeg River from the East, the Saskatchewan River from the West, and the Nelson and Churchill Rivers across the North and West, each in turn being fed by many other smaller systems. The result is that Manitoba's overall average water flows fluctuate less than those in an individual system (i.e. the lowest overall historic flows produced only a 30% reduction below average.)

Figure 11



Manitoba's internal system diversity can therefore help provide Ontario both with a guaranteed supply (which it is capable of sending even if facing a repeat of the lowest historic river flows since records began in 1912), as well as with the additional hydraulic energy available during average and wet years. Beyond hydraulic resources, Manitoba also has access to supplemental thermal energy from its existing system, energy from new emerging renewables, plus energy available from other interconnected suppliers.

PROJECT ENERGY COSTS

In assessing the cost of power provided for under the Clean Energy Transfer Initiative, there are three components of cost that need to be considered:

- Development costs to build new generation and transmission;
- Ongoing costs to deliver the energy on a MWh basis; and,
- The monetized value of environmental credits or costs

Use of a levelized unit energy cost (LUEC) calculation can assist decision-makers in comparing various supply options – e.g. to compare a new hydro-electric plant which could operate for 100 years with a combined cycle gas turbine (CCGT) plant which might operate for 20-40 years. Assessment of the economic feasibility of the CETI project assumes that its LUEC would have to be in a range comparable to other likely new sources of power supply to the Southern Ontario market.

Given the scheduled shut-down of existing coal-fired facilities and the potential retirement of nuclear facilities, the most likely alternative for new Ontario supply is currently CCGT. CCGT is a mature generation technology (roughly equivalent to the product offered under the CETI), is able to produce a comparable peaking power product, and has low emissions in terms of air quality and moderate greenhouse gas emissions. New nuclear designs hold potential, but their core product is baseload power, a very different product than peaking power.

Generation Costs:

Looking at the generation costs of CCGT and the CETI, the capital costs for CCGT's are relatively low, natural gas fuelling costs are relatively high and are also subject to significant volatility. The LUEC of electricity generation from a CCGT operating at a 65% load factor ranges from $65 to $78 per MWh under assumptions of low and high gas price scenarios ($5.50 to $7.50 Canadian per MMBtu – although recent gas prices have exceeded this range). The average LUEC would be $71 per MWh. (For a 90% load factor, the average LUEC falls to $62 per MWh.)

By comparison, Manitoba Hydro has estimated the LUEC of the Clean Energy Transfer Initiative, at the generation site, to be approximately $51 per MWh. The $51 per MWh generation price represents an average price based on the expected long term average delivery of a mix of on-peak and off-peak products. A central characteristic of the CETI which must be considered is that in any hydraulic generating system, the amount of energy generated in any one year is largely dependent upon precipitation and river flows, and therefore in lower flow years there will be greater reliance on other system components (i.e. non-hydraulic).

In its initial offer, during highest delivery years, Manitoba Hydro has guaranteed on-peak delivery of approximately 4,200 GWh per year of renewable generation, up to an additional 2,100 GWh during on-peak periods of mostly renewable hydraulic generation, and, with varying degrees of certainty, up to another 6,800 GWh per year during off-peak periods of a mix of hydraulic and other system components. The pricing structure will need to be the subject of further review, but it is anticipated that the first, guaranteed amounts of on-peak power will command a higher price than the surplus energy that will be available in years with very high flows. Thus the range of LUEC's for Manitoba energy, at generation, could vary from about $60 per MWh in very dry years to about $45 per MWh in very wet years, with a long-term average of about $51 per MWh, as previously noted. [8]

Environmental Adders:

As discussed in the Environmental Benefits section, different generation options release a range of air pollutants, many of which are already – or are proposed to be – subject to direct regulation, taxation or cap and trade systems. These result in a range of gross "environmental adders" being placed upon each of the generating options, and producing a set of net environmental credits depending on how each option compares to generating sources which it may actually or effectively be replacing. (See Table 3, below, for estimated environmental adders for advanced CCGT designs and existing coal-fired plants.)

Table 3
Environmental Adders for Levelized Cost
2003 Dollars & 10% Discount Rate

ADVANCED CCGT	Emission Factor tonnes/GWh	Low GHG Levelized Value ($/MWh)	High GHG Levelized Value ($/MWh)
GHG	311	4.28	8.45
NOX	0.06	0.21	0.21
SOX	0	0.00	0.00
Total		**$4.48**	**$8.66**
EXISTING COAL	Emission Factor tonnes/GWh	Low GHG Levelized Value ($/MWh)	High GHG Levelized Value ($/MWh)
GHG	953	13.10	25.90
NOX	1.09	3.80	3.80
SOX	3.92	1.20	1.20
Total		**$18.10**	**$30.90**

[8] While there will likely be non-hydro components in the Manitoba supply mix, the storage and firming capability, and the inter-annual scale of potential fluctuations within the hydraulic system make it the central determinant of overall cost.

Gas-fired CCGT plants are generally accepted as a relatively clean source of generation, producing a likely addition to its LUEC of $4 to $9 per MWh (above), increasing a 65% load factor gas plant's LUEC to $69 to $87 per MWh.

With its minimal air emissions, the LUEC of the CETI project would remain at $51/MWh. If replacing existing coal-fired plants, these options would effectively be credited with the difference between the coal-fired environmental adder and that of their own emissions.

Transmission Costs:

Transmission is the remaining component of the CETI project, with earlier estimates by the two utilities of an initial set of capital costs and levelized costs for the three conceptual line options. Further study has refined the capital cost estimates to $1.5 to $2.4 billion, of which $1.1 to $1.5 billion is attributable to Ontario-side infrastructure.

Calculating a LUEC for a transmission investment requires assumptions not only of the capital cost, but of the likely working life of the assets and the length of the contract, the amount of power flowing through the lines, and the value the line provides to all rate-payers on the network. These factors produce a high-case LUEC of roughly $36/MWh (i.e. assuming a high cost line option, 8800 GWh of power provided, no wider value to rate-payers, no Federal contribution and 100% cost recovery being required over a 20 year contract. Transmission losses are not included in this estimate, and would depend on the final delivery point – they could add up to $12/MWh.) A low-case LUEC would be approximately $10/MWh, and would assume higher power transfers, cost recovery over the working life of the asset, a lower cost line option, some possible Federal contribution and/or some degree of value being provided to ratepayers.

Table 4 (below) shows representative transmission LUEC ranging from $22-$27/MWh based on the direct option and including transmission losses to Sudbury, with the following notes applying:

1. No wider value to rate-payers is assumed from improvements to the adequacy, reliability, price stability and diversity of supply for Ontario. In reality, all line options would contribute benefits toward these objectives, thus potentially justifying the allocation of some costs to the regulated rate base, and reducing costs associated with the CETI.

2. The full cost of the transmission investment is spread only over the power flowing during a possible 20 year contract, while the expected working lifetimes of the transmission assets range from 30-50 years.

3. The Federal government has been engaged in initial discussions concerning contributions to the transmission infrastructure. The CETI would improve the national grid and boost national energy security; and would generate significant economic benefits to Canada, including $700 million in Federal tax revenues. Federal investment in recognition of these benefits would reduce the price for the CETI, and could be structured to produce a net Federal fiscal gain.[9]

4. Capital cost estimates are based on conservative assumptions, and savings could be realized. At the same time, transmission technology choice and route selection have not yet been determined, and could increase capital costs.

5. Energy prices are subject to negotiation and different "packaging" in terms of the product offering, which could lower the final price.

Total LUEC:

An advanced gas CCGT located in Southern Ontario with environmental adders included has a LUEC of $69 to $87/MWh, while the CETI project has a LUEC in the range of $67 to $78/MWh delivered to Southern Ontario, making them roughly comparable.

If the CETI project's LUEC is to be compared with that of an existing coal-fired plant in Southern Ontario, the CETI's LUEC would consist of:

- $45 to $51/MWh as the cost of generation (for average and high transfer levels);
- $22 to $27/MWh for transmission, including line losses; and,
- $18 to $31/MWh as a low and high case environmental credit (with a $25/MWh medium case figure used in the table below.)

The net result is a LUEC of $42 to $53/MWh for the CETI project as compared to existing coal-fired plants (Table 4)

[9] e.g. A Federal investment in transmission might begin to flow in 2007/08; would be paid down over the working life of the asset (30-50 years for transmission assets); and would be more than matched by the upfront, construction-related tax revenues (from 2007-12) – producing a net Federal fiscal gain.

Table 4
LUEC of the CETI Replacing Coal

	8,800 GWh – (Long-Term Average Flows)	**11,000 GWh – (High Water Flows)**
Transmission Cost (including losses)	$27	$22
Generation Cost	$51	$45
Total Cost Before Credits	$78	$67
Environmental Credits (assumed at $25/MWh)	- $25	- $25
Net Cost	**$53**	**$42**

It should be noted that the estimates and comparisons above do not include any financial value from mitigating the risk of high or volatile gas prices; do not include the identified potential improvements which could further reduce the cost of transmission; nor do they place any value on other qualitative benefits of the CETI.

Economic and Public Interest Approvals

Several legal entities would be involved in the economic and public interest review and approval process for this project:

- The Ontario portion of the transmission line is subject to Ontario Energy Board ("OEB") approval; and,
- The Manitoba portion is subject to Clean Environment Commission ("CEC") and, at the discretion of the Manitoba Government, potentially Manitoba Public Utilities Board ("PUB") review. The Manitoba PUB review may be conducted separately or as part of the environmental approval process.

The preparation for and conduct of these reviews and approvals themselves could take four to five years and require coordination with other regulatory processes. For example, the economic review of Manitoba's Wuskwatim project is currently being done in conjunction with the EA. In Ontario, there may be a possibility to combine the OEB and EA processes, but a special regulation is likely required.

CONCLUSIONS AND RECOMMENDATIONS

This study indicates that several tangible benefits could be expected from implementation of the proposed Clean Energy Transfer Initiative. It could:

- Help Ontario make significant progress in reducing the projected supply gap to 2020, contributing to the portfolio of solutions currently being pursued by the Province of Ontario.

- Enhance the national transmission grid, substantially improving the reliability and security of electricity supply for Canadians, and strengthening the largest East-West gap in the system.

- Reduce CO2 by at least 7 Mt per year- Canada's largest single CO2-reducing project. The NPV of its total environmental benefits is estimated at $700 million to $2.2 billion, with the Federal government's GHG savings worth an NPV of up to $1.2 billion.

- Assist Ontario in diversifying its electricity supply, reducing exposure to volatile natural gas prices.

- Create an estimated 85,000 person-years of employment, increased GDP of $5.6 billion, and increased tax revenues to all governments of $1.6 billion, including $700 million to the Federal government.

- Provide Aboriginal communities with significant direct training, employment and business opportunities, as well as with opportunities for ownership and other project partnerships.

- Deliver affordable, predictable and competitively-priced power, when compared to the most likely alternatives.

The benefits associated with the Clean Energy Transfer Initiative are significant and while there are major challenges to the project there do not appear to be any insurmountable obstacles. Therefore, the joint Manitoba/Ontario study team recommends that that the necessary next steps be undertaken, including more detailed engineering and cost analysis; that comprehensive consultations be initiated; and that commercial negotiations begin, supported by the necessary policy and political determinations. It is also recommended that the Federal government be more fully engaged, in recognition of the potential national energy, environmental, and economic benefits.

NEXT STEPS

Given the potential benefits associated with the CETI, further work on this project should be undertaken by the appropriate governments and utilities of Manitoba, Ontario and Canada, including:

By the Ontario buyer or buyers, Hydro One and Manitoba Hydro:

- Develop potential business arrangements including appropriate pricing arrangements.
- Optimize and select a preferred transmission option to be further evaluated, including the definition of the associated ancillary benefits such as local reliability.
- Proponent consultations with Aboriginal and other communities.
- Detailed comparison of the cost of the CETI versus alternative supply sources, which would require the involvement of the eventual Ontario buyer, or a proxy entity for such a buyer.
- Clarify applicable market rules.
- Refine the engineering and cost estimates.

Actions by the Governments of Ontario, Manitoba and Canada should include:

- Determine the value to the Federal government of developing an expanded East-West electricity grid.
- Agree on the quantity, timing, ownership and value of the CO2 credits flowing from the project, as well as the potential for Federal purchases.
- Initiate comprehensive consultations, with the assistance of Manitoba Hydro and Hydro One, that engage Aboriginal people.
- Action to streamline environmental regulatory processes and economic approvals while meeting the requirements of provincial and Federal legislation.

GLOSSARY OF TERMS

Term	Definition
AC	Alternating Current: An electric current that reverses direction, usually at a frequency of 60 cycles per second.
Acid Rain	Rain containing acids that form in the atmosphere when industrial gas emissions combine with water.
Base Load	Minimum continuous load over a given period of time.
Bi-Directional Capability	In the context of electricity transmission, refers to the ability to transmit electricity in two opposite directions.
Carbon Dioxide	Heavy odourless colourless gas formed during combustion of fossil fuels.
CCGT	Combined-Cycle Gas Turbine: Electricity generating station that uses waste heat from its gas turbines to produce steam for conventional steam turbines.
CEC	Manitoba Clean Environment Commission: Arms-length provincial agency that encourages and facilitates public involvement in environmental matters and offers advice and recommendations to the Minister of Conservation with respect to environmental issues, project approvals and environmental licenses.
CETI	Clean Energy Transfer Initiative.
Clean Energy Transfer	Project related to a long-term power supply arrangement between Manitoba and Ontario.
Clean Energy	Electricity deemed to be generated in an environmentally less intrusive manner than most traditional generation, usually in accordance with standards established by government or regulatory agencies; sources include wind, water, biomass, natural gas, nuclear and solar.
Coal Generation	Use of coal to generate electricity.
Cogeneration	Simultaneous production of electricity and thermal energy in the form of heat or steam from a single fuel source.

Conawapa site	A 1,250 MW potential hydro development, located on the Nelson River in Northern Manitoba.
Contractual Guarantee	Minimum purchase of electricity and other guarantees under the Clean Energy Transfer Initiative.
DC	Direct Current: An electric current that flows in one direction steadily.
Direct Option	An HVDC line direct from Northern Manitoba to Sudbury, with improvements and reinforcements to the system from Sudbury to Southern Ontario (the "Direct Option").
Dirty Power	Electricity generated from environmentally harmful generation options.
Discount Rate	Rate of return used to calculate the present value of monetary values.
Distribution	The delivery of energy to retail consumers connected to the low-voltage power system.
DSM	Demand Side Management: Any program or action which reduces the amount of energy consumed.
Electricity Act	The key piece of Ontario provincial legislation, enacted in June 1999, intended to facilitate competition in the generation and sale of electricity.
Electricity Conservation and Supply Task Force	A group of experts and leaders from the electricity sector, established by the Ontario government in June 2003 to develop an action plan for attracting new generation, promoting conservation and enhancing the reliability of the transmission grid.
Emission	A discharge into the air, land, or water from an industrial process, transportation vehicle, household activity, or other source.
EA	Environmental Assessment
Fossil Fuel	Remains of organisms embedded in the earth's crust, with high carbon and/or hydrogen content and used as a source of energy (e.g., coal, oil, natural gas).
GDP	Gross Domestic Product: Total market value of goods and services produced by workers and capital during a given period (usually 1 year).

Geothermal Energy	Energy extracted from the earth, usually in the form of steam that can be used for ground source heat pumps, water heating, or electricity generation.
Generator	An entity that owns/operates an electricity generating plant.
GHG	Greenhouse Gas: Emissions that contribute to Climate Change.
Grid	A network of electric power lines and connections.
GW	Gigawatt: 1,000 megawatts (MW) or one billion watts (W).
GWh	Gigawatt-hour: One million kilowatt-hours.
HVDC	High Voltage Direct Current: High voltage transmission of direct current.
Hydro One	A company established by the Electricity Act, whose principal business is the transmission and distribution of electricity in Ontario and to interconnected markets. It is 100% owned by the Province of Ontario.
ICGCC	Integrated Coal Gasification Combined-Cycle: Derivative of coal generation that reduces high emissions associated with coal generation.
IMO	Independent Electricity Market Operator: A non-profit, regulated corporation established by the Electricity Act. Roles involve overseeing the operation of the Ontario wholesale electricity market and managing the reliability of the high-voltage power system.
IMO Market Rules	Rules made and enforced by the IMO that govern the IMO-controlled grid and that establish and govern the IMO-administered market relating to electricity and ancillary services in Ontario.
Keeyask Site	Potential hydro development in Manitoba capable of generating 620 MW of power.
kV	Kilovolt: A unit of potential difference equal to 1,000 volts.
KW	Kilowatt: 1,000 watts (W) or 1.34 horsepower.

KWh	Kilowatt-hour: The amount of electrical energy produced or consumed by a one-kilowatt unit for one hour (1,000 watt hours).
Kyoto Protocol	Under this treaty, most industrialized nations and some central European countries agreed to legally binding reductions in greenhouse gas emissions between the years 2008 and 2012, the time period identified as the first emissions budget period.
Levelized Unit Energy Cost	Levelized Unit Energy Cost (LUEC) is the cost of the resource, to the purchaser, expressed in dollars per unit of energy produced by the option over its useful life. Costs are based on present value analysis and are expressed in constant year 2003 dollars.
Load	The amount of electric power or natural gas volume delivered or required at any specific point or points on a system. The requirement originates at the energy-using equipment of the consumer.
Manitoba Hydro	Manitoba's major energy utility. Virtually all electricity generated by the provincial Crown Corporation is from self-renewing water power.
MMBtu	One million British thermal units.
MOU	Memorandum of Understanding dated June 20, 2003 between the governments of Ontario and Manitoba calling for research into the feasibility of the Clean Energy Transfer
MW	Megawatt: 1,000 kilowatts (kW) or one million watts (W). Unit of electrical power commonly used to measure the capacity of a generating station or the maximum demand of a large electrical consumer.
MWh	Megawatt-hour: A measure of the energy produced by a generating station over time; 1 MW of power produced for 24 hours provides 24 MWh of energy.
Mt	Mega-tonne - One million tonnes
NOx	Various forms of nitrogen oxides (NO, NO2, NO3): gases produced in combustion processes which contribute to smog and acid rain.
Nuclear Power	Power generated at a station where the steam to drive the turbines is produced by heat from atomic energy.

OEB	Ontario Energy Board: A regulatory agency of the Ontario government. An independent, quasi-judicial tribunal created by the Ontario Energy Board Act. Although it reports to the Legislature through the Minister of Energy, the Board operates independently from the Ministry and all other government departments in the performance of its regulatory functions and responsibilities.
Peaking Capacity	Generating capacity used to meet the peak demand for electricity, typically during daytime hours.
Present Value	The current value of a future amount after allowing for the time value of money. Equivalent to the principal which, drawing interest at a given rate, will amount to the given sum at the date on which this is to be paid.
PUB	Manitoba Public Utilities Board: Regulates a number of Manitoba public utilities.
Regulator	An entity that, through power of law or some other legitimate means, has the authority to impose regulation.
Renewable Energy Sources	Energy sources that are renewed by natural processes including wind, biomass and biogas, solar, geothermal, water, wave and tidal.
Re-Runnering	The replacement of water turbines at an existing hydro generating station with a modern, more efficient design .
RFP	Request for Proposal: An invitation for providers of a product or service to bid on the right to supply that product or service to the individual or entity that issued the RFP.
Smog	Air pollution created from a mixture of air pollutants.
Solar Energy	The radiant energy of the sun that can be converted into other forms of energy, such as heat or electricity.
SOx	Various forms of Sulphur Oxides, primarily SO2, Sulphur Dioxide: Colourless toxic gas present in industrial emissions; causes acid rain.
Supply Mix	Refers to the different types of fuel which are used to produce electricity in a particular jurisdiction.

Thunder Bay Option	An HVDC line direct to Thunder Bay, with an AC line carrying power to Sudbury as well as system improvements and reinforcements from Sudbury to Southern Ontario.
Transmission	Movement or transfer of electricity over an interconnected group of lines. Transmission of electricity is done at high voltages (50kV or higher in Ontario); the energy is transformed to lower voltages for distribution over local distribution systems.
TWh	Terawatt-hour: One billion kilowatt-hours (KWh).
Volt	A measure of electrical "pressure". Defined as a unit of electrical potential equal to the potential difference between two points on a conductor carrying a current of 1 ampere when the power dissipated between the two points is 1 watt.
Wind Power	Electricity produced from a system of airfoils or blades that spin a drive shaft to capture the kinetic energy of the wind.
Winnipeg Option	An HVDC line from Northern Manitoba to Winnipeg combined with a high capacity AC line which would follow a Southern route from Winnipeg to Thunder Bay and on to Sudbury, as well as system improvements and reinforcements from Sudbury to Southern Ontario
Wuskwatim Project	Potential hydro development in Manitoba capable of generating 200 MW of power.