NEWFOUNDLAND AND LABRADOR

BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

120 Torbay Road, P.O. Box 21040, St. John's, Newfoundland and Labrador, Canada, A1A 5B2

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Newfoundland and Labrador Hydro
Ms. Shirley Walsh
Senior Legal Counsel, Regulatory
Newfoundland and Labrador Hydro
P.O. Box 12400
Hydro Place, Columbus Drive
St. John's, NL A1B 4K7

Newfoundland Power Inc.
Mr. Gerard Hayes
Newfoundland Power Inc.
55 Kenmount Road
P.O. Box 8910
St. John's, NL A1B 3P6
E-mail: ghayes@newfoundlandpower.com

Industrial Customer Group
Mr. Paul Coxworthy
Stewart McKelvey Stirling Scales
Cabot Place, 100 New Gower Street
P.O. Box 5038
St. John's, NL A1C 5V3
E-mail: pcoxworthy@stewartmckelvey.com

Consumer Advocate
Mr. Dennis Browne, Q.C.
Browne Fitzgerald Morgan & Avis
Terrace on the Square, Level 2
P.O. Box 23135
St. John's, NL A1B 4J9
E-mail: dbrowne@bfma-law.com

Labrador Interconnected Group
Mr. Senwung Luk
Olthuis Kleer Townshend LLP
250 University Ave, 8th Floor
Toronto, ON M5H 3E5
E-mail: sluk@oktlaw.com

Dear Sirs/Madam:

Re: Newfoundland and Labrador Hydro - Reliability and Resource Adequacy Study Review - The Liberty Consulting Group Comments on Hydro's May 2020 Near Term Reliability Report

Please find a copy of The Liberty Consulting Group *Comments on Hydro's May 2020 Near Term Reliability Report.*

If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Cheryl Blundon
Board Secretary

CB/cj
ecc

Newfoundland and Labrador Hydro
Geoff Young, Q.C., E-mail: gyoung@nlh.nl.ca
NLH Regulatory, E-mail: NLHRegulatory@nlh.nl.ca

Industrial Customer Group
Dean Porter, E-mail: dporter@poolealthouse.ca
Denis Fleming, E-mail: dfleming@coxandpalmer.com

Labrador Interconnected Group
Julia Brown, E-mail: jbrown@oktlaw.com

Newfoundland Power Inc.
Kelly Hopkins, E-mail: khopkins@newfoundlandpower.com
NP Regulatory, E-mail: regulatory@newfoundlandpower.com

Consumer Advocate
Stephen Fitzgerald, E-mail: sfitzgerald@bfma-law.com
Sarah Fitzgerald, E-mail: sarahfitzgerald@bfma-law.com
Bernice Bailey, E-mail: bbailey@bfma-law.com

Comments on Hydro's May 15, 2020 Near Term Reliability Report

Presented to:

The Board of Commissioners of Public Utilities Newfoundland and Labrador

Presented by:

The Liberty Consulting Group

June 15, 2020

1451 Quentin Rd Suite 400
#343
Lebanon, PA 17042

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I. Introduction

Hydro filed on May 15, 2020 its semi-annual report (May 2020 report) on generation adequacy for the Island Interconnected System (IIS). That report included an assessment of system reliability assuming LIL unavailability until June 1, 2021 and also until June 1, 2022. An attachment to Hydro's May 2020 report provided a Nalcor-prepared Emergency Response Plan (ERP) for LIL overhead transmission lines for the coming winter (2020-21).

We reviewed that report and we participated in the Board's June 4, 2020 Reliability and Resource Adequacy Study Review technical conference. Hydro's May 2020 report and the June 4 discussion make clear that, as stated by Hydro, material reliability risk exists for the coming winter. Hydro's calendar-year categorization of the data (discussed below) makes the size of the risk for the coming winter less transparent. Hydro does not have time to make material additions to generation resources on which it can call this winter. It has only limited opportunities to increase assurance that they will be available when needed. Imports over the Maritime Link, however, can provide a high level of risk mitigation, making assurances of their availability important.

This report provides our comments and recommended actions establishing a more robust identification of the magnitude of customer risks over the coming winter and in pursuing admittedly limited options for addressing those risks.

II. Immediate-Term Actions Needed

Hydro's May 2020 report demonstrates the significant customer risks that exist for this coming winter, in the absence of LIL availability. Hydro does not have realistic supply-expansion alternatives for addressing options. Apart from measures to inform a robust understanding of the risks customers face, ensuring full attention to means for maximizing availability of already-existing supply sources comprises the only realistic alternative for mitigating those risks. The report makes clear that management places a sufficiently high priority on risk assessment and resource maximization. We recommend the following steps to ensure full effectiveness of management's actions to address reliability for the coming winter.

Expected Winter Customer Loads: Hydro should promptly produce a more robust range of demand assumptions, in order to provide the Board and stakeholders a better understanding of the risks this coming winter will bring. Questions about expected customer demand contribute to uncertainty about the level of that risk, should the LIL remain unavailable. Setting a useful range of potential demands this winter should specifically consider: (a) the potential impacts of COVID-19 restrictions like those recently applicable, and (b) a more extreme (P90) forecast.

Measures of Load Loss: Hydro should promptly provide for this more robust range of demand assumptions an assessment of lost load using the measure to which it is transitioning (LOLE), not just that which currently forms a planning basis (LOLH). This effort should include aggregating the months of the coming winter, not separating them between 2020 and 2021, in order to make more clear the risks that LIL unavailability will present for the coming November-April period.

Maritime Link Imports: The ability to secure firm winter-period deliveries over the Maritime Link has apparently been elusive. Doing so would greatly reduce reliability risks for the coming winter. Hydro should promptly describe efforts to secure a firm source of supply over the Maritime Link

for the coming winter, more fully describe the circumstances surrounding those past hours when it did not secure scheduled deliveries from this source, and report on the regional market and supply/demand circumstances expected to affect securing supply (both firm and otherwise). The past is not necessarily fully informative in this case, and understanding the level of uncertainty associated with imports is important in gauging the level of reliability risk in the immediate term.

Water Storage: Among the very few actions that can add supply capability for the coming winter are water-storage limits designed to optimize reliability. Hydro should promptly provide a description of measures existing and planned, status in designing and implementing them, and expected net contribution to supply resources for the coming winter. Equally importantly, Hydro should provide a complete and precise description of the role of Nalcor Energy Marketing and other affiliate resources in designing and executing measures to use and to husband water resources. This description should express directly where Hydro and where others have authority, accountability, and responsibility for current and immediate-term actions that can have an impact on winter-period hydro production of electricity.

Generation Plant Work: Planned work for the coming months will not make more capacity available, but is critical in maximizing the probabilities that existing capacity will be available when required. Hydro has a sound plan for those activities and it needs to pursue them aggressively. Our two recommendations that have the greatest potential for increasing those possibilities comprise:

- Reducing the issue-discovery phases of the schedule for the overhauls of the Holyrood turbine valves and main generator, in order to leave more time for performing work whose scope remains uncertain pending issue discovery
- Conducting a comprehensive review (or reporting on any already performed recently) and aggressively completing and tracking scheduled and backlogged corrective and preventive maintenance orders whose performance individually or in combination with others may create an availability risk.

LIL Outages: Cases assuming that the LIL will not operate this coming winter moot issues of whether, how often, and how long it may be out of service. However, the LIL should operate for most of the "near term" making these questions relevant for that period. There is some overlap between near- and long-term issues surrounding LIL reliability and outages. An important study underway now and scheduled for availability this coming November will address the frequency of expected LIL overhead line outages. Certain elements of that study required to make it fully useful to the Board and stakeholders should be made clear to Hydro immediately. More directly critical to near-term LIL operation, Hydro should promptly plan, execute, and make available a far more robust study of expected LIL outage durations, using most severe yet realistic assumptions about weather conditions during restoration activities. As soon as the LIL operates, which may be this winter, it should do so under restoration plans that are sufficient and under well-founded assumptions about its outage frequency and consequences.

III. The Underlying Demand Forecast

A. Summary

The forecast reflected in Hydro's May 2020 report has changed from that used earlier. The May 20 report presents numerical IIS forecast MW and GWh values; the November 2019 Reliability

and Resource Assessment Study update (RRAS Update) shows growth rates numerically, but presents MW and GWh data graphically. Therefore, we can compare MW and GWh information only roughly. However, several observations support the need for more expanded information in assessing customer reliability risks for the immediate and near terms:

- Hydro should provide an analysis supporting the current forecast's detail, and explaining divergence from the much higher levels of the two most recent two winter seasons.
- Hydro should provide an analysis of the causes of the difference between the forecasts of its May 20 report and the lower ones of Newfoundland Power.
- Hydro should provide P90 forecast information for the coming winter to provide a suitable bounding of possible winter circumstances for the Board and stakeholders.
- Hydro should provide a summary and analysis of its knowledge of COVID-19 impacts on load to date (preferably with Newfoundland Power consultation), and should summarize available industry literature and studies, to aid in assessing how and to what extent extended or later resumed efforts to control the spread or consequences of COVID-19 may affect winter demands.

B. Discussion

1. Forecast Comparisons to Historical Demand Levels

Table 1 below shows the May 2020 forecast of IIS customer coincident demand (from Hydro's May 2020 Report, Table 3). The values appear similar to Case I Mitigated Rate scenario values presented in the November 2019 study. The November 2019 RRAS Update does provide (at Table 7) numerical values for winter 2018-2019 - - also shown in the table below. Actual IIS customer coincident demand of 1,706 MW exceeded the P50 value by some 50 MW, and fell only 12 MW short of the P90 forecasted level for that year. Moreover, the actual winter 2018-2019 peak is higher than the corresponding forecasts all the way through 2024.

Table 1: Island Interconnected System Peak Demand Forecast (MW)

	2018-19 Winter			Current P50 Forecast			
	P50	P90	Actual	2021	2022	2023	2024
Utility	1,478	1,539	1,549	1,484	1,485	1,495	1,505
Industrial Customer	179	179	157	178	180	180	180
IIS Customer Coincident Demand	1,657	1,718	1,706	1,662	1,665	1,674	1,685
IIS Transmission Losses and Station Service				76	110	109	109
Total IIS Demand				1,738	1,775	1,783	1,794

2. Hydro vs. Newfoundland Power Forecasts

Page 13 of the May 2020 report contains the statement that:

> *Hydro's forecast annual peak demand requirements for the Newfoundland Power system are approximately 40-50 MW higher than the peak demand forecast provided by Newfoundland Power. Hydro relied on these inputs to determine a five-year forecast of customer energy and coincident demand for the IIS, LIS, and NLIS.*

We did not find clear what values Table 3 of the May 2020 report used. Hydro made clear at the technical session of June 4, 2020 that it used its own, higher values. We find it useful to consider both, to provide a more robust reflection of the uncertainties surrounding the forecast.

3. Impact of COVID-19 Restrictions on Demand

Hydro also has not undertaken a broad review of the impacts that major changes in lifestyle and location resulting from COVID-19-related measures may have on demand. Hydro did identify at the June 4 session the potential for such changes to increase demand, given the high penetration of electric heat and the much greater time that residents have remained at home. Certainly, it is not possible to predict with a high degree of confidence what this winter will bring, but, at the least, the Board and stakeholders would benefit from as much knowledge as possible about the degree to which continuation or recurrence of stay-at-home guidance may affect demand.

4. P50 vs. P90 Demand Forecasts

Hydro argues, with justification, that it should plan on the basis of a P50 forecast, observing that its P90 forecast lies within the demand forecast uncertainty distribution input to the reliability model. If so, then this distribution accounts for the possibility that demand will reach the P90 level through application of the reliability model. The difference between the P50 and P90 forecasts amounts to approximately 60 MW. Inputting the P90 forecast into the reliability model, with weather-driven demand uncertainty layered on top, would in effect cause the reliability model to account for a level of demand 120 MW higher than the P50 demand with the probability of the P90 level. Thus, using the P90 forecast together with the weather driven demand uncertainty distribution may be argued to double count the uncertainty on the upside.

The actual "Utility" component of 2018-2019 demand exceeded even the P90 forecast. We question whether the P90 level of demand should remain "buried" in a probability distribution when it comes to examining this coming winter. There is merit in examining an alternative approach, such as turning off the demand uncertainty distribution when running the P90 demand forecast in the reliability model.

IV. Measurement Basis of Load Loss

A. Summary

Hydro's May 2020 report presents near-term reliability measured in "Loss of Load Hours" (LOLH) - - the basis for its current planning. Hydro plans to change to "Loss of Load Expectation" (LOLE), which it considers preferable; we agree. Hydro has not provided and does not plan to show this winter's load-loss data measured in LOLE. We believe that Hydro needs to undertake further analysis of load loss expectation, in order to provide a more robust measure of reliability for the coming winter:

- Hydro should calculate this winter's LOLE, and for the remaining winters of the period encompassed by the "near-term," to provide another measure, acknowledged by Hydro as meaningful, for consideration in assessing near-term customer reliability risk.
- Hydro should directly calculate November 2020 through April 2021 reliability measures assuming no LIL availability, or should that prove too cumbersome to perform promptly, employ a November 2020-October 2021 analysis, which should have the same practical effect, given that expected load loss falls predominantly in those months.

B. Discussion

1. LOLH vs. LOLE

Hydro recognizes that a move to LOLE will provide a better foundation assessing reliability in planning its system. It does not plan to change from its current LOLH measure prior to the end of the coming winter period. Neither does it plan to measure load loss expectations for the coming winter in LOLE, observing that: (a) LOLH forms it current planning basis, and (b) LOLE is customarily measured on an annual basis, encumbering its use as a metric for a winter period, which by definition comprises less than a year and crosses two calendar years.

The tables presented in the May 2020 report, some shown below, demonstrate what one would expect of a system like Hydro's - - loss of load occurs predominantly in the coldest months, whether measured in LOLH or LOLE. Calculating LOLE on an annual basis, but using a non-calendar, 12-month period from November 2020 through October 2021 would serve the purpose of identifying load loss expectations for the coming winter. Given the recognition that LOLE offers a preferable measurement basis, we do not find its failure to serve as planning criterion now convincing. The Board's examination of near-term reliability needs to consider the perspective of customer risk - - a topic too broad for limitation to formulaic application of current criteria, even before considering their destiny to become superseded.

LOLH measures load loss in total hours; LOLE does so in number of days per year. Neither directly quantifies the magnitude of that loss; *i.e.*, total megawatt hours. LOLH provides an indication of the distribution of risk across the months in a year. LOLH data proves useful, especially in the near term, but also in the long term. Further, LOLH is intuitively useful in analyzing the reliability benefits of generating capacity. Therefore, we recommend keeping it for this purpose, at least.

LOLE can also provide an indication of the distribution of risk across the months. It is defined as, "The expected number of days each year where available generation capacity is insufficient to serve the daily peak demand."[1] Calculating it sums, over all the days in a year, the "Average Unserved Energy Hours" from PLEXOS in the peak hour of the day. One can calculate it just as well by summing over the days of each month.

An LOLE value quantifies the expected number of days that system operators will have to curtail (through disconnecting feeders serving customers) some amount of firm demand for a duration of at least one hour sometime during the day, in that year. An LOLH value quantifies the expected number of hours in a year that firm demand will require curtailment. EUE adds another dimension by accounting for the quantity curtailed. Load varies hourly throughout the day, causing the probability of a curtailment to vary through the day as well. One cannot simply multiply LOLH by 24 to calculate LOLE. The LOLH/LOLE ratio is significantly less than 24.

Under its older reliability model, Hydro found that an LOLE of 0.2 approximates an LOLH of 2.8. Use of its new model changes that value quite considerably. An LOLE of 0.1 approximates an LOLH of 0.6. Hourly load profiles drive this relationship, producing a dramatic effect in Hydro's

[1] NERC Probabilistic Assessment Technical Guideline Document, as quoted in the Reliability and Resource Adequacy Study, November 2018, vol. 1, p. 11.

case . The relationship can change as the hourly load shape changes, or as the hourly profiles of generating resource availability change. Thus, this relationship can change over time. Nevertheless, in the absence of a present, careful calculation by Hydro, one might begin by comparing the LOLH hours shown in Hydro's May 2020 report tables against a value of 0.6. That comparison provides a stark reminder of the sizeable risks that customers bear this coming winter.

2. Measurement of Reliability on a Calendar-Year Basis

Hydro's May 2020 report presents annual reliability index values on a calendar-year basis. Hydro's data unsurprisingly shows negligible LOLH outside the November-April time period, given the weather in which its system operates. Hydro has presented expected load-loss results that assume no LIL availability this winter, but has separated this winter's risks into two different calendar-year periods (2020 and 2021). This separation has the effect of diminishing the visibility of the large size of potential load loss in the November 2020-April 2021 period. Cases for 2021 that assume LIL availability in mid-2021 are not informative. Presenting 2020 numbers on a calendar period is also less helpful, because the focus is on system conditions and forecasts for a coming period, not a prior one.

Recategorizing study periods to keep the November 2020 through April 2021 months intact is critical in ensuring that load-loss analysis covers all the months of LOLH for the coming winter, focusing much more precisely on the period of immediate concern with respect to LIL availability.

To show results that do focus on this coming winter, we reformatted Hydro's May 2020 report tables to keep the months of important focus together, retaining each month's individual values. Table 2 below (Table 6 of the report) shows Hydro's annual, calculated LOLH values. Table 3 below groups the measurements in Tables 7 through 11 of the report for the colder months. Given at most negligible LOLH outside of the six months from November through April, we show a 12-month period as divided in to two parts, this six-month subperiod and the rest of the year. Both Tables 3 and 4 below show months during which Hydro's current 2.8 LOLH criterion would be exceeded (yellow highlight) and its LOLE criterion (assuming it equates to an LOLH of 0.6) would be exceeded (bolded, red font).

Table 2: Annual LOLH

Scenario	**Annual LOLH** (hours)				
	2020	2021	2022	2023	2024
S1: LIL 2021, HRD TGS DAFOR = 15%	**0.66**	**2.45**	**0.27**	0.52	0.49
S2: LIL 2021, HRD TGS DAFOR = 18%	**0.92**	**3.79**	**0.29**	N/A	N/A
S3: LIL 2021, HRD TGS DAFOR = 20%	**1.19**	**4.82**	**0.28**	N/A	N/A
S4: LIL 2021, HRD TGS DAFOR = 20%, 50 MW imports	**0.71**	**2.69**	N/A	N/A	N/A
S5: LIL 2021, HRD TGS DAFOR = 20%, 100 MW imports	0.41	**1.45**	N/A	N/A	N/A
S6: LIL 2022, HRD TGS DAFOR = 15%	**0.66**	**3.23**	**2.61**	0.37	N/A
S7: LIL 2022, HRD TGS DAFOR = 18%	**0.92**	**4.81**	**4.02**	0.38	N/A
S8: LIL 2022, HRD TGS DAFOR = 20%	**1.19**	**6.16**	**5.07**	0.39	N/A
S9: LIL 2022, HRD TGS DAFOR = 20%, 50 MW imports	**0.71**	**3.45**	**2.91**	N/A	N/A
S10: LIL 2022, HRD TGS DAFOR = 20%, 100 MW imports	0.41	**1.9**	**1.64**	N/A	N/A

Table 3: Seasonal LOLH

Scenario	LOLH (hours)							
	2020-2021		2021-2022		2022-2023		2023-204	
	May - Oct	Nov - Apr	May - Oct	Nov - Apr	May - Oct	Nov - Apr	May - Oct	Nov - Apr
S1: LIL 2021, HRD TGS DAFOR=15%	0	**3.10**	0	0.01	0	0.65	0	0.53
S2: LIL 2021, HRD TGS DAFOR=18%	0	**4.69**	0	0.03	0	0.28	0	0.00
S3: LIL 2021, HRD TGS DAFOR=20%	0	**5.99**	0	0.02	0	0.28	0	0.00
S4: LIL 2021, HRD TGS DAFOR=20%, 50 MW imports	0	**3.38**	0	0.02	0	0.00	0	0.00
S5: LIL 2021, HRD TGS DAFOR=20%, 100 MW imports	0	**1.84**	0	0.02	0	0.00	0	0.00
S6: LIL 2022, HRD TGS DAFOR=15%	0	**3.15**	0	**3.31**	0	0.08	0.01	0.34
S7: LIL 2022, HRD TGS DAFOR=18%	0	**4.67**	0	**5.02**	0	0.10	0	0.34
S8: LIL 2022, HRD TGS DAFOR=20%	0	**6.03**	0	**6.31**	0	**0.76**	0	0.34
S9: LIL 2022, HRD TGS DAFOR=20%, 50 MW imports	0	**3.38**	0	**3.59**	0	0.10	0	0.00
S10: LIL 2022, HRD TGS DAFOR=20%, 100 MW imports	0	**1.84**	0	**2.01**	0	0.10	0	0.00

Dividing winters between two calendar years diminishes the visibility on a scenario that assumes the coming winter without the LIL.

V. Benefits of Maritime Link Imports

A. Summary

A number of Hydro's near-term scenarios assume availability of import power over the Maritime Link; but no firm arrangements appear currently to exist or are anticipated. Firm arrangements would better ensure availability of such imports. Instead Hydro relies on broadly available import sources in the past as support for considering their availability in the future. Hydro should:

- Describe the current status of efforts to secure firm imports, and provide the reasons for not securing them despite efforts to date.
- Provide an analysis of expected regional (*i.e.*, considering the sources available for import) market supply and demand conditions for the coming and other near-term winters, and explain and justify expectations that the market will be able to offer needed resources at peak times.
- Hydro should also address any delivery issues that could impair the availability of this power to its system.
- Provide details on availability and price for the scheduled hours Hydro noted that it did not secure delivery in the past.

B. Discussion

Hydro's May 2020 report addresses "Expected available import power over the Maritime Link" by establishing scenarios that assume 50 MW and 100 MW of firm imports. Such levels

significantly affect the amount of load loss (measured in LOLH), as Hydro's Scenarios S3, S4, S5, S8, S9, and S10 demonstrate.

The May 2020 report observes that Hydro used monthly, day-ahead, and real-time transactions to import power from September 2019 through March 2020, securing power deliveries for more than 95 percent of scheduled hours during this period. However, no firm purchase agreements for future deliveries appear to exist. The reasons why warrant examination, as do the time and load conditions surrounding past non-delivery during hours scheduled. Most important are expected regional supply and demand conditions for the coming winters, which bear on the confidence that "the past is prologue" in assessing reliance on continuing non-firm imports.

Consideration of Maritime Link deliveries, firm or not, bears close attention, because those deliveries can very significantly mitigate near-term reliability risks. Whether planning criteria permit consideration of non-firm sources has merit, but should not be considered determinative. We believe that the Board and stakeholders should look at and past those criteria wherever doing so contributes to the holistic view of customer risk in the immediate term. A balanced examination of risk should consider matters that mitigate and compound risk on an even-handed basis.

VI. Use of Hydroelectric Energy Storage

A. Summary

Hydro has recognized the contribution that specifically-tailored water storage limits can make to maximizing reliability. How it is doing so and how Hydro should act to ensure that it, as opposed to Nalcor Energy Marketing, maintains control in informing, establishing, and managing those limits warrant further explanation. Hydro should:

- Describe the modeling process, how it accounts for and produces differences based on assumptions about LIL availability, and what difference those assumptions make.
- Establish and make clear to the Board and stakeholders the precise nature of how Hydro and Nalcor Energy Marketing participate in developing information, performing analyses, formulating issues, and deliberating about water limits decisions and their effects on day-to-day use of Hydro's hydro units.
- Describe with detail the measures that ensure Hydro's final authority, accountability, and responsibility for maximizing use of its hydro resources to ensure reliability.

B. Discussion

Section 5.0 (System Energy Capability) of the May 20 report discusses Hydro's establishment of minimum storage limits through April 30, 2021, to address LIL availability delays. The methods for doing so and Hydro's (versus affiliate) roles in doing so should be made clear. The resulting limits and their impacts on expected winter reliability should be provided when complete. Specifics about the modeling process and how it accounts for the presence or absence of the LIL should be included. The schedule for completing the establishment of the limits is important to know as well.

We have expressed concern about the role of Nalcor Energy Marketing (versus Hydro) in amassing and analyzing information, producing guidelines, or otherwise engaging in activities that affect the use of the utility's hydro generating units. The near-term consequences of LIL delays add further to what was, in our view, already a material matter. Hydro must retain full control of its assets, a

foundation for which is that Hydro should not be limited to second-hand access to or forced reliance on data amassed or analyses performed by Nalcor Energy Marketing. Hydro's personnel need to determine and fulfill information needs, conduct their own analyses, and make their own decisions about how utility generating units can best operate to ensure reliability.

VII. Generation Asset Reliability

A. Summary

The measures Hydro has used to project reliability and the resulting assumptions about unit availability conform to historical unit performance and reflect apparent unit material condition. The series of Holyrood capital projects slated for completion before the coming winter will better ensure achievement of projected unit availability, but the schedule for overhauling turbine valves and the main generator is aggressive, and warrants review of means to enhance assurances that management will meet it. Hydro should:

- Adhere to the recommended Bay d' Espoir Penstock No.1 mitigation practices to reduce the significant possibility of stress cracking.
- Review the Holyrood Turbine Valves and the main generator overhaul schedules to address the lack of float in the current schedule, perhaps by shortening the time slated for completion of issue-discovery, thereby increasing the time for actions and repairs to address matters whose scope, extent, and complexity that discovery process will identify.
- Conduct a comprehensive review of scheduled and backlogged corrective and preventive maintenance orders, to ensure timely completion of those presenting availability risk. This review should incorporate reviews of orders that may not have materiality in isolation, but that, in combination can have availability ramifications.
- Assess root causes of Upper Salmon rotor rim key cracking to determine whether actions beyond frequent monitoring exist.

B. Discussion

1. Unit Reliability Metrics

Unit forced outage rates have a direct impact on capacity requirements. Hydro's use of the Derated Adjusted Forced Outage Rate (DAFOR) for its thermal and hydraulic units conforms to industry practice. DAFOR measures the percentage of time during which units are expected to be unable to generate at maximum continuous rating due to forced outages or deratings. Derated Adjusted Utilization Forced Outage Probability (DAUFOP) serves more commonly as a measure of reliability for units operating in peaking or standby mode. DAUFOP measures the percentage of time units are expected to be available relative to when the units are required. This measure also considers deratings of the units. Comparing Hydro's historical and projected unit availabilities disclosed no evident concern based on what we know about the units. Nor did any divergence in the values suggest undue optimism. Hydro experienced a decline in hydro unit DAFOR between the 12-month periods ending March 2020 and March 2019. Thermal DAFOR improved. We also observed improved Stephenville and Hardwoods performance and a slight decline at Happy Valley Gas Turbine.

2. Holyrood Condition

A significant number of condition issues have affected Holyrood units in recent years. We agree with management's assessment that many of them appear to have been successfully resolved, with variable frequency driver power-cell failure correction a work in progress. The four capital projects scheduled for completion this year are material to ensuring effective unit performance. Performance of two of them is taking place under schedules that appear to provide sufficient time for completion, allowing for a typical level of uncertainty:

- Boiler Condition Assessment and Upgrades - - scheduled for August 20, 2020 completion
- Overhaul Unit 3 Main Boiler Feed Pump - - scheduled for September2020 completion.

A third Holyrood capital project underway presents greater concern. The Overhaul of Unit 2 Turbine Valves requires valve disassembly, internal inspections, refurbishment as necessary, and reassembly. These valves are critical to safe and reliable unit operation, making the work important for ensuring their continued operation through March 2022. The schedule calls for work start in July 2020 and completion in November 2020. Schedule completion runs up against winter start, presenting completion risk, should initial inspection after disassembly disclose significant issues. We believe that shortening the inspection stage, if possible, will provide greater assurance that the time remaining before winter's onset will be sufficient to perform required refurbishment. Finding ways to produce schedule float is important.

The last of the four Holyrood capital projects underway also has a schedule with little float. The Overhaul of the Unit 2 main generator requires disassembly of the generator, pulling the rotor, performing internal inspections and electrical testing, and addressing any issues disclosed by inspection or testing. The schedule calls for a July 2020 work start and completion in October 2020. This schedule has some, but still little float for addressing significant issues, should inspection and testing disclose them.

3. Bay d' Espoir

Several leaks have occurred in the penstocks, resulting in unit availability reductions. Penstock No. 1 presents the most significant concern. Nearing its end of life, this penstock experienced leaks in September 2019. Hydro has reported that previously penstock inspections have not identified major defects or areas of concern. However, it appears from recent analysis that 2016 and 2019 Penstock No. 1 failures arose from "high secondary and peak stresses at the longitudinal weld seam under internal pressure." Units 1 and 2 have experienced a DAFOR of 3.73 percent - - higher than management's near-term planning assumption of 2.8 percent. Note that all the units combined have performed at a lower weighted average DAFAOR for the last twelve months.

Penstock No.1 could negatively affect the reliability of these units going forward. There have been four failures of Penstock No. 1 in the last four years. Mitigation measures have been adopted to reduce transient stresses in Penstock No.1, to lower the risk of cracking due to high stresses. However, the area where the cracking has occurred or is prone to cracking lies in a thinner-wall section of the Penstock. A long-term plan to fix this area of the Penstock will be needed to guarantee a better probability of reliability.

4. Gas Turbine Units

The major issue challenging these units is their age and the availability of spare parts. We understand that a spare engine is now on site. Previous engine rebuilds have had quality issues and required re-work. We do not recommend a change to assumptions about unit availability, but these units will continue to form a weak link in reliability assurance for their remaining period of service.

VIII. LIL Return Periods and Restoration

A. Summary

The June 4 technical conference made clear that it will be at least November before Hydro can provide the Board and the stakeholders with LIL overhead line equipment failure rates (number of recurrences in 50, 150, and 500 year periods) based on local climatological information Hydro concedes is central to informed decisions about those rates. That information will be critical primarily for assessing long-term, as opposed to this coming winter's reliability and resource adequacy. It has some applicability to the near term as well. To some extent, the issues raised are similar, therefore, it is important to provide a logical basis and record for examining both terms. Doing so requires that the study and analysis preceding Hydro's report scheduled for November issuance proceed in a manner designed to ensure that it provides comprehensive and high-confidence results. Therefore, Hydro needs to incorporate into its plans and actions for supporting the November report assurances that its assessment:

- Considers as-built, not merely as-designed conditions.
- Makes use of local climatological conditions (like glaze ice, rime ice, winds, and combinations of them) that are transparently assembled and applied, comprehensive, and reliable.
- Considers those scenarios that could produce cascading structure failures.
- Applies broader consideration of the impacts of wind direction.
- Analyzes the towers models on each end of overlapping LIL sections.

This concern focuses on an immediate administrative need - - ensuring that the expected November report contributes fully to near- and longer-term Board and stakeholder consideration of LIL contributions and threats to reliability. More substantively, we believe that Hydro has not addressed the length of potential LIL outages using an extreme, yet realistic set of conditions under which restoration will have to proceed. The need for restoration plans considering such conditions will exist from initiation of LIL operation, which if not this coming winter, will take place at some point within the "near term." Therefore, to inform both near- and long-term LIL emergency response planning and the assessment of reliability and resource adequacy, Hydro should promptly:

- Assess and quantify expected LIL restoration times under combinations of extreme conditions, such as the following, considering activities required of all groups involved, including work and time required, details of each activity or group of activities (including at least equipment and human resource marshalling, transit and work set-up time, and restoration completion and verification):
    - An assumed midnight outage initiation
    - Duration to full restoration of monopole operation
    - 10 feet of snow cover

- High winds impairing helicopter access to affected line segments
- Most remote line location
- One downed support structure
- Multiple downed support structures at the same location
- Concurrent downed support structures at different locations.

B. Discussion

1. LIL Return Periods

Hydro made available an April 30, 2020 EFLA report addressing LIL reliability, including an assessment of the likelihood of weather-related failures, expressed in "return periods." The return period (frequency of outages of overhead line portions of the LIL) has important long-term consequences for assessing resource adequacy and reliability. The June 4 technical conference included discussion of short-term plans for LIL emergency response planning. Hydro attached its Emergency Response Plan covering the LIL to its May 2020 report.

We anticipate that Board review and stakeholder participation in that review will place significant attention on LIL return periods and restoration in the coming months. Important aspects of that attention must await the next report that Hydro, as it noted at the June 4 technical conference, expects to file this coming November. Overlap exists between near- and long-term LIL return-period and restoration-duration issues. It will be important to ensure that means exist for a very robust review of those issues, given the nature of work Hydro has completed so far versus what it plans for the remainder of the year.

Critical information needs and issues that should be considered in planning to address such issues include:

- Ensuring that assessment of return periods considers as-built, not merely as-designed conditions
- Ensuring that this assessment makes robust use of comprehensive and reliably localized climatological data for factors like glaze ice, rime ice, winds, and combinations of them
- Scenarios that could produce cascading structure failures
- Broader consideration of the impacts of wind direction
- Analyzing the tower models on each end of overlapping LIL sections.

Hydro should incorporate these needs now into continuing return-period studies scheduled for November issuance of results that appropriately consider the factors management concedes are required for meaningful assessment of realistic LIL return periods.

2. LIL Emergency Response Planning

Hydro provided the Emergency Response Plan covering the LIL as an attachment to its May 2020 report. The June 4 technical conference included discussion of short-term plans for LIL emergency response planning. It appears generally appropriate. However, Hydro has not yet provided the Board with an analytically-founded analysis of LIL emergency response times under the severe weather conditions that often tend to accompany high peak loads. We continue to find Hydro's assessment too general and unsupported by clear and effective analysis of transit times, access limitations, and work-impairing factors likely to exist under such conditions.