

Muskat Falls to Happy Valley Interconnection

Questions of Labrador Interconnected Group

1. Please disclose the amount of load from data centre contracts that:
 - a. are in service
 - b. Hydro has committed to serving but are not yet in service
 - c. has been requested but Hydro has not yet committed to serving
 - d. has been the object of inquiries without a formal request for service

For the Happy Valley-Goose Bay area, there are three (3) data centres with demands greater than 1 MW that are current Hydro customers and are in service. The load commitment for these data centres is 1.3 MW each for two, and the third is 6 MW, for a total of 8.6 MW. Their combined load is currently at 1.6 MW; however, this can increase at any time. Load requests have been received for this area totaling almost 32 MW. Inquiries have been received for 200 MW of service in Labrador East.

2. For each type of load from Question (1), please disclose any information Hydro has about:
 - a. the nature of the load's activities (cryptocurrency mining, data storage, real-time internet services, etc.)
 - b. the maximum capacity requested or provided
 - c. the date when the service was requested (if applicable)
 - d. the duration of the service contract requested or entered into
 - e. the nature and extent of any financial guarantees provided by the client to Hydro
 - f. any information regarding load shape provided by the client

For Labrador East customers, Hydro has not requested specific load activities other than generic "data centres". From general knowledge however, it is believed that they are cryptocurrency type groups engaged in data mining. The maximum capacity requests that Hydro has received is 24 MW for one single customer and an informal request for service was received for a single customer at 100 MW. As noted in the response to question 1, the current maximum size Labrador East data centre customer is 6 MW. Service requests were received as shown in Table 1. General Service Customers do not require service contracts under the current General Service requirements. Therefore, there are no financial guarantees provided by these customers. As per Hydro's experience, these types of customers have a generally flat load profile mirroring an annual load factor at greater than 90%.

Table 1: Service Requests for Labrador East

| Date | Service capacity requested |
|--|-----------------------------------|
| November 10, 2016 | 1.3 MW |
| June 5, 2016 | 1.3 MW |
| August 6, 2015 (updated September 7, 2016) | 6 MW |
| July 12, 2017 | Cancelled request |
| July 13, 2017 | Cancelled request |
| July 13, 2017 | Cancelled request |
| August 8, 2017 | Cancelled request |
| December 7, 2017 | 0.85 MW |
| January 4, 2018 | 0.75 MW |
| January 10, 2018 | 0.4 MW |
| January 18, 2018 | 4 MW |
| January 18, 2018 | 24 MW |
| January 25, 2018 | 0.8 MW |

3. What is the load shape for Happy Valley-Goose Bay, before and after the existing data centre contracts? What is the load shape for Happy Valley-Goose Bay if the projected contracts are entered into?

From Hydro’s experience of data centre loads, and as noted in PUB question 1.a., the data centres are operating at 90% annual load factor. Therefore, once the data centres are fully operational the load profile would be basically the same, with an increased load throughout the year corresponding to their load requirements.

4. Please provide hourly capacity at Happy Valley-Goose Bay for the three most recent winters available, and/or for the three most recent years available.

As capacity does not vary, it is assumed that the question is around hourly load. Please refer to response #2 in Attachment 1. Hourly load tracings will take time to produce, and there was insufficient time available to complete this task prior to the meeting time. As provided in the response to question 3 above, the load shape will not materially change, given that Hydro's experience for data centres provides for a predominantly flat load profile throughout the year.

5. Please provide any information Hydro has regarding the price point at which existing data centres would relocate their Labrador-based operations, and at which projected data centre loads would choose to locate elsewhere.

Please refer to the response to Question 1c in Attachment 1.

6. Has Hydro raised with the customers and potential data centre customers the possibility that they might be required to take financial responsibility for a certain share of the network additions that providing service to them will require? If so, please describe in detail these exchanges. If not, why not?

There has been no direct communication related to generation capacity additions or transmission capacity additions for customers’ specific service. The Contribution in Aid of Construction (CIAC) process covers financial responsibility for additions required to provide service to these customers.

7. Has Hydro raised with existing and potential data centre customers the possibility of load curtailment? Please disclose any information regarding how much load curtailment, and in what seasons, may be possible for data centre customers.

Load curtailment or seasonal load has not been discussed with these customers.

8. With respect to the additional Department of National Defence (“DND”) load currently anticipated in 2020, please indicate:
- Whether or not a contract for this additional capacity has been signed with DND;
 - Whether or not Hydro has had exchanges with DND regarding possible curtailment options that might be associated with this increase in capacity. If so, please provide details of these exchanges. If not, why not?
 - More specifically, whether or not Hydro has asked DND what compensation would be required for DND to be open to curtailing demand during the winter peak;
 - Whether or not Hydro has provided DND with any estimates of its future rates, from 2020 onward, and, if so, if DND has indicated any price sensitivity with regard to its future power requirements, and
 - Whether or not Hydro has raised with DND the possibility that, if it goes ahead with this capacity increase, it would have to take responsibility for a portion of the additional capital cost required to allow Hydro to provide such service.

A contract has not yet been signed with DND; however, if and when this occurs they will fall into the approved process for General Service customers. Details regarding curtailment have not been discussed with DND. Hydro has not discussed price sensitivity with DND in their decision making process in regards to future power requirements. Hydro also has not discussed with DND any requirement for them to take responsibility for the additional capital cost of transmission upgrades, as this is not aligned with the requirements of a General Service customer.

9. Please clarify to what extent loads greater than 77 MW at Happy Valley-Goose Bay are compatible with reliable electric service. More specifically, please describe the consequences of transient or short-term loads that exceed this level, in increments of 1 MW, taking into account existing diesel generation, utility-scale energy storage, curtailment options and any other demand management resources available to Hydro.

The transfer limit of the existing system is 77 MW. Any load above 77 MW will result in voltages below acceptable standards with voltage collapse to follow (Refer to Figure 1). A voltage collapse of this nature will cause a brown out followed by a blackout.

Existing Diesel Generation

The existing diesel generation consists of two 2.5 MW diesel generators; however, as noted in the 2018 Capital Budget Application (Volume 2, Tab 13, Appendix 1, page 10) the existing units are unreliable, and cannot be considered as a supply source.

Utility Scale Energy Storage

For utility-scale energy storage, at the time of its construction the Battery Energy Storage System (BESS) installed by Golden Valley Electric Association (GVEA) in Fairbanks Alaska was the largest BESS in the world. It is rated at 46 MW for five minutes before being recharged. It

can pick up 40 MW for 7 minutes or 26 MW of load for 15 minutes. The GVEA website indicates that total funding for the project was \$35M. Energy storage systems must be recharged when the customer load is reduced. Given the limited transfer capacity in Labrador East, this recharge would have to happen at off peak periods, i.e. night time. Given winter peak load profiles, the peak can last longer than the fifteen minute ratings of the Fairbanks example, so therefore this type of technology is not a viable solution for Happy Valley.

Curtailment and Demand Management

With respect to demand management, there are no large industrial customers connected in the Upper Lake Melville area. As a result, curtailment options would require the curtailment of commercial and residential customers over peak, at a time when heating load would be at its highest. The existing rates in Labrador are believed to be too low to signal customer initiated demand side management.

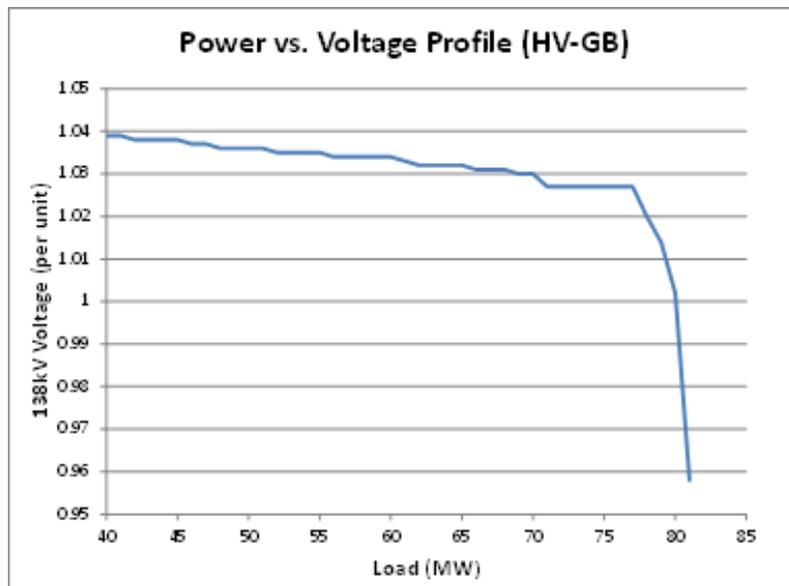


Figure 1: Power versus Voltage Profile – Happy Valley Goose Bay

10. Please provide estimates of the additional generation that would be required – both in MW and in MWh/year – to meet forecast loads for a) the 2018-2019 winter, and b) the 2019-2020 winter, taking into account the specific load shapes of existing and planned data centre loads, as well as the existing clientele. Please provide hourly forecasts in support of your response.

Please refer to the response to Question 5 in Attachment 1.

11. Under the interim OATT approved by the Board in P.U. 3(2018), how would the costs of the proposed Labrador capital additions affect NLSO’s revenue requirement? Please explain in detail how these additional costs would flow through to the various categories of consumers and of other potential users of the transmission system.

These capital additions will have no effect on the transmission tariff administered by the NLSO as they are below the 230 kV threshold and therefore not included in the any of the Transmission Owners' revenue requirements that contribute to the tariff rate.