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Policy Paper

Atlantic Canada and the U.S. Electricity Market: Projects and Perspectives

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Halifax, Nova Scotia

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About the Author

Gordon L. Weil is a former energy official and consultant. He was chair of the U.S. national organization of state energy agencies and of the negotiations leading to the creation of a single New England transmission system and market. He headed the Maine energy agency and two other state agencies. He is the author of *Blackout,* a book on the restructuring of the electricity market, and several papers published by AIMS. He received a Ph.D. from Columbia University.

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Executive Summary

Atlantic Canada electric utilities have tried to increase their access to the New England markets and have had limited success. Several new transmission links, discussed in this paper, have been proposed to supplement the existing ties. Generation owners in Atlantic Canada have renewed optimism about increasing their New England power sales. However, new Atlantic Canada power exports, valuable because they largely originate from renewable resources, face major challenges that resulted from limits on demand growth because of increased efficiency and conservation, availability of low-cost domestic natural gas for generation, greater use of local New England wind power and competition from Hydro Quebec. Enhanced regional arrangements within the region or the creation of an electricity market including both Atlantic Canada and New England could offer better opportunities for power sales.

Historical view

The development of the electric sector in Atlantic Canada cannot be fully understood without recognizing the influence of the region's continuing efforts to increase access to the New England market.

The most significant element of these efforts has long been the relatively small size of the Atlantic Canada market, while relatively large generating units have been constructed because of the economies of scale they provide. An outlet for sales from these large units has inevitably turned attention to the nearest external market. In addition, Atlantic Canada and New England are, in fact, part of a single region composed of small states and provinces and similar markets. The northern section often seeks a market in the southern section, which is seen as waiting for the opportunity to buy power.

The earliest major interconnection between Maine, at the northern end of the New England system, and New Brunswick, its Atlantic Canada interface, was built to allow the New England Power Pool (NEPOOL) utilities to gain access to competitively priced power from the neighbouring province, notably from the Point Lepreau nuclear station. Over time, NB Power came to see its power sales as an aspect of its business operations and became interested in developing an export business.

NB Power was interconnected with the northern Maine utility, Maine Public Service Company, which was not connected to the rest of New England and consequently was not a NEPOOL participant. NB Power was also interconnected with the Eastern Maine Electric Cooperative (EMEC). Operationally, northern Maine is more a part of Atlantic Canada than it is of New England.

In the case of the major tie and the smaller northern Maine interconnections, the intent was for power to flow from north to south. These transactions could lower rates when compared with oil-fired generation on the New England side and provide revenue to offset the financial obligations of NB Power.

Over time, many transmission projects between New Brunswick and Nova Scotia on one side and New England on the other have been proposed but have not been carried forward to completion. In virtually all cases, uncertainty that the high cost of a project could be justified by the potential market has been the underlying cause of the lack of progress. To a degree, the proposals may be seen as marketing efforts to determine if enough market interest existed to justify proceeding further.

Role of Hydro Quebec

As it developed major hydro generating projects in the north of the province, Hydro Quebec (HQ) looked for export markets, particularly in New York and New England.

The Vermont market, located at Quebec's southern border, provided an opportunity. A transmission link was constructed to feed Vermont utilities.

On a larger scale, HQ saw export opportunities for its excess hydro, which could produce significant revenue to offset in-province costs. Eventually, a transmission interconnection was built through Vermont and New Hampshire, and it was the largest single import conduit for NEPOOL. Power from HQ was transmitted as direct current and converted on the U.S. side to alternating current for the market.

Industry restructuring

In 1992, the U.S. Congress took action that led to the restructuring of the electric industry. This had the effect of making electric transmission a common carrier open for use by any power generator, which can then supply other utilities. These are known as wholesale transactions. This "open access" was available to Canadian suppliers provided their systems were equally open to wholesale transactions from the United States.

In New England, five of the six states — Vermont was the outlier — mandated that their utilities would have to abandon the generating business, thus allowing their end-use retail customers access to supply by others. A transmission provider, often called a wires company, could own generation outside of its service territory, but this did not happened in New England.

NEPOOL gave way to ISO-NE, the independent system operator of the transmission system. A single homogenized transmission tariff for almost all of New England replaced the individual rates for each utility. As a result, the cost to transmit power from Canada was reduced.

One effect of this industry restructuring, not really deregulation as it was often called, was to open markets to Atlantic Canada suppliers.

The New England utilities became attractive to outside purchasers. While U.S. regulation requires an entity that owns both transmission and generation and whose

output may flow over its lines to keep the two businesses separate, there is no deterrent to outside acquisition of the wires companies.

Emera, the Nova Scotia power holding company, acquired Bangor Hydro, at the northern end of the New England system, and Maine Public Service, the New England utility connected only to NB Power. Meanwhile, the two largest Vermont electric utilities merged, and Gaz Métro, a gas company with historical links to HQ, acquired the new entity. Outside interests purchased other utilities in the region.

Current links

NB Power

As New Brunswick is the only Atlantic Canada province sharing a border with New England, all existing transmission interconnections are between it and Maine.

There are now two major transmission lines. On the New Brunswick side, both are owned by NB Power, while at the border, ownership shifts to New England entities.

The older of these is a line from Keswick in New Brunswick to a transmission line originally connected to the now-closed Maine Yankee nuclear power plant. On the U.S. side, this is the Maine Electric Power Company (MEPCO) line, and it has a capacity of approximately 700 MW north to south.

The second line is the International Power Line in New Brunswick and the Northeast Reliability Interconnect in New England. It runs from Point Lepreau to Orrington, Maine, on the Emera system. It raises the total transfer capacity between New Brunswick and New England to 1,000 MW and creates a more reliable path for power to flow northward. Because it was presented as a reliability project, recovery of costs on the U.S. side was made easier by their inclusion in the ISO-NE transmission rate, which is guaranteed to be paid.

Separate from connections with ISO-NE, NB Power has four relatively small links with the Northern Maine Independent System Administrator (NMISA). Three are with Emera's Maine Public District (MPD), as the principal utility in the area is now called, and one is with EMEC. Depending on operating characteristics, they may now amount to approximately 120 MW in total capability.

Hydro Quebec

The main interconnection between HQ and New England is the Phase II line. It crosses the border as an HVDC (high voltage direct current) line, and power is converted to AC in New Hampshire. In effect, it is the single-largest source on the ISO-NE system. This line's capability is rated at 1,400 MW, though it could operate at a higher level if transmission system changes were made. To some degree, the New England system is protected by the ability to limit the total amount of transfer to an

amount below the physical maximum and by the variety of generating resources in Quebec. However, reliability concerns may make a second line more desirable than increasing the transfer on the existing single interconnection.

HQ also has a relatively small 210 MW interconnection with Vermont at Highgate. Because of the size of the Vermont load, this interconnection supports an unusually close relationship with Quebec. Vermont utilities have traditionally looked to HQ for supply, and now a Quebec entity owns the two largest interconnections. Unlike northern Maine, Vermont is also connected to the ISO-NE grid.

Current projects

Over the recent decades, numerous interconnections have been proposed to link the Canadian Maritimes with New England, often with an eye on developments originating in Quebec. Several interconnections are proposed, in development or in the regulatory process.

Nalcor and New England

Nalcor seeks to be a major new entrant into the New England markets. Because of its agreements with Emera regarding the development of Muskrat Falls in Labrador, Nalcor gained transmission access from Emera for 300 MW on the MEPCO line. Though all of the necessary additions to the grid will take place within Atlantic Canada (Labrador-Newfoundland and the Maritime Link between Newfoundland and Nova Scotia), a major advantage would be Nalcor's ability to sell excess power from the new generating resource into the United States. Power should begin to flow by 2018, though if its price could clear the market is not yet known.

In theory at least, power could flow from Atlantic Canada to HQ on the new Muskrat Falls transmission lines and then onward to New England or New York. Such transmission is unlikely, given the high cost of transmission across multiple systems, notably through HQ. Emera might eventually gain access to HQ power over the Muskrat Falls lines.

NB Power and northern Maine

With the closure of generating units in northern Maine, the area under NMISA administration faces the possibility of insufficient reliability. Without actions on the New Brunswick side of the interface, this problem cannot be resolved. All solutions involve some additions to transmission. The Maine Public Utilities Commission (MPUC) is conducting an investigation into northern Maine reliability.

In addition, there is some concern among NMISA participants about the possibility that resolution of reliability issues would involve the interconnection of northern Maine with ISO-NE, which would almost certainly involve higher costs for northern Maine customers.

The most economical solution is likely to involve the upgrading of the Tinker hydro facility in New Brunswick, traditionally part of the northern Maine system from its location near the border, and the improvement of the transmission interconnection with the Emera MPD system. This depends on the New Brunswick Energy and Utilities Board's decisions on cost recovery for related transmission on the NB Power grid.

Also proposed is a direct interconnection between NB Power and Houlton Water Company (HWC), an electric utility in northern Maine. This link would be similar to the long-standing interconnection between NB Power and EMEC. The HWC arrangement would both assure that utility that it could avoid later interconnection with ISO-NE, with related savings, and reduce the reliability problem in northern Maine by effectively removing a portion of the NMISA load.

As part of the consideration of the northern Maine reliability concern, Emera proposed a new 138 KV transmission line between New Brunswick and its MPD system — the Northern Maine Reliability Solution. Emera suggested that the lower-cost Tinker upgrade would not be sufficient. However, the MPUC rejected the Emera proposal, preferring the Tinker upgrade.

Whatever the resolution of the northern Maine reliability issue, it seems that the interconnection between New Brunswick and either NMISA or ISO-NE or both is likely to be strengthened. The major issue to be resolved will revolve around cost recovery for the new lines by NB Power, the province, NMISA, ISO-NE or wind developers. On the New England side, the cost would be too great for the NMISA, requiring that it either be recovered from customers on the larger ISO-NE system or by wind development of sufficient size to require significant transmission. Whether the cost can ultimately be met remains uncertain.

Northern Maine and ISO-NE

In the MPUC proceeding on northern Maine reliability, three other proposals have been advanced for the direct connection of the region to ISO-NE. In theory, they could be linked to a direct Emera line into northern Maine. One is an independent line connecting the MPD to the ISO-NE system (New Hampshire Transmission LLC). Another (Maine GenLead LLC and Northern Maine Interconnection) would connect a wind project to the northern Maine grid to provide increased reliability. .

Perhaps more significant is the third, a proposal involving Emera and Central Maine Power. They have established a partnership to develop transmission for wind

generation from northern Maine to ISO-NE. It would carry at least 250 MW. This project could link northern Maine to ISO-NE, ending the region's separate operation. If Emera developed a line from New Brunswick, it could interconnect Atlantic Canada with this line. Based on a decision by the Federal Energy Regulatory Commission that may require customers to pay for transmission from renewable resources, it is possible that the cost of this line could be recovered from New England customers as part of the ISO-NE rate.

Emera and National Grid have proposed the Northeast Energy Link, a 1,100 MW HVDC transmission line from the Maine end of the two existing transmission interconnections with NB Power to the ISO-NE grid in Massachusetts. The transmission lines would be underground and presumably avoid some environmental objections. It is offered as an alternative to the HQ-driven Northern Pass project (see below), relying instead on Atlantic Canada resources.

An independent company proposed the Maine Green Line, a 1,000 MW HVDC transmission line, to link Maine wind generation and possibly Atlantic Canada supply to ISO-NE by undersea cable.

Reverse flows

While the focus on Atlantic Canada-New England interconnections is on the north-to-south flows from supply to markets, reverse flows are also possible. An international link could occasionally improve the reliability of the Atlantic Canada system or even supply power to replace units that are out of service.

HQ to New England

Northeast Utilities (now known as Eversource Energy) and HQ proposed the Northern Pass Transmission line, which would connect their two systems and run most of the length of New Hampshire. It should carry 1,200 MW. It would import power as HVDC, which would be converted to AC in New Hampshire. The project is in the regulatory process. Though Northern Pass has encountered strong environmental opposition, ISO-NE includes it in its future transmission plans. Faced with environmental objections, the project has been modified to include about 60 miles of underground transmission, which would raise its cost. This project would be larger than the proposed Atlantic Canada interconnections.

A competing proposal is the independently developed New England Clean Power Link. To avoid the kind of environmental objections faced by Northern Pass, this 1,000 MW project would be underwater (Lake Champlain) and underground in connecting HQ with the Vermont transmission company and, in turn, ISO-NE. The development of this project and Northern Pass is highly unlikely, so this must be seen as an alternative to Northern Pass.

Perspectives on projects

The continuing interest in promoting Atlantic Canada exports to New England is based on three considerations: the need for power, the relative cost of power and the required increase in the use of renewable sources in New England. In each case, developments in recent years affect these reasons for importing power.

For decades, New England power generation was heavily dependent on imported oil. With the increased price of Middle East oil beginning in the early 1970s, alternative fuels to displace this generation became attractive. At the same time, greater environmental sensitivity with respect to air quality supported efforts to move away from oil. Coal-fired generation degraded air quality and its use was limited. Natural gas was more desirable, but supplies were not available to a sufficient degree, and its cost was relatively high.

While the region developed nuclear and biomass power, it sought supplies from Canada that would have little or no environmental impact and were available at competitive prices. This led to the construction of the major MEPCO and HQ interconnections. Canadian suppliers could price power below oil-fired generation while keeping the price above the in-province rates. In addition, HQ and NB Power derived income from use of their transmission lines to the border.

In New England, the belief developed that Canadian power, especially power provided by HQ, was inexpensive and would cost less than almost any other alternative. By focusing on Quebec in-province pricing, some political figures concluded that power would be available in the United States at the same rates. This was contrary to HQ price proposals, because the province sought New England market prices rather than the lower charges paid by its provincial customers.

In Atlantic Canada and Quebec, the idea persisted that New England offered a market that was relatively isolated from the rest of the United States and thus would continue to grow as a relatively lucrative market. Accessing this market would require the construction of additional transmission in Canada, but its cost could be justified by long-term power sales to the New England market.

The New England situation has changed in recent years for several important reasons.

1. Thanks largely to encouragement by the U.S. federal government, efficient use of electricity increased, slowing the growth of demand to levels significantly less than had been originally forecast. As nuclear units went out of service, the need for

replacement resources was less than had been expected.

2. Small, dispersed sources known as "distributed generation" began to develop, reducing the need for both large, new units and major imports.

3. U.S. federal and state policies have placed heavy emphasis on promoting the development of renewable power. In many cases, the focus has been on small units, mainly to ensure their in-region development, which would tend to discourage imports from sources like HQ. Accordingly, large-scale hydro imports might not assist states in meeting their renewable supply goals as would smaller hydro facilities. However, this small-unit policy appears to have lost support.

If able to withstand legal challenge, recent action by the U.S. Environmental Protection Agency to improve air quality with further limits on generator emissions will increase opportunities for renewable resources. By participating in the Regional Greenhouse Gas Initiative, most New England states are already generally in conformity with the proposed new standards, so they should not produce much new demand for renewables.

However, distribution utilities in three states — Connecticut, Massachusetts and Rhode Island — are scheduled to seek an estimated 5.1 terawatt-hours (equivalent to the energy from approximately 1,100 MW of traditional generation) of renewables from small and large suppliers. These states want to fill renewable power goals, though state governments cannot mandate specific purchases. Utilities will have to contract for the power subject to regulatory approvals. Proposals not involving new transmission are likely to be less costly than imports.

4. Hydraulic fracturing — fracking — has made natural gas more readily available. Not only has the quantity of natural gas increased, but also its price has been significantly lower than oil. The result is the massive replacement of oil-fired generation by natural gas generation. In short, a domestic fossil fuel has displaced an imported fossil fuel and limited the prospects for imports. In effect, it reduced the relative isolation of the New England electricity market.

Unless they receive tax and other government benefits, wind power generators may also be affected by the availability of low-cost gas. There are already signs nationally that growth in the wind industry is slowing.

5. The restructuring of the U.S. electric industry has also affected imports. Utilities could enter into long-term supply arrangements with Canadian suppliers, thus justifying the construction of necessary transmission on both sides of the border.

In five of the six New England states utilities were required to leave the supply business and focus on the transmission and distribution of power. The daily market or short-term contracts largely replaced long-term arrangements. This could increase the risk for suppliers seeking assurance of long-term power sales to support the cost of new transmission. In Vermont, where the utilities remain responsible for generation and wires, restructuring did not affect long-term arrangements with HQ.

Unfinished projects litter the history of Atlantic Canada proposals for interconnection with New England. Canadian suppliers have been unwilling to take risks building transmission when they do not have firm assurances that they can sell power to the target market. With no certainty about transmission cost recovery, projects were abandoned.

In recent years, Canadian suppliers have sought to enhance the attractiveness of proposed supplies by showing considerable sensitivity to New England environmental concerns. This led to undersea and underground transmission proposals. For the very reasons that defeated earlier proposals, it seems virtually certain that only one or two have a realistic chance of success.

Emera, which was based originally on Nova Scotia Power, appears to have decided that the best method of accessing the New England market is to become a player in it rather than simply seeing it as an export market. As a result, it became the owner of the two smaller of the three investor-owned electric utilities in Maine. It was involved in the development of in-region wind power.

The future relationship between Atlantic Canada and New England

Attempts at further development of Atlantic Canada power exports to New England can be expected to continue. The Nalcor Muskrat Falls sales are planned to take place in the daily market, though their cost will face significant uplift from transmission costs on the systems this power must cross. The NB Power arrangement with HWC, though small, may be completed.

The next steps will be impeded by the developments in New England that are reducing the need for exports, the competition from HQ's Northern Pass and the cost of transmission across at least two systems. Even if the new, renewable supply sought by three states were to be met by Atlantic Canada, it would not justify the expense of a new transmission interconnection. With a relatively small domestic market and significant undeveloped resources such as Labrador's Gull Island and wind across the region, Atlantic Canada utilities may need access to a larger market to absorb some of their production.

While interest has been focused on the New England market, relatively little attention has been paid recently to increasing interprovincial power exchange. For example, the construction of new diesel-fired generation in Atlantic Canada would not seem justified when regional generating resources could be deployed more economically.

The relationship between Atlantic Canada and ISO-NE has expanded in recent years, as more transmission links have been placed into service. Ultimately, a merged market of the two regions could provide benefits to both. This regional arrangement would be more likely to produce a market for Atlantic Canada power than would current proposals, partly as a result of lower transmission costs.

Such a cross-border arrangement is not unprecedented. For example, Manitoba Hydro participates in the Midcontinent ISO, and the NMISA links with the Maritime Balancing Authority/Reliability Co-ordinator.

Whatever the future developments in interregional power and transmission relationships, they will inevitably have to evolve from traditional patterns as loads, markets and regulations reflect changing customer requirements and competing resources.

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