IN THE MATTER OF
the *Electrical Power Control Act, 1994*, SNL 1994, Chapter E-5.1 (the "*EPCA*") and the *Public Utilities Act,* RSNL 1990, Chapter P-47 (the "*Act*"), as amended, and regulations thereunder; and

IN THE MATTER OF Newfoundland and Labrador Hydro's Reliability and Supply Adequacy Study.

PUBLIC UTILITIES BOARD
REQUESTS FOR INFORMATION

PUB-NLH-080 to PUB-NLH-179

Issued: June 30, 2020

Newfoundland and Labrador Hydro - EFLA Consulting Engineers Report - *Structural Capacity Assessment of the Labrador Island Transmission Link*, April 30, 2020 ("EFLA" Report)

PUB-NLH-080 With respect to LIL design modeling performed as part of the analysis underlying the April 30, 2020 EFLA report, please describe the nature, extent, methods, and documents and data reviewed by EFLA to verify the original SNC-Lavalin design load models in any way. If verification did not occur, explain whether there is and how there is an adequate basis for assuming that those load models were appropriately designed and executed.

PUB-NLH-081 Please list and explain the basis for all April 30, 2020 EFLA report assumptions that differed from those made by SNC-Lavalin with respect to LIL design. For any specific assumptions addressed in responses to other requests for information at a level sufficient to satisfy this request, please note the relevant response number.

PUB-NLH-082 With respect to comments by Hydro at the June 4, 2020 Technical Conference addressing as-designed versus as-built LIL characteristics and structural capabilities, please describe the efforts made by Hydro and the detailed documentation that support a conclusion that as-built structural capacities of all LIL line sections and components are the same as "as-designed."

PUB-NLH-083 With respect to comments by Hydro at the June 4, 2020 Technical Conference, please state whether it has been confirmed that all LIL line sections and components have as-built structural capacities at least equal to their as-designed capabilities with respect to wind and ice loadings.

PUB-NLH-084 With respect to comments by Hydro at the June 4, 2020 Technical Conference, please describe the types and extent of documentation or other evidence now existing that demonstrates for each location the performance of inspections made, the nature of the inspections, and application to each element of tower structure, conductors, hardware, insulators, guys, anchors, and foundations in determining compliance with the design specifications and drawings used for the study.

PUB-NLH-085 Please state all identified deviations from the LIL designs and specifications that were corrected (such as re-tightening bolts); and not corrected (such as the removal of a conductor strand).

PUB-NLH-086 Please provide documentation listing differences in tower locations and construction, conductors, hardware, insulators, guys, anchors, and foundations between "as-designed" and "as-built," and verify that each of these differences have been considered in the EFLA study.

PUB-NLH-087 Please explain the details of how ongoing LIL reliability studies Hydro cited at the June 4 technical session and to be filed with the Board by November 15, 2020 will amass, localize, categorize, analyze, and report on the impacts of local climatological conditions in assessing LIL return periods.

PUB-NLH-088 With respect to use of CSA Standards in performing analyses addressed in the April 30, 2020 EFLA report, please confirm that EFLA made no use of climatological condition values other than those standard values provided in the standards. If not confirmed, provide a complete list of where and how localized, actual climactic data was used and the sources for such data.

PUB-NLH-089 With regard to Hydro's ongoing LIL reliability studies (referred to at the June 4 technical conference) and to be filed with the Board by November 15, 2020, please confirm that Hydro is performing another assessment considering glaze ice data that is based on local climatological data; *i.e.*, different from the glaze ice data underlying the results presented in the April 30, 2020 EFLA report, and provide a description of the efforts, data sources, and use that such an assessment will employ. If not so confirmed please explain why not.

PUB-NLH-090 Further to PUB-NLH-089 provide the currently expected date of availability of the assessment results and Hydro's understanding of the major risks that this date will not be met, and Hydro's confidence level that it will be met.

PUB-NLH-091 Please describe in detail the purpose, methods, data collection and assessment activities, and intended use of local topographical conditions in the ongoing LIL reliability studies Hydro referenced at the June 4 technical conference and which is to be filed by November 15, 2020.

PUB-NLH-092 Regarding the April 30, 2020 EFLA report, page 26, statement about excluding load cases related to security level and safety level from the EFLA study, please:

a. Confirm that security and safety requirements are critical for reliability (cascading prevention) or safety (maintenance safety).
b. Describe the reasons for excluding security and safety related load cases from the EFLA study.
c. Describe the scope, extent, and date for completion of any planned study of load cases pertaining to security (cascading) and safety. If none are planned explain why not.
d. State if, and if so, when Hydro or EFLA intends to conduct studies related to the conditions that would cause cascading, and safety hazards during maintenance operations.
e. State whether the scheduled November 15, 2020 reliability study report is intended to address the results of load cases related to security and safety level. If not intended for inclusion in the November 15, 2020 report, explain.

PUB-NLH-093 Please see Footnote 12 of the April 30, 2020 EFLA report, noting that "tension towers were designed for extreme unbalanced ice with full load on one side and no conductor on the other side, for one conductor at a time." Please provide the data and analysis supporting this statement, and describe and explain why or why not tension towers are designed to remain intact when subjected to impact forces from sudden breaks of one conductor with full ice load.

PUB-NLH-094 With reference to pages 26 and 27 and Footnote 11 of the April 30, 2020 EFLA report, please:

a. Explain the justification for excluding unbalanced ice loads.
b. Explain the justification for assuming that wind directions are transversal, 45 degrees, or longitudinal to spans, thus excluding other possible worse case wind directions and unbalanced ice formations.
c. State whether global wind directions and unbalanced ice loads will be addressed in the November 15, 2020 reliability report. If not, explain.

PUB-NLH-095 Regarding footnote 13 of the April 30, 2020 EFLA report, please state whether detailed load analyses of the ends of overlapping sections will be completed and included in the November study report. If not, explain why not.

PUB-NLH-096 With respect to detailed study and analysis of expected LIL restoration, please state whether and if so when, Hydro or Nalco plans a detailed study and analysis of 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):

- Midnight outage to full restoration of monopole bipole service
- 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

PUB-NLH-097 Further to PUB-NLH-096 provide Hydro's views on whether the assumptions listed are reasonable to postulate as worst-case circumstances. If not provide Hydro's view as to such worst-case circumstances. If no such study is planned in the near term, explain why not.

PUB-NLH-098 With respect to Hydro's cover letter for the April 30, 2020 EFLA report, describing "unsurprising" differences between the results of expert opinion in the EFLA report and that previously provided, please summarize the principal areas of divergence in the opinions being referred to, and describe the primary contributing factors in the areas summarized.

PUB-NLH-099 Further to PUB-NLH-098 with respect to Hydro's cover letter for the April 30, 2020 EFLA report, referring to a Halder & Associates study, please explain in as much detail as is available the scope of the study and provide any documentation that describes the scope.

PUB-NLH-100 Further to PUB-NLH-099 explain what specific results from the EFLA study will be used and how in the Halder study.

PUB-NLH-101 With respect to the April 30, 2020 EFLA report's Study Summary citation, page 5, that the "goal was to use loading specified in the CSA without a special study of local conditions" and "it was not part of this study to review or verify PLS-CADD and PLS-Tower models made by the designers," please identify all the unstudied local conditions that the CSA considers appropriate for consideration in the design of facilities like the LIL.

PUB-NLH-102 Further to PUB-NLH-101 describe efforts to review and verify any such models used to provide data or analysis for EFLA's use in this study.

PUB-NLH-103 With respect to the phrase "the design exceeded some of the basic requirements in the standard" cited on page 5 of the April 30, 2020 EFLA report, please:

a. Explain in detail what is meant by this statement.
b. Define specifically what those requirements are and where they are cited or explained in the standard.
c. Explain qualitatively and for all cases if, where, and how requirements other than these were applied.
d. Provide a table listing all quantified values comprising these basic requirements and provide in that table a one-to-one comparison of all values other than those comprising these basic requirements used in assessing LIL structural capacities as part of the EFLA analysis.
e. Identify where in the study report return periods or other quantified measures of LIL structural capacities with respect to wind and ice loadings are presented. If not so presented, provide them measured against all values (basic requirements and others) analyzed as part of the EFLA work, at the greatest level of detail (tower, conductor, and any others employed) analyzed.

PUB-NLH-104 With respect to the statements set forth in the three bullets beginning near the bottom of page 5 of the April 30, 2020 EFLA report, please:

a. Define methodologically and quantitatively what specifically is meant by the "approach" indicated under the first bullet, associated with design of the LIL.
b. Provide the specific ice values used under the "same approach cited" and provide their source.
c. Define specifically, provide the values, and cite the source for what are termed "CSA recommendations" and explain the basis for concluding that the CSA has opined that such values are "recommended."

d. Provide the best available quantitative measures of how EFLA defined "realistic" and "probable" recognizing, for example that the latter can mean 51 percent.
e. Identify and provide the values set forth in all sources of information considered by EFLA in analyzing ice and wind conditions specific to particular tower and conductor locations.
f. Cite the locations in the EFLA report that show return periods or other structural capacity measures under such localized conditions, and, if EFLA has performed analysis using such conditions, but not included them in the report, provide them.
g. Provide the exceedance utilization level EFLA does consider "critical" and explain in detail if and whether any level less than qualifying as critical is material to assessing tower and conductor structural capacity.
h. Define "should not" as used in the second bullet and provide and support EFLA's" judgment about the likelihood (expressed as quantitatively as possible) of breakage or outage.
i. Provide and quantify what EFLA considers "normal design practice," indicated under the third bullet, with respect to electrode conductor suspension hardware.
j. Define as quantitatively as possible "marginal increase" with respect to failure of such hardware, and identify as particularly and quantitatively as possible the amount of increase EFLA considers as present.

PUB-NLH-105 With respect to the last statement on page 6 of the April 30, 2020 EFLA report, please describe with specificity what consideration remains to be given to the "above-mentioned exceptions," and describe in detail EFLA's view on the means, analyses, criteria, and other aspects warranting such consideration.

PUB-NLH-106 With respect to the April 30, 2020 EFLA report's page 11 reference to "the operational experience and special studies" used in "original design of the LITL," please:
a. Confirm that such original design conforms in all material respects to the "as-designed" LIL basis examined by EFLA.
b. Describe the documents that comprise the studies cited.
c. Identify all ice and wind conditions identified by those studies and used in such original design.

PUB-NLH-107 With respect to benchmarking "against the 50, 150 and 500-years return period loadings provided in the CSA 60826-10 standard", page 11 of the April 30, 2020 EFLA Report, please:
a. Provide EFLA's opinion and explanation of what consideration applying good utility practice (or alternative definition of the standard EFLA considers appropriate in design of overhead lines serving purposes like those of the LIL and define any such alternative standard applied) should be given to localized wind and ice conditions in assessing return periods.

b. With respect to the use of 50, 150, and 500 year return periods, provide and explain EFLA's opinion on which should apply to the LIL, given its purposes and intended operation, and explain the reasons for its selection.

PUB-NLH-108 Regarding references to the EFLA study's non-addressing of "construction quality and effects of component fatigue" and review of "detailed engineering work undertaken in design of the LITL transmission line" (page 12), please describe the timing, nature, and results of any studies, analyses or other work performed by or for Hydro/Nalcor with respect to excessive aeolian vibration or galloping conductors on the LIL.

PUB-NLH-109 With respect to the statement on page 12 of the April 30, 2020 EFLA report that EFLA's analysis was not "intended to review, verify, or audit the detailed engineering work undertaken in design of the LITL transmission line; please describe in detail what examination EFLA did undertake of engineering work and describe the results of such examination as was undertaken.

PUB-NLH-110 With respect to the statement on page 12 of the April 30 EFLA report, describe each principal category, conclusion, or analysis influencing initial design that EFLA did examine, assess, reconfirm, or otherwise test and each principal category of judgment, conclusion, or analysis influencing initial design on which EFLA relied and which were material to its conclusions about return periods.

PUB-NLH-111 Page 23 of the April 30, 2020 EFLA report observed that Hydro provided "as-built" line profiles for the study. Please describe how Hydro developed the as-built profiles and how the as-built profiles were used in the EFLA study.

PUB-NLH-112 With respect to the April 30, 2020 EFLA report's page 23, statement about modifications to the tower analyses made to the PLS-CADD and PLS-Tower models used for the original design, please provide further description of the reasons for these modifications and the nature and magnitude of their effects on study results, with respect to:

- Using the PLS-Cadd option "IEC 60824.2017F, rather than using "wind on face" as used in the design.
- Reducing the stiffness of a few elements in seven suspension towers by a factor of 10.
- Improvements made to modeling the earth wire peak in tower 1219.

PUB-NLH-113 With respect to the April 30, 2020 EFLA report's page 24, statement that "Allowable conductor tension limits were verified in all sections using the same settings from the "as-designed" in using the ruling span concept analysis in the PLS-CADD" please:

a. Confirm that incorrect ruling spans (average span length between tension towers) used can cause either excessive sag or excessive tension, and if cannot be confirmed explain why not.

b. Describe how actual "as-built" ruling spans for each line section were verified to be the same as the "as-design" ruling spans.
c. State whether any "as-built" ruling span lengths were different from "as-design" ruling span lengths, and were any changes considered in the study.
d. Describe whether and how the reported removal of a strand in the "as-built" conductor was considered for determining tension limits for that LIL line section.

PUB-NLH-114 Regarding footnotes 11 through 14 of the April 30, 2020 EFLA report, please explain in more detail why the following assumptions and simplifications indicated on pages 26 and 27 were made for the study and whether and how each assumption or simplification might allow conditions for higher risk of LIL component failure:

a. Use of assumptions from design unless conflicting with CSA standard (and indicate where the LIL design assumptions differed from the CSA standard).
b. Ice load on tower members assumed the same as radial ice on conductor (and indicated whether this is worst case, and it not, why this assumption was made).
c. Load cases contain only uniform ice formation (and indicate whether this is worst case, and if not, why this assumption was made).

PUB-NLH-115 With respect to the April 30, 2020 EFLA report's page 27 listing of the following sources of data used to establish the design load conditions included CSA Standards:

- A study of glaze ice undertaken by Cold Regions Research and Engineering Laboratory.
- Studies made by Landsvirkjun Power which evaluated rime (or in-cloud) ice loadings
- Hydro's nearly 50-year operating history along the transmission line route
- Measurements in test spans at LRM that measure rime icing
- Studies completed by Meteorology Research, Inc., Teshmont, and RSW
- Climatic Monitoring Program from 1973-1987 concerning transport power to Newfoundland from the proposed Gull Island Project measurements and monitoring programs

Please:

a. Indicate how data from each of these data sources were used to influence or modify the glaze ice and wind data indicated in Table 14 of the EFLA report.
b. Address how these sources are intended to be used in the ongoing analysis for the reliability report scheduled to be filed by November 15, 2020.

PUB-NLH-116 With respect to these sources of data cited on page 27 of the April 30, 2020 EFLA report, please identify any others considered, how they were considered,

and what adjustments to wind and glaze ice data they produced for the EFLA analysis.

PUB-NLH-117 With respect to use of localized wind and ice loadings, please:

a. Provide and explain EFLA's opinion and explanation thereof about what types of sources are appropriate for consideration in design of a facility serving the purposes of and having the physical characteristics (describing those characteristics that are material) of the LIL.
b. Provide and explain EFLA's understanding of what specific sources are available to do so for the corridor traversed by the LIL.
c. Provide and explain EFLA's understanding of how initial design did account for and employ such consideration and where it produced uniquely determined (versus CSA-provided) values.

PUB-NLH-118 With respect to the bullets beginning at the bottom of page 28 of the April 30, 2020 EFLA report and continuing through the top of page 29, please explain in detail the responsibility, bases, and calculations and values used for:

a. Determining whether glaze or rime ice was controlling for each loading zone.
b. Assessing the contribution of wind conditions in making that determination.
c. The Category B and Category C determinations.
d. Determining from local conditions that wind speeds for 8 LIL zones in Table 14 were increased.
e. Determining to increase wind speed for zones 71, 7b, and 7c were increased by 1.64 compared to the CSA standard.
f. Increases in wind speed in zones 5 and 9 (was not 1.64, but what was it), and based on what data.
g. Not considering topography in other zones.

PUB-NLH-119 With respect to air density factor addressed at page 29 of the April 30, 2020 EFLA report, please:

a. Explain why the values of air correction factors used by the designers were different than CSA air correction factors.
b. State which the EFLA analysis used: CSA, LIL design basis, or other (explain if other).
c. How choosing the other would affect return period measures.

PUB-NLH-120 With respect to the April 30, 2020 EFLA report's page 28 discussion of assuming all icing to be radial, please:

a. Provide the basis for making this assumption.
b. Describe circumstances that have material potential for producing non-radial accumulation.
c. Explain whether non-radial accumulation has the potential for magnifying the impact of the accumulation.

PUB-NLH-121 With respect to the statement on page 31 of the April 30, 2020 EFLA report that, "It was not part of this study to assess the suitability of the terrain category selection or local wind effects used in the design assumption for the LITL" please:

a. Describe why the terrain categories selected by the designers were not verified in the EFLA study.
b. Provide a depiction of the categories and a list of their mileages for the DESIGN loading.
c. Provide Hydro's comparison of that categorization and those mileages with expected terrain conditions assuming anticipated vegetation management methods.

PUB-NLH-122 With respect to the April 30, 2020 EFLA report statement at page 31 that, "the effects of acceleration due to funneling between hills or due to sloping grounds are not covered and may require specific studies to assess such influences" please:

a. Please describe any specific funneling studies prepared as part of LIL design, the EFLA study, or otherwise.
b. If no such studies have occurred, please explain the reasons and assess the impact of their absence on the confidence that can be placed in the results of the EFLA analysis.

Newfoundland and Labrador Hydro – Near-Term Reliability Report, May 15, 2020

Demand Forecast

PUB-NLH-123 Please provide a comparison of forecast values for IIS customer coincident demand in MW and IIS forecast energy requirement in GWh, for all scenarios and all years covered by the forecast, for the following reports and studies:

a. Near-Term Reliability Report – May 2020.
b. Reliability and Resource Adequacy Study 2019 Update.
c. Near-Term Generation Adequacy Report, May 15, 2019.
d. 2018 Reliability and Resource Adequacy Study.

PUB-NLH-124 With respect to IIS customer coincident demand, please:

a. Confirm or provide the corrected values if not confirmed that the actual IIS utility demand (1,549 MW) in winter 2018-2019 exceeds both the P50 (1,478 MW) and P90 (1,539 MW) forecasts for that year, as presented in the November 2019 RRAS update.
b. Explain the causes of the high actual demand in terms of how the key drivers of the forecast compared to the actual values that year.
c. Provide an explanation and analysis of how the May 15, 2020 report forecasts considered and differ from 2019-2020 winter period actual demands.

PUB-NLH-125 Page 13 of the Near-Term Reliability Report, May 15, 2020 states 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." Please provide an analysis of the causes of the difference between Hydro's forecasts in its May 2020 report and the lower ones of Newfoundland Power.

PUB-NLH-126 Please provide a P90 forecast for the coming winter.

PUB-NLH-127 With respect to present, extended, and potential resumed application of COVID-19 circumstances, restrictions, and guidance, please:

a. Confirm that their application during the winter season can have implications that may cause a material impact on peak loads for this season. If not so confirmed explain why not.
b. Describe whether Hydro has collected during the existence of current COVID-19 circumstances, restrictions, and guidance demand and usage data available and suitable for use in examining changing use and demand patterns.
c. Provide the results of any study or analysis that Hydro has performed to address usage and demand impacts of COVID-19 circumstances, restrictions, and guidance. Also provide the scope, activities, questions to be answered, and schedule of any such study no underway or contemplated.
d. Summarize Hydro's knowledge, understanding, and perspectives and views about industry writings, studies, or analyses of the impact of COVID-19 circumstances, restrictions, and guidance on customer usage and demand.

PUB-NLH-128 With respect to possible joint discussions, information gathering and sharing, and dialogue with Newfoundland Power, please:

a. State and explain Hydro's views on whether such joint initiatives may have significant potential for gaining useful understanding about usage and demand impacts of COVID-19 circumstances, restrictions, and guidance.
b. If they may, describe if, and if so how, such joint efforts might be expected to provide useful information (and the earliest realistic dates for doing so) for consideration in the Board's Reliability and Resources Adequacy Study review.

Measures of Load Loss

PUB-NLH-129 Regarding the results shown in Table 6, page 17 of the Near-Term Reliability Report, May 15, 2020, on a calendar year basis, please provide Hydro's views on the usefulness of presenting the results on the basis of a 12-month period that keeps the months of November through April together, given that one of

the assumptions required to be employed would have the LIL in service shortly thereafter.

PUB-NLH-130 Please provide LOLE results corresponding to the scenarios and periods in Tables 6 through 11, Near-Term Reliability Report, May 15, 2020. (Note: Monthly numbers can be calculated by taking the sums over all days in each month of the Average Unserved Energy Hours in the peak hours of the day. If another approach is in Hydro's view more appropriate, please (in addition to responding as noted in this request) describe it and provide the results of employing it.

PUB-NLH-131 With respect to the scenarios in Section 6.0: Results, Near-Term Reliability Report, May 15, 2020, please:

a. Provide the dates on which each of the Muskrat Falls units was assumed to be available in those scenarios.
b. Clarify whether the LIL was assumed to be completely unavailable in winter 2020-2021 in any of the scenarios reported.
c. If there were such scenarios, identify them.
d. If there was no scenario reported in Section 6.0 in which the LIL was assumed to be completely unavailable in winter 2020-2021, provide results for a variation of scenario S1 in which LIL availability is zero.

PUB-NLH-132 Please explain why or why not near-term reliability should be evaluated against the LOLE≤0.1 days/year criterion.

Maritime Link Imports

PUB-NLH-133 Please describe efforts and results of efforts and who has made them to secure firm power purchase agreements for any period with a duration of one month or longer.

PUB-NLH-134 Please describe efforts to secure firm power purchase agreements for any period with a duration of one month or longer during any part of the November-April 2019-2020 period over the Maritime Link.

PUB-NLH-135 Please describe the reasons (focusing on both firmness and economy) why no firm power purchase agreement with a duration of one month or longer over the Maritime Link was secured in winter 2019-2020.

PUB-NLH-136 Please outline the efforts (and results) Hydro has undertaken or that have been undertaken for Hydro to secure a firm power purchase agreement for any portion of the November-April 2020-2021 period over the Maritime Link.

PUB-NLH-137 Please describe market and regional supply/demand conditions as they affect the likelihood for securing a firm power purchase agreement for any period in winter 2020-2021 over the Maritime Link.

PUB-NLH-138 Please describe Hydro's and Nalcor's understanding of the coincidence/difference between expected peak loads of the IIS and Nova Scotia Power systems and of the relationship between Nova Scotia Power's supply resources and demand (and those of other relevant market participants) at its expected winter peak period for the coming and the following winter and relate that understanding to confidence levels with respect to the availability of supply over the Maritime Link during peak conditions.

Hydro Electric Energy Storage

PUB-NLH-139 Refer to the Section 5.0, System Energy Capability, Near-Term Reliability Report, May 15, 2020, statement that, "Hydro is establishing minimum storage limits to April 30, 2021 in consideration of potential delays in the availability of the LIL to deliver energy to the IIS." Please describe: the modeling process and how it accounts for and produces differences based on assumptions about LIL availability and what difference those assumptions make.

PUB-NLH-140 With respect to developing information, performing analyses, and making decisions about water limits and their effects on day-to-day use of Hydro's hydro units, please:

a. Describe in detail the roles played by Hydro, Nalcor Energy Marketing, and other Nalcor personnel and contracted resources.
b. Identify the groups and the lead personnel from each of those organizations involved.
c. Identify key decisions that affect such day-to-day use.
d. Identify the organizations and the lead persons with direct accountability and responsibility for making such decisions.

PUB-NLH-141 Please describe with detail the measures that ensure Hydro's ability to maximize use of its hydro resources to ensure reliability, given Nalcor Energy Marketing's role in managing Hydro's hydro resources.

Other Near-Term Issues

PUB-NLH-142 How many test failures occurred in the Factory Acceptance Test (FAT) that finished on May 1, 2020?

PUB-NLH-143 With regard to the FAT setup and circumstances, please:

a. Describe the ac networks to which the LIL was connected during the FAT; addressing the different system configurations used at the connection points of the MF converter and at the Soldiers Pond converter.
b. Provide the minimum the short circuit level for each setup tested.

PUB-NLH-144 Please provide the following details of the software deficiencies and the setup that resulted in the failure of the FAT:

a. The network configuration during the test.

b. Whether the same test had been passed with other network configurations.
c. If so, list the configurations that passed.
d. A detailed description of tests that resulted in the failure.
e. A description of the software function that caused the failure.
f. Whether this software function had previously been known to result in test failure, and if so, the actions taken to avoid this failure prior to the FAT.
g. If this was a new/unknown fault, please explain why this software fault/"bug" had not been identified during the pre-FAT testing and what action(s) will be taken to correct the deficiency.

PUB-NLH-145 Regarding FAT of the updated interim software ("second FAT"), scheduled to commence on the 6th June, please:

a. State whether, it started on the scheduled date, and if not, when it commenced.
b. Please describe in detail the testing of the software that had been performed before second FAT commencement.
c. Provide the number of known "bugs", if any, remaining in software prior to second FAT commencement. If any exist, please provide a full description of each bug, including its potential impact/consequences of operation and explain why each remaining bug had not been corrected.
d. Confirm or explain if not that there were no known issues with the software prior to second FAT commencement.
e. State whether the second FAT will include as a minimum all the tests performed in the first FAT, and if not, why not.
f. Identify all additional tests, if any, included in second FAT to ensure that the previously faulty software is fully fit for its intended purpose.

PUB-NLH-146 Please describe the bipole control available in the interim LIL software version. In particular:

a. Whether the controls can automatically balance the current in the two poles when in bipole operation.
b. In the event of a trip of one of the poles, whether the controls will automatically transfer the power from the lost pole to the remaining pole, subject to the power not exceeding 450MW.
c. What other features are provided in the interim bipole control.

PUB-NLH-147 With respect to the sea electrodes and the electrode lines, please:

a. Confirm that they have not yet been tested with significant power. If they have been fully tested, please described the test and provide the results.
b. If they have not been tested, describe how these two components will be tested/commissioned.

PUB-NLH-148 With respect to bipole commissioning, please confirm or if not explain, when the scheme has been commissioned up to 225MW whether it will be subjected to trial operation with continuous power transmission at levels between 90MW

and 225MW for 30 days and that any malperformance will require the recommencement of the trial operation period, after the rectification of the cause of the trip.

PUB-NLH-149 With respect to trial operation period without synchronous condensers available, please state:

a. Whether it may be permitted.
   i. Whether it will take place, and if not, will Nalcor be permitted to use the LIL at power up to 225MW.
b. Whether any tentative or firmer decisions have been regarding such operation.
c. What principal conditions and other limits will guide the decision whether to permit operation.

PUB-NLH-150 Please state whether Nalcor personnel will be operating the LIL during the trial operation period, and if so, what training will have been provided to the operators before they take control of the LIL, and if not, when will the operators receive the necessary training. If not, how many operators will be provided by GE.

PUB-NLH-151 In the event of a trip during the LIL's trial operation period, please:

a. Confirm or explain if not that GE and Nalcor personnel will examine the records and determine the cause of the trip.
b. Describe actions to resolve any LIL trial-operations-period trips found to be caused by a software bug (*e.g.*, whether the software will be changed/corrected prior to re-starting).

PUB-NLH-152 Please state and if so describe whether any corrections/changes to the LIL software will be tested on the real Time Digital Simulator in Stafford prior to implementation of the change at site.

PUB-NLH-153 Following successful completion of the LIL's trial operation period, please describe:

a. Whether and if so how commissioning at higher power will proceed, with up to 450MW being transmitted.
b. Whether and if so how operation at higher power than 225MW will depend on the availability of synchronous condensers.
c. Whether and if so how and for how long a trial operation period will be required before continuous operation at 450MW is permitted.
d. Please explain the reason for the maximum limit for operation of the LIL with the interim software, noting that the report "Stage 4D LIL Bipole: Transition to High Power Operation" found that operation up to 900MW was possible when exporting 500MW on the ML, and at up to 550MW without the ML in service.

PUB-NLH-154 Assuming the LIL has been fully commissioned with the final software, and is operated at up to 900MW, please:

a. Confirm or explain if not that a trip of the bipole can result in Under Frequency Load Shedding (UFLS) of up to 913MW.
b. Estimate the time to re-connect all lost loads assuming no ML and no LIL (or reconnect all available generation).
c. Estimate the time to re-connect all lost loads assuming no ML and one LIL pole, with and without frequency control.
d. Estimate the time to re-connect all lost loads assuming ML at up to 150MW and no LIL.
e. Estimate the time to re-connect all lost loads assuming ML at up to 150MW and one LIL pole.

PUB-NLH-155 With respect to operation of Synchronous Condenser No. 3 operation to date, please confirm or explain if not known that it was run at rated speed for two or three days with vibrations noted during that period.

PUB-NLH-156 With respect to running of the synchronous condensers for a continuous period of many months assuming continuation of past observed level of vibrations, please:

a. Describe Hydro's understanding (informed by Nalcor if required) of rights and obligations of General Electric with respect to permitting and taking responsibility for any consequences of doing so and the risks that the exercise of such rights may present to permitting such synchronous condenser operation.
b. The positions of Nalcor and Hydro with respect to the need, wisdom, desirability, and consequences of doing so.

Generation

PUB-NLH-157 With respect to the root cause of the rotor rim key cracking for the Upper Salmon Plant/Unit, please:

a. Describe the status of efforts to determine the root cause(s).
b. Identify the root cause(s) if known.
c. Describe corrective actions planned or in place, other than frequent monitoring.

Reliability and Resource Adequacy Study Update, November 15, 2019

PUB-NLH-158 Please provide the following documents:

a. Operational Study - Stage 4C: Labrador Transfer Analysis (TP-R-034).
b. Labrador Interconnected System - Expansion Study (TP-R-019).
c. Application of Emergency Transmission Planning Criteria for a Labrador Island Link Bipole Outage (TP-TN-069).
d. NLSO Operating instruction TOP-P-022 - TL248 Planned and Forced Outage.

e. NLSO Operating instruction TOP-P-068 - Granite Canal Tap Shunt Reactor.
f. NLSO Operating instruction TOP-P-076 - NL Transmission System Operating Limits.
g. TP-S-001 NLSO Standard – Facilities Rating Guide.
h. TP-S-003 NLSO Standard – Annual Planning Assessment.
i. TP-S-007 NLSO Standard – Transmission Planning Criteria.
j. NLSO Standard – Transmission Facilities Rating Guide (TP-S-001).
k. 2019 CDM Potential Study.

PUB-NLH-159 Please provide the versions of the following documents (underlying the November 2018 RRAS) for the 2019 update, or the most closely corresponding information if structure or format have changed:
a. Modelling Assumptions.
b. PLEXOS Loss Calculation.
c. Wind Data Update.
d. LIL Firm Capacity.
e. Reliability Model 2.09.
f. Reliability Model 2.13.
g. Expansion Model 2.09.
h. Island LOLE Calculator.
i. Province LOLE Calculator.
j. LOLE Calculator – Benchmarking.

PUB-NLH-160 Reference Reliability and Resource Adequacy Study – 2019 Update *Volume* III: Long-Term Resource Plan, page 30, Section 7.1.1. Please provide the analysis deriving the selection of the 16 percent planning reserve margin for the Island.

PUB-NLH-161 With regard to operational studies, please provide:
a) A list of all completed, ongoing, and future operational studies pertinent to the Reliability and Resource Adequacy Study and the LIL Include how information in these studies will be used in the assessment of long-term reliability of the Newfoundland and Labrador Integrated System.
b) A status update regarding all operational studies that have not yet been filed with the Board, are underway, or are yet to be started.

PUB-NLH-162 Given that Newfoundland is now interconnected with Nova Scotia through the Maritime Link, and will be interconnected with Quebec through the LIL, please describe what NERC or NPCC requirements currently or will apply to Hydro, and outline Hydro's current or planned efforts to comply with these requirements.

TGS Study Reports

PUB-NLH-163 Regarding the TGS Technical Notes' identification of the need for up to 120MW of generation on the Avalon Peninsula, please:

a. State when Hydro will complete the analysis of options and make the results available.
b. Describe the next steps (nature, issues to be addressed, expected questions to be answered) in assessing optimum means for determining and meeting such needs, and address specifically any role of the Holyrood units in those next steps.
c. State when Hydro expects to have completed such efforts and make results available.

PUB-NLH-164 With respect to the TGS analysis of the impacts of trips of ac lines connecting the ML and the LIL, please:
a. Confirm that this analysis has identified potential thermal overloads resulting from single contingencies ("N-1") and from further events following them ("N-1-1") and that operational protocols will be developed by Hydro to manage the relevant overload conditions and that circumstances may require the inclusion of limits on ML exports.
b. Based on what Hydro knows to date, provide a brief summary of the potential nature and scope of those protocols and limits, in order to provide an overall perspective on how significant they might be from a customer perspective.
c. Describe the likely worst-case customer impacts of these operational protocols on consumers in the IIS.

PUB-NLH-165 Further to PUB-NLH-164 provide Hydro's current estimate of the date when these operational protocols will be available and an assessment of the risks to and likelihood of meeting that date.

PUB-NLH-166 With respect to full-power LIL operation at short circuit levels (SCL) less than 2,833MVA, please state whether such operation require General Electric's approval, and, if so, provide the status of discussions with GE and any tentative, preliminary, or final agreements, decisions, or criteria regarding any such operation and its approval.

PUB-NLH-167 Further to PUB-NLH-166, state whether General Electric has agreed to or offered for discussion a limit for operation at SCL levels below 2,833 MVA, and if so identify such levels. If no limit has been set, state whether GE has confirmed that they will allow operation up to 900MW without any SCs and with the SCL below 2,833 MVA.

PUB-NLH-168 With respect to the potential for a three-phase fault in the area near Soldiers Pond to cause a commutation failure during fault recovery have commutation failures happened in some cases after the clearance of faults near the Soldiers Pond converter station.

PUB-NLH-169 Further to PUB-NLH-168 confirm that additional studies are being performed using the more appropriate PSCAD software to investigate this matter. If so

when will the results of any study will be available, the risks to that date, and Hydro's estimation of the likelihood of availability at that date.

PUB-NLH-170 With respect to the study of temporary HVDC overhead line faults, please state whether Hydro intends to study them and if so when the results of any study will be available, the risks to that date, and Hydro's estimation of the likelihood of availability at that date.

PUB-NLH-171 With respect to the threat of system instability following a three-phase fault on line TL267 at load flows above 650MW, please state whether Hydro now plans to address this threat through tuning of the SC stabilizers to control transmission line oscillation on the Bay d'Espoir to Avalon corridor. If so, please describe the principal activities required to do so and when Hydro expects to complete the work required, the risks to that date, and Hydro's estimation of the likelihood of availability at that date.

PUB-NLH-172 With respect to restrictions General Electric has placed on LIL operation, please confirm or if not explain that Hydro has stated to Liberty that it, as opposed to Nalcor, has no role in such matters, which Hydro described as "commercial" in nature.

PUB-NLH-173 Further to PUB-NLH-172, please provide a robust description of what Hydro defines as commercial issues with respect to LIL operation, as opposed to those issues where Hydro does have a role. Secure from Nalcor agreement to provide its views on LIL operational restrictions that's General Electric has imposed and advise when it has been received.

PUB-NLH-174 Confirm that Hydro has stated to Liberty that Hydro has no role in commercial matters with General Electric and with respect to responsibility for potential damage to LIL or other equipment connected to the ac network.

PUB-NLH-175 With respect to manual activities TGS had to perform to supplement the ML model available for conducting an analysis, which resulted from the tripping of lines connecting the ML to the IIS, state whether Hydro asked or will ask for an updated model. If so, state when Hydro expects to receive the model.

PUB-NLH-176 With respect to the impacts of UFLS resulting from contingencies studied by TGS, please:

a. Confirm or explain if not that Hydro's calculation of maximum expected UFLS (at present 963MW) is not yet accompanied by: (i) a mapping of the areas affected, (ii) frequencies that will trigger disconnection by area, or (iii) load shed by area. Please also identify which of the three Hydro will accomplish, describe the activities required to accomplish each and state when Hydro expects to complete the work required for those it intends to accomplish, the risks to that date or dates, and Hydro's estimation of the likelihood of availability at dates estimated.

PUB-NLH-177 With respect to TGS's identification of a possible voltage collapse in the Bay d'Espoir -Soldiers Pond corridor, caused by a reactive power problem, please state whether Hydro plans to address such collapse as part of resource adequacy study activities. If not explain why not. If so, state when Hydro expects to complete the work required, the risks to that date, and Hydro's estimation of the likelihood of availability at the date estimated.

Generation

PUB-NLH-178 Please describe the status and schedule of studies being performed to accomplish the following regarding Holyrood as a short- and long-term capacity resource.

a. Faster start of the Holyrood generating station and any plans to reduce the startup times for the generating station.
b. Evaluation of Holyrood as a viable long-term capacity generating asset.
c. The risks to study completion dates, and Hydro's estimation of the likelihood of study results availability at the completion dates estimated.

PUB-NLH-179 With respect to supply resource options under consideration, please describe:

a. The nature, scope, and schedule for analyzing them and providing preliminary or final results for stakeholder examination in this review.
b. The roles of Hydro, Nalcor, and outside resources in performing such analyses.
c. Whether the results will provide direct comparisons of Holyrood extension options and all other options identified from least cost, availability date, and other relevant criteria (list them) in order to present a basis for making an optimum selection in fulfilling future resource requirements.

DATED at St. John's, Newfoundland this 30th day of June 2020.

BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

Per

Cheryl Blundon
Board Secretary