

April 2, 2019

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

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

Dear Ms. Blundon:

Re: The Liberty Consulting Group Report: "Analysis of Newfoundland Island Interconnected System Power Supply Adequacy for the Winter of 2018–19" Biweekly Update Report

In its correspondence of September 19, 2018, the Board of Commissioners of Public Utilities (the "Board") requested that Newfoundland and Labrador Hydro ("Hydro") provide a biweekly report on Hydro's supply adequacy for winter 2018–2019, commencing October 1, 2018.

In a letter dated March 19, 2019, the Board requested that future biweekly update reports be suspended, following the filing of the April 1, 2019 report, until the fall of 2019 when an evaluation as to the appropriate level of monitoring required for the anticipated Labrador-Island Link ("LIL") bipole commissioning is undertaken. In the interim, Hydro will continue to work with Liberty on their quarterly monitoring of the progress towards the commissioning of the LIL monopole.

This final biweekly report for winter 2018–2019 provides an update on the in-service of the LIL and the manner in which it relates to winter 2018–2019 supply adequacy, as well as details on Hydro's production facilities asset management.

The LIL In-Service Update

This report contains:

- An overview of the critical path tasks required for reliable operation of the LIL for winter 2018–2019;
- An overview of the highest risks being monitored and mitigated for the LIL in-service in winter 2018–2019;

- Hydro's updated modelled assumptions for winter 2018–2019 supply adequacy planning; and
- Hydro's proposed contingency plan to mitigate the consequences of unavailability or unreliability of the LIL for all or part of winter 2018–2019.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO



Shirley A. Walsh
Senior Legal Counsel, Regulatory
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Encl.

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Labrador-Island Link In-Service Update

April 2, 2019

A Report to the Board of Commissioners of Public Utilities



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1 **1.0 Introduction**

2 Newfoundland and Labrador Hydro (“Hydro”) closely monitors its supply-related assets and
3 issues to ensure its ability to provide reliable service to customers. The availability of power
4 over the Labrador-Island Link (“LIL”) for winter 2018–2019 was identified in previous reports to
5 the Newfoundland and Labrador Board of Commissioners of Public Utilities (the “Board”) by
6 both Hydro and The Liberty Consulting Group as contributing to supply adequacy in advance of
7 availability of the Muskrat Falls generation supply to the Island. Hydro is working closely with
8 Nalcor’s Power Supply leadership (Transition to Operations, Power Supply Transmission
9 Operations, and the Lower Churchill Project Transmission Project) to monitor and mitigate the
10 risks associated with the timing of the in-service of the LIL to supply off-Island capacity and
11 energy to the Island Interconnected System. In each biweekly report, Hydro will also provide an
12 update on supply adequacy for winter 2018–2019 with the most up-to-date in-service
13 assumptions of the LIL, as required. The information in this report is current as of March 29,
14 2019. It is noted that typical commissioning issues will be occurring as commissioning
15 continues. Updates regarding those issues known to materially affect the assumptions of
16 capacity and availability for the 2018–2019 winter season will be provided as they become
17 known. Otherwise, any developments occurring after the preparation of the biweekly report
18 will be included in the next biweekly report.

19

20 **2.0 In-Service Activities Update**

21 The following outlines the specific critical path activities required for operation of the LIL for
22 winter 2018–2019,¹ as well as schedule or constraint information for those tasks. As this report
23 is updated on a biweekly basis, Hydro will provide information on the key activities and the
24 associated schedule to inform the Board if any potential supply issues arise from the delivery of
25 those activities.

¹ This report discusses operational readiness for winter 2018–2019. The final in-service review of the LIL is undertaken separately with the Board’s consultant, The Liberty Consulting Group, on a quarterly basis with Nalcor Transition to Operations.

1 As reported in the February 4, 2019 report, biweekly leadership level meetings that were
2 initiated in the fall of 2018 have ceased since all material efforts to place the LIL in service have
3 been completed. The leadership level meetings that track progress will proceed if there is a
4 material issue related to availability. The day-to-day operation of the LIL is now being
5 communicated at the morning system meetings, with any technical items addressed similar to
6 any other resource asset on the system—the operational teams work with project and
7 engineering support and communicate results to the appropriate Hydro and Nalcor
8 representatives.

9

10 **Project Delivery**

11 **Activity 1: Churchill Falls Breaker Upgrade**

12 ***Status: Completed, no further updates.***

13

14 **Activities 2 and 3: 315 kV GIS Voltage Transformer² Replacements**

15 ***Status: Completed, no further updates.***

16

17 **Transitions to Operations Delivery**

18 **Activity 4: Emergency Response Plan (“ERP”)/Emergency Restoration and Recovery (“ERR”):**

19 **Interim ERP/ERR in place as required at all sites/assets**

20 ***Status: Completed, no further updates.***

21

22 **Activity 5: Contracts: Support Services in Place and Resources on Board**

23 ***Status: Completed, no further updates.***

24

25 **Activity 6: Assets: Operationalize High Frequency Preventive Maintenance Program**

26 ***Status: Completed, no further updates.***

² 315 kV instrument transformers.

1 **Activity 7: Contracts: Operations, Maintenance, and Administrative Services for Monopole**

2 **Status: Completed, no further updates.**

3

4 **Activity 8: Inventory: Pre-Winter 2018 Readiness**

5 **Status: Identification, inspection and verification of winter readiness spares completed,**
6 **ongoing procurement. No change from previous update.**

7

8 • Completed the winter readiness spares inventory requirement for the overhead
9 transmission lines and submarine cables.

10

11 • All critical spares for the overhead transmission lines and submarine cables are in place.
12 Deficiencies have been identified and procurement activities will continue until all items
13 are received. Spares for HVdc assets will remain in the contractor's care, custody and
14 control until they are transferred to the project/operations upon completion of the bi-
15 pole low power trial operation.

16

17 **Activity 9: Newfoundland and Labrador System Operator ("NLSO"): Operational Acceptance**

18 **Criteria Received**

19 **Status: Single remaining item to be delivered at conclusion of Activity 12.**

20

21 • Four of the five NLSO requirements have been met. The operational readiness
22 document has been delivered in draft and will be updated as final along with the release
23 for service form at the conclusion of the monopole commissioning activities.

24

25 • A description of the five NLSO requirements and status is as follows:

26

27 ○ Item 1: Ability to monitor the ac equipment associated with the converter stations
28 (including filter banks) remotely from the Energy Control Centre for system
29 reliability considerations. **Status: Completed/Accepted.**

- 1 ○ Item 2: Asset owner contact details (to be responsive 24/7). **Status:**
2 **Completed/Accepted.**
3
- 4 ○ Item 3: Redundant communications paths (voice, teleprotection, and SCADA)³
5 between the Energy Control Centre and all stations. **Status: Completed/Accepted.**
6
- 7 ○ Item 4: Provide a technical resource in the NLSO control room to support the Energy
8 Control Centre during the initial start-up period. **Status: Completed/Accepted.**
9
- 10 ○ Item 5: Documentation including an Operational Readiness document (outlining
11 commissioning/testing activities, operating limits/restrictions, and identified
12 risks/plans for mitigation), and a completed/updated release for service form
13 outlining remaining deficiencies and expected timelines for completion. **Status: In**
14 **Progress.** The operational readiness document has been delivered in draft and will
15 be updated as final along with the release for service form at the conclusion of the
16 monopole commissioning activities.
17

18 **Activity 10: People: Implement Interim 24/7 Staffing Model for Muskrat Falls**

19 ***Status: Completed, no further updates.***
20

21 **Power Transfer**

22 **Activity 11: Re-Energize Labrador Island Link**

23 ***Status: Completed as planned on November 1, 2018.***
24

- 25 • The LIL was re-energized on November 1, 2018 at 45 MW using the existing version
26 (Version 15) of GE software. Another version (Version 16) has been delivered to site and
27 factory acceptance testing of the next release (Version 17) has been completed in
28 Stafford. A decision has been made to remain on Version 15 for the remainder of the

³ Supervisory Control and Data Acquisition (“SCADA”).

1 winter season. The decision was based on the ongoing satisfactory performance of
2 Version 15 and the impact during the peak winter demand period of a multi-week
3 outage to the LIL required for implementation of a new version, which would have to
4 undergo additional testing.

5
6 **Activity 12: Transmission Link Monopole Commissioning**

7 ***Status: Initiated November 1, 2018 and ongoing.***

- 8
- 9 • As noted in the February 18, 2019 report, the cause of a trip on February 5, 2019 was
10 determined to be an overly sensitive feature of the protection system. An investigation
11 since the trip has led to a better understanding of the root cause and the potential
12 impact of this sensitivity. Hydro has confirmed that, while such faults are experienced
13 infrequently, there are certain faults that could trigger a Holyrood unit and the LIL to
14 trip simultaneously. As a result, the NLSO has restricted the combination of LIL and
15 Holyrood unit loading to adhere to its "maximum unit loading" limits which have been
16 developed as follows:

- 17
- 18 ○ Maritime Link and frequency response in service – to ensure that there is no
19 customer impact (i.e. under frequency load shedding) in the event of
20 instantaneous loss of any single resource (such as a generating unit or the LIL).
- 21
- 22 ○ Maritime Link or frequency response not in service – to ensure that under
23 frequency load shedding does not encroach on the 58.0 Hz block and to avoid
24 system instability in the event of instantaneous loss of any single resource (such
25 as a generating unit or the LIL).
- 26

27 These limits are variable and in proportion to the load on the Island Interconnected
28 System at any time. Through most of the winter when load is high, this limit is 170 MW,
29 which is the maximum output from a single Holyrood unit.

1 In addition, Nalcor Power Supply has confirmed that this issue will require both
2 hardware and software changes and that shifting focus of the software development
3 team to this issue with the monopole software would introduce risk of delaying bipole.
4 Given the significant benefit of having bipole in place to enable deliveries from the first
5 unit at Muskrat Falls and improve LIL reliability next winter, the software development
6 team have not been reassigned to this protection sensitivity, and there is potential that
7 it may remain unresolved until bipole implementation, which is currently forecast for
8 the fall of 2019. While this protection sensitivity issue is limiting its operation, the LIL
9 continues to add value, and Hydro and Nalcor are assessing LIL performance to
10 determine when monopole commissioning is concluded. Investigation of options to
11 mitigate the impact in the interim period resulted in the removal of the 45 MW limit
12 that was initially imposed in favor of the NLSO operating practice described earlier. This
13 allows maximum LIL deliveries while preventing customer impact in the event of a
14 simultaneous trip of the LIL and a Holyrood unit. For much of March, the LIL was
15 operated up to 100 MW while Holyrood units were able to be reduced to 70 MW.

- 16
- 17 • Since the last reporting period, there was one trip on the LIL, which occurred on March
18 22, 2019 while LIL was transferring 100 MW. The cause of the trip was a current signal
19 error from an optical current transformer. A visual wiring inspection was performed but
20 no apparent issue was found and the error could not be replicated. The event logs have
21 been sent to GE for further analysis. Hydro does not have formal criteria for the
22 categorization of low, medium or high impact issues; however, the NLSO restriction
23 described earlier ensures that a recurrence of this issue will not compromise system
24 stability or impact customers and, therefore, its impact would be low. As a result, the LIL
25 was returned to service a short time after identifying the cause.
 - 26
 - 27 • Further investigation on the March 7, 2019 trip has been undertaken to understand why
28 an error in equipment that is not used in the present operating configuration caused a
29 trip. The dc Current Transformer in question was not energized, but the control signal

1 was intact and being monitored by the control system. Since this trip, the signal from
2 this unused equipment was bypassed to avoid future malfunction.

- 3
- 4 • Punch list items are continually being addressed and closed by the project team. While
5 punch list resolution shall continue in an effort to improve system reliability, this effort
6 is not considered critical for power transfer.

7

8 **3.0 Key Risks**

9 There has been no change in the key risks since the October 1, 2018 report. In addition to the
10 activities described in Section 2.0, Hydro notes that the reliability of the current GE software
11 implementation is being monitored on a daily basis as the LIL is now online 24 hours a day; the
12 software's performance will inform the reliability assumptions of the LIL. Alternative software
13 versions have been received from GE and are under consideration for future implementation.

14

15 Dynamic commissioning with power transfer activities recommenced as scheduled on
16 November 1, 2018 with existing software. A further software version has been completed
17 including testing at the vendor's facility; however, this new version would not resolve the issue
18 of the LIL's sensitivity to external ac faults (as described in Activity 12). Therefore, Hydro and
19 Nalcor Power Supply are jointly assessing whether there is merit in installing this new version.
20 As stated above, an investigation into means of mitigating the impact of the recently identified
21 issue with the LIL protection system has led to practices that maximize LIL deliveries while
22 preventing negative customer impact, but no means of fully mitigating the issue prior to bipole
23 implementation has yet been identified. The investigation remains ongoing, and further
24 developments will be reported to the Board as they arise.

25

26 An additional risk being monitored is the Maritime Link frequency response to the LIL initiated
27 disturbances when the LIL is in service. The frequency controller has remained in operation
28 using the settings that were investigated in operational studies. These settings help to avoid
29 underfrequency load shedding and provide support to the Nova Scotia system.

1 To avoid frequent operation of the frequency controller, it has been equipped with a deadband
2 of +/-0.5 Hz. As such, there will be a frequency controller activation if frequency drops below
3 59.5 Hz or goes above 60.5 Hz. When the LIL is switched on, the instant injection of 45 MW to
4 the Island triggers overfrequency controller responses. Blocking (i.e., shutting off) the LIL results
5 in an underfrequency response. To reduce the number of responses, the current operating
6 philosophy is to disable the frequency converter just prior to the LIL startups (for a period of
7 approximately five minutes) to minimize the overall number of frequency controller activations.
8 This is completed to satisfy Nova Scotia Power and New Brunswick Power System Operators
9 regarding the number of activations. When the Maritime Link frequency response is turned off,
10 the LIL contribution to the Island's power supply is similar to a generator and the reliability of
11 the LIL will be the major factor in the decision on loading level. The NLSO continues to work
12 with Nova Scotia Power and New Brunswick Power Service Operators to keep those bodies
13 informed of testing plans so as to understand and mitigate risk from their perspective.

14

15 **4.0 Modelled Assumptions**

16 There has been no significant change in the modelled assumptions since Hydro's "Reliability
17 and Resource Adequacy Study" filed on November 16, 2018. These results showed increased
18 Loss of Load Hours ("LOLH") and Expected Unserved Energy ("EUE") over values previously
19 shared as part of Hydro's analysis. The change in the LOLH and EUE is largely due to a change in
20 the modelling methodology rather than a change in the underlying system conditions. As
21 discussed in the November 2018 Study, the new model is more conservative and, as a result,
22 the LOLH and EUE numbers produced by the model are higher. Many factors contribute to the
23 increase in LOLH and EUE between the two models; however, the two factors that have the
24 largest impact are dynamic loss modelling and the inclusion of load forecast uncertainty:

25

- 26 1) Dynamic modelling of losses: The previous model used a fixed value for losses. The
27 current model calculates losses based on system conditions, which has the effect of
28 increasing losses when there are units out of service on the Avalon, thus increasing
29 the frequency and severity of outages.

1 2) Load forecast uncertainty: The previous model used a fixed load shape with a 60
 2 MW adjustment on peak to represent the P90 condition. In the current model, a
 3 random variation is applied to the load shape in each hour in the model to reflect
 4 the variation in load due to weather. On average, this increases the frequency and
 5 severity of outages.

6
 7 As a result, the model is showing violations in the LOLH criteria for Holyrood forced outage
 8 rates above 15% combined with the LIL capacity of zero. There is expected to be a significant
 9 increase in system reliability once the first Muskrat Falls unit is available in late-2019.

10
 11 It is important to note that, based on the performance of Hydro’s generation assets thus far for
 12 winter 2018–2019, the analysis represents a conservative view of system conditions. The
 13 Derated Adjusted Forced Outage Rate (“DAFOR”) for Holyrood was 8.1% in November 2018,
 14 5.8% in December 2018, 1.3% in January 2019, and 0.3% in February; all of which were below
 15 the 15% DAFOR considered as the base assumption.

16
 17 A detailed description of the modelling assumptions and process for the current system model
 18 can be found in Volumes I and II of the “Reliability and Resource Adequacy Study”. All results
 19 reflect the implementation of the contingency plan as described in Section 5.0.

Table 1: Supply Adequacy Modelling Results for Updated Assumptions

Reliability Metric	LOLH	EUE	Normalized EUE
Base Load Forecast, Holyrood DAFOR = 15%	2.21	118	11.0
Base Load Forecast, Holyrood DAFOR = 18%	3.31	184	17.0
Base Load Forecast, Holyrood DAFOR = 20%	4.13	230	21.2

20 **5.0 Contingency Plan**

21 In light of the current LIL winter 2018–2019 transfer assumptions, Hydro developed and
 22 implemented a two-phased contingency plan for the 2018–2019 winter season that includes
 23 incremental internal and external system support. Phase I of Hydro’s contingency plan contains
 24 items that have been secured and incorporated into Hydro’s base planning assumptions for the

- 1 2018–2019 winter operating season. Details and the status of items in Phase I of Hydro’s
- 2 contingency plan are contained in Table 2.

Table 2: Phase I of Hydro’s Contingency Plan

Item	Description	Incremental System Benefit	Parties Involved	Status	Notes
1	Increase of Capacity Assistance from 90 MW to 105 MW ⁴	+15 MW	Hydro, Corner Brook Pulp and Paper (“CBPP”)	Ongoing	CBPP has indicated that up to 105 MW is available. The proposed agreement was approved by the Board on November 22, 2018.
2	Reinstatement of Capacity Assistance Program	+7.6 MW	Hydro, Vale	Ongoing	Vale has indicated they are in agreement with Hydro’s proposed Capacity Assistance Agreements; one for diesel generation (8 MW) and one for load curtailment (6 MW).
3	Reinstatement of Load Curtailment Program	+6 MW	Hydro, Vale	Ongoing	The proposed agreement was approved by the Board on November 30, 2018.
4	Voltage Reduction	+20 MW	Hydro, Newfoundland Power	Complete	Hydro has confirmed that it is reasonable to assume availability of 20 MW of Peak Voltage Reduction for the coming winter season. Voltage reduction is forecast on a week-ahead basis by the NLSO.
Potential Incremental System Benefit on peak		48.6 MW			

- 3 Hydro notes that voltage reduction is not what is publically known as "brown-out." Voltage
- 4 reduction is a measured and controlled process whereby there is minimal reduction in the
- 5 delivery point voltages to customers. This process, utilized by utilities across North America as a
- 6 typical system management tool, has been used for peak demand management in almost every

⁴ Hydro has confirmed there is 105 MW available as compared to the 110 MW reported in the October 15, 2018 report. Given the relatively small change in magnitude of the available assistance, Hydro has not run the model for this 5 MW difference. Hydro presented the full analysis of its supply adequacy for winter 2018–2019 in its November 16, 2018 filing to the Board regarding supply adequacy.

1 year on the Island system. Customers see no impact to their service during a period of voltage
 2 reduction (typically up to four hours) and equipment is not harmed.

3
 4 In addition to the items listed in Phase I of Hydro’s contingency plan, Hydro has also identified
 5 elements that can provide additional system benefit, but will only be enacted if absolutely
 6 required. These items form Phase II of Hydro’s contingency plan and are detailed in Table 3.

Table 3: Phase II of Hydro’s Contingency Plan

Item	Description	Incremental System Benefit	Parties Involved	Status	Notes
5	Increased output of Holyrood Gas Turbine beyond current base assumption	+10 MW	Hydro	Complete	The ability to increase the capability of the unit is available on a temporary basis subject to atmospheric and system conditions. The Holyrood Gas Turbine has been previously safely demonstrated to operate to 134 MW.
6	Temporary increased output of Holyrood Diesels	+1.5 MW	Hydro, Department of Environment	Complete	Hydro met with the Department of Municipal Affairs and Environment and provided an overview of the potential upgrading requirements.
Potential Incremental System Benefit on peak		+11.5 MW			

7 **6.0 Conclusion**

8 Hydro is actively monitoring the availability of supply as it relates to the LIL and associated
 9 impact on reliability of the Island Interconnected System for the 2018–2019 winter season.

10 Hydro’s contingency plans described above are in place in the event that the LIL does not meet
 11 the current assumed capacity and reliability parameters.

12
 13 Through its biweekly report, Hydro will keep the Board informed on developments related to
 14 the operation of the LIL should its performance impose material changes impacting supply
 15 adequacy for the Island Interconnected System.