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**From : "McGrath, Rob"**

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**Subject : House papers**

**Attachment : Electricity Imports (Muskrat Debate).DOC;Export Opportunities (Muskrat Debate).DOC;**

Heather,

As requested and discussed, here are the draft imports and exports papers.

Rob

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Record Number : DOC-17015

Title : Electricity Imports (Muskrat Debate)

-----< TRIM Record Information >-----

Record Number : DOC-17014

Title : Export Opportunities (Muskrat Debate)

# Electricity Imports

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Department of Natural Resources

July 2012

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This paper is one in a series by or for the Department of Natural Resources to inform the general public about the Muskrat Falls Project. Topics covered in this series include:

- Energy Plan Overview
- Electricity Demand Forecast: Do We Need the Power?
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- Small Hydro Development as an Alternative to Muskrat Falls
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- Upper Churchill: Can we wait until 2041?
- Electricity Imports
- Export Markets

## Introduction

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One of the main principles of the 2007 Energy Plan was that the people of Newfoundland and Labrador would take ownership of the province's energy resources and would be the primary beneficiaries of its development. In order to meet the province's energy needs with, "environmentally friendly, stable, competitively priced power", and to secure a source of long-term revenue for the province, Government committed to developing the Lower Churchill Project (a separate discussion paper on the Energy Plan is available).

However, as an alternative to developing the province's resources to meet the its electricity demand and displace thermal production at the Holyrood Generating Station, Newfoundland and Labrador Hydro (NLH) could construct a transmission interconnection to regional electricity markets and import electricity.

At the present time, electricity on the Island is generated on an isolated system and as such, does not have the transmission capability to access power from other jurisdictions. Therefore, the two options for importing electricity to the Island would be:

1. A transmission interconnection from Upper Churchill to the Island with the view to importing electricity from or through Quebec (QC);
2. A transmission interconnection from the Maritimes to the Island with the view to importing electricity from or through the Maritimes.

In either scenario, the transmission link would end at Soldiers Pond on the Avalon Peninsula.

Following a summary of the markets and associated transmission/distribution systems, this paper will provide an analysis of the options for importing electricity and a summary of why importing electricity is not a viable solution to meet the province's long-term electricity needs.

### Key Findings:

- Importing power to meet the province's long-term electricity needs is not a viable alternative.
- There are significant issues related to: insufficient transmission capacity in New England/Maritimes; lack of long-term transmission rights in New England and New York markets; and reliability concerns.
- There is a concern about security of supply for both the Maritimes and the New England and New York markets.

July 24, 2012

- As electricity prices in both New England and New York are historically tied to natural gas prices, imported electricity from either market would be subject to price volatility.
- In addition to paying the market price for the electricity, other costs would be factored in to the final price including transmission tariffs and a premium to secure a long-term contract.
- As compared to the Muskrat Falls alternative, Nalcor estimates that the QC import option is \$1.4 billion more expensive, and the Maritime import option is \$1.5 billion more expensive.
- Importing electricity from another jurisdiction would provide limited benefits to the people of the province in terms of employment, income, and business opportunities; particularly when compared with the Muskrat Falls alternative.

## Electricity Imports as a Supply Alternative

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### 1. Electricity Imports through Quebec:

Under this scenario, the construction of a transmission link would be required to enable electricity imports from QC to the Island system. This transmission link would be built from the Upper Churchill to Soldiers Pond.

#### *Supply*

Over 97 percent of QC's electricity is generated by hydropower. Hydro-Quebec (HQ) owns 59 hydroelectric generating stations and three thermal generating stations representing an installed capacity of 36.8 GW. Other sources of electricity include nuclear power, wind and thermal generation.

#### *Distribution System*

TransÉnergie, HQ's transmission division, operates the largest electricity transmission network in North America. It acts as the independent system operator (ISO) and reliability coordinator for the QC interconnection of the North American Electric Reliability Corporation system, and is part of the Northeast Power Coordinating Council (NPCC).

TransÉnergie's network stretches over 33,630 km through a network of 514 substations. In addition to its connections to Newfoundland and Labrador via Upper Churchill, its network is connected to neighbouring provinces of Ontario, New-Brunswick (NB) and the U.S. Northeast (New York and New England) by 17 connections.

**Overview of QC Interconnections**

Neighboring system	Import mode (MW)	Export mode (MW)
New York	1,100	2,000
Ontario	1,945	2,705
New England	1,870	2,260
New Brunswick	785	1,029
Newfoundland and Labrador	5,150	0

Source: Hydro-Quebec : December 31, 2011

HQ sells some of its surplus electricity to the neighboring systems under long-term contracts; however, most of its exports are short-term transactions. In 2010, the value of HQ exports totaled approximately \$1.5 billion.

Currently, HQ has no export capability into NL in terms of physical transmission lines. Consequently, importing through QC could be achieved through a reduction of the electricity delivered from Upper Churchill to HQ. Under this scenario, electricity that is currently sold to from the Upper Churchill to HQ for \$2.50/MWh (reducing to \$2.00/MWh in 2016) would be sold to NLH for considerably higher prices – potentially up to 40 times as high.

## 2. Electricity Imports through Nova Scotia

Under this scenario, the construction of the Maritime Link would be required to provide electricity imports through Nova Scotia to the Island portion of the Province.

### *Market Structure*

Nova Scotia Power Incorporated (NSPI) is the utility that provides 97% of the generation, 99% of the transmission, and 95% of the distribution in the province of NS. The remaining distribution is owned and operated by NS's six municipal utilities. NSPI was privatized in 1992, and is now owned by Emera Inc., a publicly-traded company.

July 24, 2012

NSPI has a generating capacity of 2,368 MW and operates a variety of generating stations using various sources of energy including coal, natural gas and renewables. NSPI also purchases energy from independent power producers who generate electricity using wind, hydro, and biomass.

New Brunswick Power (NB Power) is an electrical utility wholly owned by the Government of NB. NB Power operates 14 generating stations and serves over 370,000 direct customers. The generation fleet uses a variety of energy sources, including hydro, nuclear, heavy fuel oil and coal.

NB is interconnected to neighbouring power systems in QC, New England, NS, Prince Edward Island (PEI), Northern Maine, and Eastern Maine. NB's Open Access Transmission Tariff (OATT) allows NS and PEI to have access to the U.S. markets due to the possibility of wheeling power through NB. For example, NS currently exports electricity through NB and receives backup power from that province.

#### Overview of NB Interconnections

Interconnection Transfer Capability Neighbouring System	Transfer Capability to New Brunswick (MW)	Transfer Capability from New Brunswick (MW)
Québec	1,000	720
New England	550*	1,000
Nova Scotia	350**	300**
Prince Edward Island	124	222
Eastern Maine	15	15

\*Transfer capability from New England varies according to Maritimes Area largest contingency, load levels in Maine, status of area 345 kV MVAR resources, and the generating status of large generators near Bangor, Maine.

\*\*Transfer capability to and from Nova Scotia is constrained by the import and export limits of the Nova Scotia electricity system.

## Analysis

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July 24, 2012

Importing electricity as a solution for the province's long-term energy requirements raises a number of significant issues that resulted in Nalcor determining that this alternative was not viable.

### *Transmission*

- 1. Insufficient existing transmission capacity in New England/Maritimes:** the current import capacity from NB to NS is limited to 350 MW. Similarly, the connection between New England and NB has a maximum of 300 MW of firm capacity. NL requires 500+ MW of firm capacity to meet its peak demand. Thus, it is technically not possible at this time to meet the Island's demand solely with imported electricity from New England or the Maritimes.
- 2. No long-term physical transmission rights in New England/New York markets:** there are currently no long-term physical transmission rights (beyond 1 to 2 years) in the New England and New York markets. This presents considerable risk with respect to securing supply to meet the province's energy needs.
- 3. Reliability concerns:** to allow imports through NS, the Maritime Link would likely be required to reverse power flow direction on demand to compensate for generation variability on the Island. While this is technically possible, neither the NS nor NL systems have the ability to absorb these swings; consequently, outages would be likely. Additionally, importing electricity through NS via the Maritime Link to the load centre on the Avalon Peninsula would require the construction of additional transmission lines on the Island to ensure reliability.

### *Supply*

- 1. Uncertain security of supply:** similar to NL, both NS and NB are winter peaking systems. This means that they consume the most power in the winter months, which is when NL also would require the most power. Therefore, surplus capacity in those jurisdictions is not expected to be available to import into NL. Additionally, beyond 2015, both New England and New York are potentially facing significant plant retirements due to the age of the generation fleet and because a significant proportion of generation in the regions is carbon-fuelled (coal and gas in particular). The New York Independent System Operator predicts that almost 24,000 MW of generation capacity will be impacted by more stringent Environmental Protection Agency regulations; similarly, the New England System Operator estimates that between 5,800 and 8,700 MW of generation capacity will be impacted. The uncertainty of future generation sources in New England and New York presents considerable risk with respect to securing supply to meet the province's energy needs.

### *Price*



July 24, 2012

1. **Price volatility:** there is a strong correlation between electricity prices and natural gas prices in both New York and New England markets. As such, the imported electricity from either market would be subject to gas price volatility.
2. **Additional costs:** in addition to the market price for electricity in either scenario, there are a number of additional costs that would have to be factored into the final price to deliver the electricity to the province. Examples of these costs include: transmission tariffs; and, a premium for securing long-term contracts.
3. **Comparison with Muskrat Falls:** when all costs are taken into account, including the market price, transmission tariffs, and premiums for securing long-term contracts, both import options are significantly more expensive than the Muskrat Falls alternative. Using the New York market price, Nalcor estimates that importing electricity from QC is \$1.4 billion more expensive. Using the New England market price, Nalcor estimates that importing from the Maritimes is \$1.5 billion more expensive.

#### *Benefits*

1. **Limited long-term benefits:** importing electricity from other jurisdictions to meet the province's long-term electricity needs would provide limited benefits to the people of the province in terms of employment, income, and business opportunities; particularly when compared with the Muskrat Falls alternative.

## Conclusion

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As an alternative to developing the province's resources to meet the its electricity demand and displace thermal production at the Holyrood Generating Station, Newfoundland and Labrador Hydro (NLH) could construct a transmission interconnection to regional electricity markets and import electricity.

The two options for importing electricity to the Island would be:

1. A transmission interconnection from Upper Churchill to the Island with the view to importing electricity from or through Quebec (QC);
2. A transmission interconnection from the Maritimes to the Island with the view to importing electricity from or through the Maritimes.

In addition to technical limitations, there are a number of risks and uncertainties associated with either option related to transmission, security of supply, and price. Additionally, importing electricity to meet the province's long-term electricity needs would provide limited long-term benefits to the people of the province as compared with the Muskrat Falls

options. Consequently, the reliance on electricity imports as a long-term supply option for the province is not viable.

# Export Markets

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Department of Natural Resources

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## 1. Introduction

The 824 MW Muskrat Falls Project is first and foremost a domestic project to meet the province's long-term electricity needs in a least cost manner. Irrespective of the potential value of the surplus electricity that will be generated, the Muskrat Falls Project has been independently shown to be the least cost alternative to meet the province's electricity needs.

The Muskrat Falls Project will initially generate 40% of its power for domestic use. Through an agreement between Nalcor and Emera Inc., 20% of the remaining Muskrat Falls power will be delivered to Nova Scotia for 35 years in exchange for the construction of the Maritime Link, and the excess 40% of power generated at Muskrat Falls (over 300 MW) will be utilized through a combination of serving industrial demand in Labrador and selling into markets.

With respect to exporting power from Muskrat Falls to external markets, there are four key considerations to be addressed:

1. access to markets
2. price competition in those markets
3. selling potential
4. maximizing value

This paper will address these considerations and explain why Muskrat Falls power will be sold into export markets for profit.

### Key Findings:

- Nalcor has secured transmission access for Muskrat Falls power through the Maritimes and into the New England market via its agreement with Emera Inc. Nalcor also has existing access to New York, New England, Ontario, and New Brunswick.
- Muskrat Falls power will be priced in the markets at the cost of transmission only which will make it competitive with other generation sources such as coal, oil, and gas.
- The New England market is forecasting steady demand growth in the coming years.
- Despite a current surplus of capacity, beyond 2015, New England is facing significant plant retirements.
- The combination of secured transmission access to markets, competitive price, and existing water management arrangements will ensure that the value of surplus Muskrat Falls power will be maximized.

## 2. Access to markets

Nalcor already has access to markets and has been selling electricity into these markets every day since 2009. Through a 265 MW long-term transmission reservation on the Quebec transmission system, Nalcor has access to New York, New England, Ontario, and New Brunswick markets for Upper Churchill recall power. This reservation has the capability to transmit up to 2.3 TWh of energy annually.

For surplus Muskrat Falls power, Nalcor's agreement with Emera Inc. will result in the construction of the Maritime Link which will connect the Island system with North America. The agreement also provides Nalcor with transmission rights through Nova Scotia, New Brunswick, and into New England for 50 years.

The combination of these transmission arrangements gives Nalcor access to electricity markets in Quebec, Ontario, Nova Scotia, New Brunswick, Prince Edward Island, New York, and New England. Of course, none of these agreements preclude Nalcor from seeking additional transmission capacity should it be required and is economically viable.

### 3. Price Competition

The New England market has a significant amount of natural gas capacity which has had, and will continue to have, an affect on the market price for electricity. Historically, natural gas has been the price-setter in the New England market as there has been a strong correlation between electricity prices and natural gas prices. Although these prices are subject to volatility, the current price for natural gas is low and as a result, electricity prices in the New England market are low as well. However, while the price will vary, there will always be a market to sell electricity.

The cost to produce the surplus power at Muskrat Falls is essentially zero. Consequently, the only costs to Nalcor to get the surplus Muskrat Falls power to market are the costs associated with transmission in other provinces. As a result, Muskrat Falls energy will be priced at the cost of transmission only, which will make it competitive to other sources of generation in the market such as coal, oil, and gas.

These transmission costs are regulated and, while the total cost will depend on the market in which the electricity is being sold, the current estimated cost to transmit to New England, for example, via the Maritime route is approximately \$10/MWh.

### 4. Selling Potential

There are two basic market structures in the regions that Nalcor will be selling surplus Muskrat Falls electricity. These are best described as "contract" markets or "financially settled" markets.

The markets in Quebec, Nova Scotia, New Brunswick, and Prince Edward Island are contract based markets in which electricity sales are made between a willing seller and a willing buyer. Since 2009 Nalcor has entered into many contracts to sell surplus recapture energy from Upper Churchill to Nova Scotia and New Brunswick.

The markets in New York and New England are financially cleared markets in which multiple generators submit bids to the entire New York or New England system and those that are competitive “clear” the market and sell into the market at the “market clearing price”. The market in Ontario is best described as a hybrid of these two types of markets.

As previously mentioned, Nalcor has secured transmission access through the Maritimes and into New England. The New England Market is operated by the Independent System Operator-New England (ISO-NE) and serves over 14 million people in six states: Connecticut; Maine; Massachusetts; New Hampshire, Rhode Island and Vermont. ISO-NE’s bulk power generation and transmission system provides for more than 34,000 MW of capability.

At present, the New England market has a significant surplus of capacity in excess of 4,000 MW, and this surplus is projected to remain until 2020. However, New England is forecasted to see steady growth in demand in the coming years. Additionally, beyond 2015, New England is potentially facing significant plant retirements due to the age of the generation fleet and pending environmental regulations that may affect the region’s carbon-based generation. ISO-NE estimates that between 5,800 and 8,700 MW of generation capacity will be impacted.

Nalcor has been participating in these markets since 2009 and has successfully sold power from this province to external markets since that time. The competitive price of Muskrat Falls power in these markets will ensure that it will be sold for profit.

## 5. Maximizing Value

Acknowledging that the fundamental business case for Muskrat Falls is to meet the province’s long-term electricity needs in a least cost manner, it is also vital to achieve maximum value for the energy that is surplus to domestic needs. The alternatives for this surplus energy are to either: do nothing and forgo the opportunity to earn additional revenue for the province; or sell the surplus energy into markets for profit.

As previously discussed, given the secured transmission access and its competitive price, Muskrat Falls energy will be competitive in export markets. Based on Decision Gate 2 estimates, if Nalcor sold the surplus Muskrat Falls only in New England market, the net profit would be in excess of \$325 million (2012 dollars) over the life of the project.

Additionally, existing Water Management arrangements enable Nalcor to store energy in the Upper Churchill reservoir and release it at times that offer greater value in the markets. These combined factors ensure that the maximum value for the surplus Muskrat Falls power is achieved.

## 6. Conclusion

There are four key considerations to assess for the export of power from Muskrat Falls to external markets:

1. access to markets
2. price competition in those markets
3. selling potential
4. maximizing value

With respect this assessment: Nalcor has secured long-term transmission access to multiple export markets; Muskrat Falls power will be priced competitively in these markets which will ensure it will be sold for profit; and, the combination of all of these factors, along with the water management arrangements, will extract maximum value for surplus Muskrat Falls energy.