The Power of Mutual Benefit

An outline of the potential benefits of increased Ontario-Quebec electricity trade

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In June 2008 the Governments of Ontario and Quebec set the stage for a new era of climate awareness and action during their historic joint cabinet meeting in Quebec City. As part of this meeting, they signed a farsighted Memorandum of Understanding on Energy that called for building "on synergies between the two provinces' electricity systems and [working] toward more interconnected electricity systems by identifying and acting on opportunities to improve planning coordination, cooperate on system operations, and encourage greater electricity interconnectedness, where practical."[1]

Achieving the vision outlined in the Memorandum will help both provinces in assuring future prosperity while reducing their collective climate impact. Leadership in building cooperation on electricity usage and generation will help them become North American leaders in developing green economies. The "synergies", noted in the Memorandum, are vast — from significantly reduced greenhouse gas emissions to major cost savings on new generation and new revenue flows to fund vital public services.

Ontario and Quebec have set the stage for a new era of climate awareness and action — action that can be supported through increased cooperation between the provinces' electricity systems

With the completion of the new 1,250 megawatt (MW) interconnection between Quebec and Ontario in 2010, the total transfer electricity transfer capacity between the two provinces will rise to 2,788 MW.[2] Furthermore, all of Ontario's coal-fired generation will be phased-out by 2014 and most of the province's nuclear generation capacity will come to the end of its life during the next 10 to 15 years.[3] As a result, the opportunity exists to achieve very significant economic and ecological benefits by integrating Quebec's and Ontario's electric power systems. This briefing paper will outline four key electricity services that Quebec could provide Ontario, as well as the resulting benefits for Quebec.

Peaking electricity supplies

Ontario's electricity demand peaks on hot summer days when the province's air conditioners are running full out. The Ontario Power Authority (OPA) is proposing to contract for the construction of 1,350 MW of simple-cycle natural gas-fired generation capacity to meet the province's peak day demands.[4] As a result of its very low energy efficiency (36%) and very low annual capacity factors, the cost of peaking gas-fired generation is very high at approximately $1.35 per kWh.[5]

On the other hand, Quebec's electricity system peaks on cold winter days. As a consequence, Quebec has significant surplus electricity generation capacity on hot summer days. In 2007 Hydro Quebec's average revenue from its electricity exports was 8.2 cents per kWh.[6]

The difference between Ontario's cost of peaking supplies and Quebec's average export revenues is $1.27 per kWh ($1.35 – 8.2 cents). Fifty per cent of this cost differential is 63.5 cents per kWh. If Ontario were to purchase peaking supplies

from Quebec for 71.7 cents per kWh (8.2 plus 63.5 cents per kWh), Ontario would save 63.5 cents per kWh and Quebec would gain 63.5 cents per kWh. The total economic benefit would be $85.7 million per year for each province.[18] An additional major benefit is that the smog and greenhouse gas emissions from the gas-fired peaking plants would be eliminated.

Firming services for wind generation

Wind power is a relatively low cost source of clean, renewable energy. Furthermore, Ontario's total wind power potential is 10 times greater than its total annual electricity consumption.[7] On the other hand, wind power is intermittent and therefore, by itself, it cannot provide a constant firm supply of electricity.

By integrating Ontario's wind generation with Quebec's hydro-electric reservoirs, wind power can be converted into a constant 24/7 source of electricity supply.

However, by integrating Ontario's wind generation with Quebec's hydro-electric reservoirs, wind power can be converted into a constant 24/7 source of electricity supply. For example, when its wind generation is above average, Ontario could export its excess wind generation to Quebec. As a result, Hydro Quebec could reduce its hydro-electric generation and store more water behind its hydro-electric dams. Conversely, when Ontario's wind output is below average, Hydro Quebec could increase the output of its hydro-electric generation stations and export electricity to Ontario. On an annual basis Ontario's net wind exports to/imports from Quebec would be zero. Nevertheless, since the output of Ontario's wind farms is greater during the winter than the summer, Ontario's net wind exports to Quebec during the winter would help Hydro Quebec meet its annual peak day demands.

In short, by integrating Ontario's wind generation with Quebec's hydro-electric reservoirs, Ontario's intermittent (variable) wind generation can be converted into a firm (non-variable) renewable electricity resource for Ontario consumers while also assisting Quebec to meet its winter peak day demands.

Hybrid Water/Natural Gas Generation

By 2010 Ontario will have 4,183 MW of natural gas-fired combined-cycle generation capacity.[8] These power plants can provide Ontario with a very reliable, firm source of electricity supply. Furthermore, the greenhouse gas emission rate per kWh of these gas-fired power plants is 70% lower than those of Ontario's dirty coal-fired power plants.[9]

While Hydro Quebec does not currently have excess hydro-electric generating capacity at the time of its peak annual demand (a cold winter day), it does have excess generation capacity during the spring, summer and fall. As a consequence, in 2007, Hydro Quebec was able to export 17.2 billion kWh of electricity pursuant to short-term contracts.[10] That is, in 2007, Hydro Quebec's short-term export sales were slightly greater than the total output of Ontario's Pickering Nuclear Generating Station.[11] Most of these exports were to the United States.[12]

If Ontario were to import off-peak power from Quebec, it could meet up to 2,788 MW of its needs for firm supply by a hybrid combination of natural gas and water power. If the water power imports were to displace 50% of the annual generation of the gas plants, the combined annual greenhouse gas emission rate of this hybrid electricity supply option would be 85% lower than those of Ontario's dirty coal plants.

Base-load renewable electricity

The Eastmain-1-A/Sarcelle/Rupert Hydro-Electric Project

The Eastmain-1-A/Sarcelle/Rupert "Eastmain" hydro-electric generation project (893 MW) is currently under construction and will be completed in 2012. It will produce 8.5 billion kWh at cost of 5.1 cents per kWh, according to Hydro Quebec.[13]

The Government of Ontario is considering signing contracts for the construction of two new nuclear reactors at the Darlington Nuclear Generating Station. According to Moody's Investors Service, the cost of new nuclear power is 15.1 cents per kWh.[14]

The cost differential between these two sources of base-load (24/7) supply is 10 cents per kWh. If Quebec were to sell 100% of the output of Eastmain to Ontario for 10.1 cents per kWh, it would earn a profit of $425 million per year and the electricity bills of Ontario consumers would fall by $425 million per year.

Wind Power

Hydro Quebec is planning to acquire 3,500 MW of wind generation capacity by 2017. According to Hydro Quebec, this wind generation capacity will produce 10.7 billion kWh per year at a cost of 10.5 cents per kWh.[15]

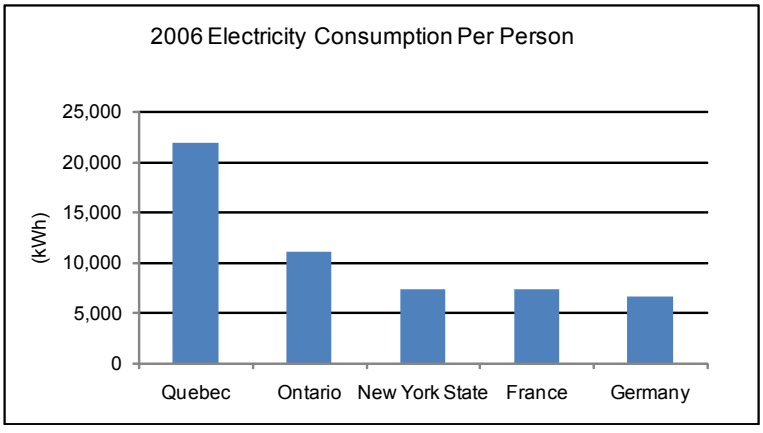
The cost differential between wind power and new nuclear generation is 4.6 cents per kWh (15.1 – 10.5). If Quebec were to sell 100% of the output of its wind farms to Ontario for 12.8 cents per kWh (10.5 plus 2.3), it could earn a profit of $246 million per year and Ontario's electricity consumers would save $246 million per year.

Energy Efficiency

Currently, the domestic wholesale price for Hydro Quebec's heritage water power resources is 2.79 cents per kWh.[16]

Hydro Quebec has set a target of reducing its domestic customers' electricity consumption by 11 billion kWh per year by 2015.[17]

The cost differential between Hydro Quebec's heritage hydro-electric generation and new nuclear generation is 12.3 cents per kWh (15.1 – 2.79). If Quebec were to sell 100% of the reduced domestic demand for its heritage hydro-electric generation to Ontario for 8.94 cents per kWh (2.79 + 6.15), it would earn a profit of $676 million per year and Ontario's electricity consumers would save $676 million per year.



Conclusion

As the above examples indicate, increased electricity flows between Ontario and Quebec could provide economic benefits in excess of $1 billion per year. Depending on the international demand for the output of Quebec's aluminum and pulp and paper industries; the savings produced by Hydro Quebec's energy efficiency programs; and increased inter-provincial transmission capacity; the economic benefits of increased electricity trade between our two provinces could exceed $2 billion per year. These benefits can be realized without the need for Hydro Quebec to commit to additional hydro-electric generating projects.

Increased electricity exports can be realized through the power of greater efficiency and the further development of wind power, one of the lowest impact electricity sources.

Meanwhile, greater system cooperation will also help guarantee a permanent coal phase-out in Ontario and allow the province to reduce emissions from natural gas-fired generation. It will also help to avoid the need for the construction of costly new nuclear plants that will delay greenhouse gas emission reductions and raise reliability concerns. In fact, greater use of hydro imports from Quebec is one of the most secure and cost effective ways to help Ontario move towards a 100% renewable electricity grid.

Endnotes

1 Office of the Premier of Ontario, *Backgrounder*, "Memorandum of Understanding Between the Government of Ontario and the Government of Quebec on Energy", (June 2, 2008).

2 Ontario Energy Board Docket No. EB-2008-0272, Exhibit I, Tab 5, Schedule 6: *Hydro One Networks response to Pollution Probe Interrogatory #6.* URL: www.hydroonenetworks.com/en/regulatory/oeb_applications/EB-2008-0272/Exhibit_I/Tab_5_Pollution_Probe.pdf

3 Ontario Power Authority, *Supply Mix Advice Report*, Volume 1, (December 2005), page 2.

4 Ontario Power Authority, *Integrated Power System Plan*, Exhibit D, Tab 8, Schedule 1, page 16. URL: www.powerauthority.on.ca/Page.asp?PageID=924&SiteNodeID=320

5 According to the Ontario Power Authority (OPA), the Northern York Region simple-cycle gas-fired peaker plant will have a capital cost of $928 per kW. Amortizing this cost over 20 years at a 10% cost of capital and assuming that it operates for 100 hours per year yields a capital cost of $1.09 per kWh. According to the OPA, the fuel and operating costs of a peaker plant are 26 cents per kWh. OPA, *News Release*, "Contract Awarded for Northern York Region Power Plant", (December 11, 2008); and OPA, *Integrated Power System Plan*, Exhibit I, Tab 31, Schedule 6.

6 Hydro Quebec, *Annual Report 2007*, page 101.

7 According to a report prepared for the OPA by Helimax Energy Inc., Ontario's total land-based wind power potential equals 1,711 billion kWh. Ontario's total annual electricity consumption is approximately 150 billion kWh. Helimax Energy Inc., *Analysis of Wind Power Potential in Ontario,* (November 2005), page 15.

8 The following natural gas-fired combined cycle power plants are in service or will be in service in Ontario by the second quarter of 2010. Brighton Beach (580 MW); Greenfield Energy Centre (1005 MW); Portlands Energy Centre (550 MW); St. Clair Energy Centre (577 MW); Goreway Station Project (839 MW); and Halton Hills Generating Station (632 MW). Independent Electricity System Operator, *The Ontario Reliability Outlook*, (December 2008), page 7; and *18-Month Outlook: An Assessment of the Reliability of the Ontario Electricity System: From January 2009 to June 2010*, (December 22, 2008), page 12.

9 According to the Ontario Power Authority, the greenhouse gas emission rates of natural gas-fired combined-cycle and coal-fired power plants are 290 and 1020 kg/kWh respectively. Ontario Power Authority, *Supply Mix Analysis Report*, Volume 2, (December 2005), pages 213 & 226.

10 Hydro Quebec, *Annual Report 2007*, page 101.

11 In 2007 the total output of the Pickering A and B Nuclear Generating Station was 16.855 billion kWh. Ontario Power Generation, *Sustainable Development Report 2007*, page 40.

12 In 2007 Hydro Quebec's net electricity exports to Ontario equaled 838 million kWh which is equivalent to 4.3% of Hydro Quebec's total exports, namely, 19.624 billion kWh. Email to Jack Gibbons, Ontario Clean Air Alliance from Peter Lafoyiannis, Market Information Services, Independent Electricity System Operator, (December 3, 2008); and Hydro Quebec, *Annual Report 2007*, page 101.

13 Hydro Quebec, *Financial Profile 2007-2008*, pages 17 & 20.

14 Moody's Investors Service, *Special Comment: Moody's Corporate Finance,* "New Nuclear Generating Capacity: Potential Credit Implications for U.S. Investor Owned Utilities", (May 2008), page 15.

15 Hydro Quebec, *Financial Profile 2007-2008*, page 13; and Hydro Quebec, *Press Release*, "Tender call for 2,000 MW of wind power: Hydro-Quebec accepts 15 bids", (May 5, 2008).

16 Hydro Quebec, *Annual Report 2007*, page 9.

17 Hydro Quebec, *Press Release*, "Hydro-Quebec Distribution files 2009-2010 rate application", (August 1, 2008).

18 Assuming that the water power imports displace the need for 1,350 MW of peaking gas generation that would have operated for 100 hours per year.

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