

April 16, 2018

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL
A1A 5B2 Canada

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Newfoundland and Labrador Hydro – 2018 Capital Budget Application – Response to item 1 pursuant to Board Order P.U. 9(2018) Re: Muskrat Falls to Happy Valley Interconnection Project

The enclosed is in response to P.U. 9(2018), which states “Hydro shall file on or before April 16, 2018 a proposed plan in relation to the provision of reliable service in Labrador East in 2018/2019.”

The Labrador East system is an aged system as it currently exists. Service to Labrador East is provided by the 138 kV transmission line (L1301/L1302), which is a radial transmission system from Churchill Falls constructed in 1976, and a gas turbine/synchronous condenser package at the Happy Valley Terminal Station commissioned in 1992. The system is challenged by growing demand, infrastructure reliability, and location conditions (i.e. weather and remoteness).

Existing System Risks

1. Growing Load Forecast

The load forecast continues to grow in Labrador East primarily due to data centre growth. The current system capacity is 77 MW and the 2018/2019 winter P50 forecast is 80.6 MW, which is 3.6 MW above the available system capacity. The P90 load forecast is approximately 4 MW higher than the P50 forecast. To manage this demand and provide reliable service to customers, load curtailment or additional capacity is required.

Hydro is currently working on a plan to address increased demand related to data centre applications, in particular data mining centres. Acceptance of requests and their in-service dates are subject to capacity availability.

2. Infrastructure Reliability

The Labrador East system is an aged system with limited capacity for expansion given its current configuration. All components of the system are required to be in service to provide reliable power. Regular preventative maintenance is completed to maintain the existing assets; however, the system continues to be challenged by the age and condition of these assets.

a. North Plant

This plant has 5 MW of standby diesel generation; however, the units are beyond life expectancy and are not considered to be a reliable source of capacity and energy for this coming winter.

b. L1301 Reliability

L1301 is a 42-year old, 269 km transmission line. The line is of substandard construction for a transmission line¹ and has had a considerable impact on customer reliability. The line has known crossarm issues and has been maintained through the Wood Pole Line Management (WPLM) program². Since 2015, of the 1,390 crossarms on the line, 12 failed and were replaced, and a further 31 have been reinforced with steel bracing. Bi-annual helicopter patrols are maintained for this line. The crossarm issue increases potential for transmission failure under heavy load conditions.

c. Synchronous Condenser Reliability

The operation of the gas turbine as a synchronous condenser is required for voltage support in order to serve peak load and was part of the rationale for its original installation. The maximum load that can be served without the synchronous condenser is 63 MW, which is below current peak, and is 77 MW with the synchronous condenser online.

In the event of a failure of the gas turbine, rotating outages³ would be required throughout the winter season until such time as the unit could be repaired and put back in service. If there is a failure of the gas turbine, it will prevent the unit from operating as a synchronous condenser and the Labrador East system will be limited to 63 MW.⁴ Analysis of the historical hourly data adjusted for the forecasted peak indicates that in the event of gas turbine failure, and no synchronous condenser capability, there would be approximately 35 to 40 days throughout the winter season where the load exceeds 63 MW, with the majority of this time from January to mid-February. The system would have more than 600 hours above this limit, with each day exceeding 63 MW triggering

¹ L1301 from Churchill Falls to Gull Island was built as a construction power line and is not built to standards that allow for inspection of the crossarm area when the line is energized.

² Please refer to Hydro's 2018 Capital Budget Application, Volume 2, Tab 13, Appendix A.

³ Hydro is currently not set up to perform automatic rotating outages and requires manual operation of its distribution equipment.

⁴ Please refer to Hydro's response to RFI PUB-NLH-049.

the necessity of customer outages or curtailed load. During this time, extended or rotating outages would be required until the load dropped substantially below 63 MW to allow for cold load pickup on the transmission line.

d. Churchill Falls Switchyard Assets

Additional transformers are required to meet the System Planning Criteria for transformer backup.⁵ Failure of the Churchill Falls 125 MVA transformer reduces capacity to 62 MW,⁶ with similar rotating outage numbers stated above for failure of the gas turbine and synchronous condenser. This transformer is relatively new; however, in the event of failure, replacement of this unit with an on-site spare would require multiple weeks.

In addition, terminal station flexibility in Churchill Falls is very limited and necessitates outages for CF(L)Co work. This has required both planned and forced outages to customers in Happy Valley-Goose Bay annually, which impacts overall reliability, particularly in the winter when load is forecast to be higher than local generation can manage.

3. Location Conditions

Severe winter weather conditions and the remote nature of Labrador East provide additional system risks. Failure of the L1301 line due to wind, ice, or a combination thereof will result in service needing to be provided by the gas turbine and North Plant diesels. Loading and unloading of the gas turbine must be completed gradually due to cold load pickup and block loading limitations, making feeder outage rotation impractical. The existing North Plant diesels have reliability concerns due to their age, as previously stated. The gas turbine and diesels are rated for approximately one-third of the required capacity. Therefore, line failure has potential for a widespread outage in Labrador East for the time it will take to repair the transmission line, which depends on the extent of failure.

L1301 is also susceptible to lightning-initiated outages as it has no overhead ground wire. This has the potential to expose customers to sporadic outages. There are no cost-effective mitigation options against lightning trips on L1301/L1302.

Hydro recognizes that the stated risks to reliability to the Labrador East system are not new and continues to perform all required preventive and corrective maintenance to maintain operational reliability. Hydro maintains the previously proposed Muskrat Falls to Happy Valley Interconnection Project can address most of the system's reliability issues and provide enhanced service for customers; however, it also respects the Board's decision on that

⁵ Please refer to the 2018 Capital Budget Application, Volume 2, Tab 13, Appendix A, Page 11.

⁶ This scenario utilizes the existing hot standby transformer in Churchill Falls and continuous running of the gas turbine generation.

application. As such, the following outlines Hydro's proposed options to mitigate the forecast capacity deficit for the region.

Options to Mitigate Forecast Capacity Deficit

Hydro has identified several options for investigation and potential execution in 2018 to help mitigate the P50 load forecast⁷ exceeding the available system capacity by approximately 3.6 MW.

1. Conservation and Demand Management (CDM)

Hydro is reviewing options for load curtailment, supplemental generation and other energy conservation and demand projects.

a. Load Curtailment and Supplemental Customer Owned Generation

Hydro will investigate commercial options to entice larger customers, such as those that can effectively reduce their load requirement (e.g. current data centre customers) and those that have customer owned back-up generation (e.g. Labrador Health Centre), to meaningfully contribute to system load reduction. This option may be adequate to address the difference between forecast peak load and system capacity for the coming winter season; however, it will require customer participation, commercial agreements and appropriate regulatory approvals.

b. Direct Load Control

Load reduction equipment, such as utility-initiated hot water heater controllers, is being reviewed. Hot water heater control systems can reduce or remove hot water heater usage at peak times. Early assessment indicates that the time and logistics required to result in meaningful capacity impact⁸ may not allow for implementation of hot water heater controllers in advance of the 2018/2019 winter season. For reference, as well, Newfoundland Power completed a pilot project in Mount Pearl in 2015 and found that the implementation of a program, although technically possible on the island, did not pass the Total Resource Cost Test economic thresholds for the CDM program development.⁹

⁷ The 2018/2019 winter P50 forecast is 80.6 MW, which is 3.6 MW above the system capacity of 77 MW. The P90 load forecast is approximately 4 MW higher than the P50 forecast.

⁸ Effective load reductions are, on average, approximately 0.6 kW per controlled hot water heater.

⁹ From the Five-Year Conservation Plan: 2016-2020, filed November 12, 2015, "In the fall of 2014, Newfoundland Power launched a pilot program to assess the economic, market, and technical feasibility of direct load control to reduce overall peak demand. This pilot was initiated in response to the constraints on system capacity that became evident after the events in January of 2013 and 2014. The pilot involved controlling hot water tanks in approximately 500 customer homes in Paradise and Mount Pearl. Demand reduction achieved by the direct load control events on average was 0.6 kW per participant and for events that included all participants, approximately 298 kW of demand reduction was achieved. The Pilot results also indicate that a full-scale provincial program does not meet the economic requirements."

c. Other energy conservation and demand initiatives

Hydro will investigate the potential for increased education and awareness and promotion of its takeCharge portfolio, and options such as LED street lights or direct install programs to determine if economic options are available which have a measurable impact on load.

2. Temporary Generation

Hydro is investigating the installation of temporary mobile diesel generation at the North Plant. The current 77 MW system capacity assumes, conservatively, that the 5 MW of diesel generation at the North Plant is not available given the condition of these aged units. To fulfill this option, mobile generation units¹⁰ will need to be procured and installed at the existing North Plant (estimated range of acquisition costs of \$2.5M to \$3.75M); however, existing infrastructure could help mitigate installation costs. Additionally, there will be associated labour and fuel costs for operation. Hydro can implement this option without additional environmental assessment, since it is restoring the capacity of the North Plant without additional expansion. If a decision to proceed is made by mid May, the temporary generation could possibly be operational by mid November 2018 under a compressed schedule with priority given by Hydro internal resources.

This option is only preferred if adequate curtailable load is not available as mobile generation is a short-term solution and not consistent with least-cost, reliable service.

3. Advance Notification Protocol (ANP)

To enhance customer service, Hydro will implement a power system ANP for Labrador East in 2018. This system will inform customers when load is approaching system capacity. The ANP is an alert system that has been used on the island since 2014. Once a forecasted load above the target threshold is expected for the following day, Hydro will trigger the ANP and inform customers of the system condition and any requested customer action.

The trigger point¹¹ for this protocol will be 73 MW at which point a Power Watch will be issued. A Power Watch is the first public alert, which provides customers with notice that the system is being watched carefully; however no customer action is required. If the forecast is expected to be 76 MW, a Power Warning will be issued requesting that customers conserve power¹² and Hydro will enact any capacity assistance available.¹³ Should the load exceed supply, and power outages are required, then a Power Emergency

¹⁰ The number of units required to offset the current 5 MW capacity of the North Plant is three 2 MW units (5.6 MW generating capacity at a cost of approximately \$3.75M). The minimum number of units required to offset the failure of only one of the North Plant 2.5 MW diesel units is two 2 MW diesel units (3.7 MW generating capacity at a cost of approximately \$2.5M).

¹¹ Hydro has not finalized the trigger points for Power Watch and Power Warnings.

¹² Please refer to <https://nlhydro.com/system-information/how-to-conserve-energy/> for details on customer energy conservation.

¹³ Hydro does not have any approved capacity assistance agreements currently in place.

will be communicated to the public. Hydro will ensure that customers are kept informed of the power system status through the winter months in the event that customer intervention is required. The ANP alerts are typically communicated through traditional media, social media, and Hydro's website. Hydro is currently investigating the use of auto-dialing for notification.

4. Use of Gas Turbine and Additional Inspections

In addition to the options outlined above, Hydro plans on investigating the feasibility and resulting expected reliability of running the gas turbine over peak demand periods, and also increasing the frequency of inspections on L1301 leading up to and during the 2018/2019 winter period.

Conclusion

Mitigating the Labrador East forecasted peak load is necessary and will be the focus for Hydro over the coming months. Hydro continues to have concerns regarding ongoing system reliability in Labrador East and wishes to improve the service for customers in that area. Hydro awaits the Board's direction on the proposed plan.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO



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