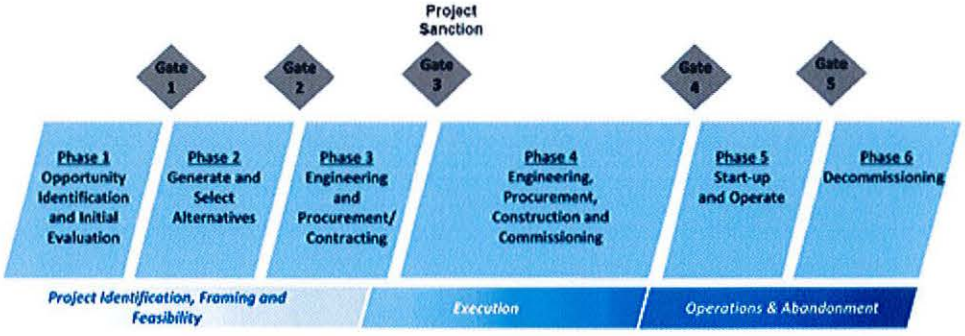
Information Note
Department of Finance

Title: Economic Opinions on Development of Muskrat Falls

Issue: Review and analysis of opinions of economic experts David Vardy, Jim Feehan and Wade Locke on the development of Muskrat Falls as the least-cost option for Nalcor to address forecasted capacity shortfalls.

Background and Current Status:

- The August 2011 environmental assessment conclusion that Nalcor's proposal to development Lower Churchill hydroelectric generation potential through facilities at Muskrat Falls and Gull Island had not sufficiently demonstrated energy or economic justification for the project led to a host of independent assessments by economic experts in the following months.
- The most prominent assessments have been put forth by David Vardy, a former provincial deputy minister and former chairman of the Newfoundland and Labrador Board of Commissioners of Public Utilities (PUB); James Feehan, a Memorial University of Newfoundland (MUN) economics professor and renowned expert on Churchill Falls; and Wade Locke, a MUN economics professor with expertise in resource economics who has been contracted by Nalcor for economic analysis projects in the past.
- At this point the development of Muskrat Falls, which would be brought online before Gull Island in the Nalcor proposal, is in the third phase of the Nalcor Gateway Process (see graphic below).



(Source: Nalcor)

This phase requires an environmental impact statement for the underwater transmission line, a public review, an environmental approval, updating of commercial arrangements (costs/timelines from vendors), updating of the project schedule and arranging for financing. Upon completion of this phase, the information will be compiled into a sanction package which will be presented to government in order to facilitate a decision to proceed with full construction or abandon the project altogether.

- The PUB has been commissioned by the provincial government to conduct a public review in order to determine if Muskrat Falls is the least-cost energy alternative for Newfoundland and Labrador on a go-forward basis. The original deadline for the PUB report was December 2011, however the provincial government decided to push this back to March 31, 2012 at the PUB's request. Recently the PUB has come out saying it needs another extension, citing communications problems with Nalcor, but this request has been denied.

- Manitoba Hydro was commissioned by the PUB to conduct an independent report on the viably of the Muskrat Falls project as part of the PUB's review. This report is expected to be released early February 2012.
- Nalcor has estimated that Muskrat Falls is $2.2[1] billion cheaper, in present value terms, compared to pursuing an isolated island energy policy that relies on developing small hydroelectric projects, wind energy and thermal energy on the island.
- Nalcor estimates that Muskrat Falls has a generation capacity of 824 megawatts (MW), while Gull Island has generating capacity of 2,250 MW. In comparison, the Churchill Falls hydroelectric facility (the majority of which is sold under contract to Hydro-Quebec and is not available to Nalcor until 2041) has a generating capacity of 5,428 MW. Newfoundland and Labrador Hydro (Nalcor's subsidiary responsible for electricity generation in the province) currently has a total generating capacity of 1,637 MW, excluding existing hydroelectric capacity in Labrador.
- Nalcor estimates that by 2027 an additional 582 MW of generating capacity will be needed in the province.

David Vardy Summary:

- David Vardy was commissioned by Action Canada, a non-profit organization devoted to developing the leadership skills of young Canadians, to produce an essay assessing the Lower Churchill hydroelectric project with regards to 1) how much power is needed on the island; 2) what are the potential energy sources for island power demand; 3) is transmitting power from Muskrat Falls the best option for supplying the island with power; 4) what are the potential uses of Lower Churchill power; and 5) is the Nalcor proposal the best use of the Lower Churchill potential. His essay was published in August 2011, just weeks after the release of the environmental assessment.
- Vardy's assessment considered not just Muskrat Falls development (Option A) versus an isolated Newfoundland island energy policy (Option B), which would rely on a series of small hydroelectric, wind and thermal generating projects, but also four additional options:
    - Option C: Gull Island Project – Develop Gull Island first, as opposed to Muskrat Falls, due to the lower per unit cost derived from the economies of scale. The downside is that due to the excess capacity guaranteed access to export markets would have to be insured, which may require a greater reliance on Hydro-Quebec.
    - Option D: Purchase Power from Quebec and Development of Labrador-Island Link – Purchase power from Quebec to meet industrial development needs in Labrador and island demand increases until Churchill Falls contract expires in 2041, which has more than enough capacity to meet provincial demand. Vardy noted that Nalcor, however, has indicated Hydro-Quebec is not receptive to such a proposal.
    - Option E: Develop Small Island Generation Sources and Implement Aggressive Demand-Side Management Measures – Allows island to meet demand until 2041 when Churchill Falls power reverts back to Nalcor. This option, though, would forego or delay development of industrial projects in Labrador and entail higher prices prior to 2041.
    - Option F: Conversion of Holyrood Thermal Plant from Oil to Natural Gas – Reduces the costs and emissions associated with thermal generation and improves viability of

[1] In an article from *The Telegram*, published on January 19, 2012, questions were raised about the accuracy of the $2.2 billion figure quoted by Nalcor. It has been asserted that this figure is flawed and does not include the substantial cost of transmitting power from Labrador to the island. This assertion has not been confirmed, but is accepted by both Feehan and Locke.

isolated island option. This option would also forego or delay development of industrial projects in Labrador and may entail significant capital and greenhouse gas emissions costs.

- Vardy questioned the validity of pursuing the development of Muskrat Falls first, as opposed to Gull Island, which has a greater generating capacity and thus lower per unit costs. He explicitly states that he views Muskrat Falls as "probably a second or third best solution".
- Overall, Vardy supports the findings of the joint Canada-Newfoundland and Labrador environmental review panel, which called for an independent assessment of Nalcor's proposal as the least-cost option. However, he went further by suggesting any such independent review should consider all potential alternatives. In terms of achieving this broad review Vardy suggested the scope of the PUB's current review commissioned by the provincial government be expanded and/or the exemption of Muskrat Falls and Gull Island from the purview of the PUB be abolished.
- Vardy also advocated the federal government taking an equity stake in the Lower Churchill development, which he theorized might change the political landscape in terms of Nalcor obtaining access to the Hydro-Quebec grid, which would allow Nalcor access to the entire North American energy market and at a lower cost than a subsea transmission link to Nova Scotia.
- On January 12, 2012 Vardy and former provincial deputy justice minister Ron Penney published an open letter in *The Telegram* urging the extension of the PUB review and increased scope for the review. They also argued that any decision on the Lower Churchill development be put to referendum and not left to the executive branch of government.

Jim Feehan Summary:

- On January 11, 2012 Jim Feehan published an e-brief for the C.D. Howe Institute, a not-for-profit organization devoted to raising the living standards of Canadians through economically sound public policies, concerning the development of the Lower Churchill hydroelectric potential.
- Feehan's main thesis was that before Muskrat Falls is even considered to address future energy demands in Newfoundland and Labrador the provincial government should explore reforming energy pricing regulations to better reflect the true cost of electricity, which might curtail demand to the point that Muskrat Falls is unnecessary until the 2020s.
- Feehan argued that prices should reflect the marginal cost of using Holyrood, which is used during peak months and times (primarily in the winter) to make up for shortfalls from existing hydroelectric generation capacity. This would not alter pricing in the summer, when Holyrood is typically offline, and would encourage reduced demand, so much so that oil-fired plants Nalcor deems necessary by the 2020s in its isolated island scenario would be redundant.
- Citing other research and using 2010 as a reference year, Feehan speculated that a 20% price increase would induce a 5% reduction in electricity consumption. Theorizing that all of this reduced demand would come during peak times of year and peak hours, Feehan offered that all of the reduction would come from Holyrood, thus reducing dependence on it by a third and reducing it to 10% of production.

Wade Locke Summary:

- Given the increase in discourse around the viability of Muskrat Falls as the least-cost option for Nalcor in recent months, Wade Locke agreed to offer his assessment of the project for a Harris Centre[2] public forum at MUN on January 17, 2012.
- Locke provided assessments of Muskrat Falls, improved electricity pricing efficiencies, natural gas and the isolated island option as potential least-cost options for Nalcor to meet future power demand. Additionally, he provided an analysis of the impacts of shale gas on energy markets and the impacts of the debt incurred if Muskrat Falls is pursued.
- Locke had previously come out in favour of the Muskrat Falls options and his presentation reinforced this stance.
- In response to Feehan's suggestion that improved electricity pricing efficiencies and small island hydroelectric and wind projects could meet demand until at least the 2020s, Locke agreed unambiguously that prices could be increased to a point such that consumption patterns would be reduced. However, Locke emphasized that this would have adverse impacts on the neediest people in society (i.e. those with fixed and low incomes), as well as unforeseen adjustment costs. Furthermore, Locke argued that without developing additional capacity as demand grows there will be a greater dependence on Holyrood, which is exposed to oil price volatility and has the highest marginal cost of Nalcor's current electricity generation sources. As a result, by 2041 you would need to increase prices by 80%, not the 20% suggested by Feehan, to ensure Holyrood only represented 10% of production.[3]
- With respect to Muskrat Falls versus the isolated island option, Locke fell back on the cost-benefit analysis of Nalcor that found the isolated island option was $2.2 billion[4] more expensive in present value terms, using a discount factor of 8%. The only way this disparity could be addressed, in Locke's view, was if long-run oil prices ended up around $60/barrel or less, instead of the $90/barrel assumed by Nalcor. Locke did not see this as likely. Additionally, he pointed out that none of this accounts for the cost of greenhouse gas emissions from keeping Holyrood online or the lack of capacity to meet future industrial demand in Labrador (in the neighbourhood of 400-500 MW) that would still exist.
- Fuel costs were also central to his assessment of the option of converting Holyrood to natural gas. Locke's analysis determined that to make conversion of Holyrood to any form of natural gas feasible one would need a long-run price of natural gas around $5.75 per one million British thermal units (MMBTU). Currently the Henry Hub price for natural gas, which is a widely referenced benchmark price, is about $3.00/MMBTU. However, Locke pointed out that due to a lack of infrastructure and transportation costs the true cost to Nalcor of purchasing natural gas would be closer to that seen in Europe and Asia, which is between $7.00/MMBTU and $9.00/MMBTU. Furthermore, development of Newfoundland and Labrador offshore natural gas reserves is only economical at $8.00/MMBTU to $10.00/MMBTU, which negates it as a supply source for Holyrood. Locke also pointed out that due to the abundance of natural gas globally and its relatively clean-burning nature,

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[2] The Leslie Harris Centre of Regional Policy and Development at MUN is devoted to assisting in the responsible development of the Newfoundland and Labrador economy and society, and to stimulating informed discussion of important provincial issues.

[3] Feehan was in the audience and offered a rebuttal to Locke's assessment of the improved pricing efficiencies option. Feehan's main point was that pricing reform would be used to slowdown the rate of increase, not reduce consumption to some constant, to give more time to fully assess the Lower Churchill development and allow time to reveal the actual need for its development with greater certainty. Further, he stipulated that increased revenues from higher prices should be used to help offset impacts on the most vulnerable people in society. Locke was skeptical this could be accomplished. It should also be noted that Feehan never assumed that no additional hydroelectric or wind capacity would be developed on the island between 2010 and 2041.

[4] See Footnote 1.

natural gas is likely to be adopted in more jurisdictions and for more diverse uses, which will drive up the fuel costs. This will make natural gas conversion of Holyrood even less feasible even as it will signal a boon to the offshore oil and gas industry in the province.

- Locke also reviewed the emergence of shale gas, which is abundant and relatively cheap to access in North America. This has affected the electricity generation market by driving down the cost of gas generation that already exists. As a result, hydroelectricity is not as competitive in a number of U.S. markets as it once was. The implication is that developing Gull Island over Muskrat Falls may not be as beneficial as originally thought because the excess capacity may not be competitive in export markets. However, with reference to the above point, whether or not this is a long-run phenomenon is difficult to ascertain if gas becomes used more broadly, which would drive up the price.
- Locke's final point was with regard to the debt burden posed by Muskrat Falls. At a total capital cost of $6.2 billion it would be by far the largest single debt obligation ever undertaken by Nalcor or the provincial government. Locke estimates that the average net cash flow from the project would be approximately $550 million per year, not taking into account any revenue from capacity that doesn't already have a claim on it. At that rate Muskrat Falls is viable even if cost overruns reach $8 billion and the interest rate is still around 5% (currently the provincial government can borrow at less than 5% and Nalcor at around 7%). Conversely, even if the interest rate rose to 10% a $5 billion debt would be manageable (a $6 billion debt would still be manageable at 8%).

Conclusion:

- Most experts concur that at some point in the future electricity generation capacity comparable to Muskrat Falls and/or Gull Island will be needed by Newfoundland and Labrador just to meet demand within the province. The debate is mainly about timing. For example, if you can get to 2041 without developing Muskrat Falls or Gull Island then Churchill Falls' 5,248 MW become available and undertaking the risks associated with Muskrat Falls and/or Gull Island is unnecessary.
- The current review process of Muskrat Falls, and the Lower Churchill potential in general, is too narrow in scope to be informative in any meaningful may. The current review being undertaking by PUB only considers Muskrat Falls versus an isolated island option with the development of small hydroelectric, wind and thermal generating projects on the island as needed. The scope of independent review should be expanded to include all possible options to supply Newfoundland and Labrador with the lowest electricity prices to meet future demand, which could include public-private partnerships, provincial-federal partnerships, importing of electricity from Quebec and/or the Maritimes, pricing reform and revenue redistribution, small hydroelectric projects, wind power, natural gas or any combination of the above.
- By limiting the scope and time for the PUB to conduct its independent review and maintaining Lower Churchill's exemption from the purview of the PUB government is abdicating its responsibility to the people of Newfoundland and Labrador to do everything in their power to provide them with the highest standard of living and greatest degree of economic opportunity at the lowest cost and least risk, which are not equivalent. To ensure government is fully insulated from criticism and, more importantly, is absolved of any responsibility (to the extent that all current information allows) for potentially saddling the people of Newfoundland and Labrador with a massive unnecessary debt burden, government should delay a decision on Muskrat Falls for 1-2 years to allow a full assessment of alternatives and a complete analysis of the potential burden to taxpayers if development of Muskrat Falls has substantial cost overruns. This delay may cause postponement of some

industrial development in Labrador, potentially lead to marginally higher borrowing costs and cause short-run price increases but that would be a small price to pay for ensuring all options and voices are fully assessed before reaching a decision on "the most important public policy issue ever to have faced Newfoundland and Labrador," as Vardy and Penney stated in their letter to *The Telegram*.

- Regardless of which avenue Nalcor eventually pursues it is crucial to build the energy link between Labrador and the island.
- As Locke himself stated in his presentation, "We should learn from our history but not be slaves to it."

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