2024 Resource Adequacy Plan

Technical Conference #2

Issue #3: Existing Generation and Transmission

October 1, 2024

newfoundland labrador hydro

Experts Present Today – Panel 1

- **Robert Collett**, Vice President, Engineering & NLSO
- **Scott Crosbie,** Vice President, Operations
- **John Adams,** Manager, Long-Term Asset Planning, Thermal Production
- **Jessica McGrath,** Project Manager, Thermal Generation
- **Samantha Tobin**, Sr. Manager, Resource & Production Planning
- **David Goosney,** Team Lead, Resource Planning
- **Samantha Smith**, Generation Performance Engineer
- **Phil DiDomenico**, Managing Consultant, Daymark (Virtual)
- **Kathy Kelly**, Vice President and Principal Consultant, Daymark (Virtual)

Safety Moment

Agenda – Existing Transmission and Generation

Panel 1: Holyrood Thermal Generating Station ("Holyrood TGS") and Transmission Constraints

- Near-Term Assumptions
- Assumptions and Costs to 2030
- Retirement Timeline
- Extension Beyond 2030
- Forced Outage Rate ("FOR") Assumptions
- Transmission Constraints

Panel 2: Labrador-Island Link ("LIL")

- LIL Short-Term Reliability
- LIL Impact on Minimum Investment Case
- LIL Long-Term Reliability
- Update on Remedial Work

Opening Statement

Desired Conference Outcomes

Newfoundland and Labrador Hydro (“Hydro”) aims to address parties issues and questions and provide adequate information in relation to the 2024 Resource Adequacy Plan to support a shared understanding amongst the parties in relation to the following topics:

- Holyrood TGS is required in the near term, as part of the Bridging Plan, until new generation has been reliably integrated into the system;
- Use of the Holyrood TGS for the Bridging Period has no impact on the decision required regarding the Minimum Investment Required Expansion Plan;
- Equivalent Forced Outage Rate (“EqFOR”) as the appropriate measurement of LIL reliability;
- Impact of LIL reliability within the Minimum Investment Required Expansion Plan;
- Hydro’s operational experience of the LIL to date; and
- Ongoing work to maintain the anticipated level of LIL reliability.

Issue 3: Existing Generation and Transmission

Panel 1: Holyrood TGS, FOR and Transmission Constraints

Holyrood TGS: Near-Term Assumptions

Assessment of the 2024 Resource Adequacy Plan:

- *Clarify the distinction between "near" term and long-term planning, and explain how near-term planning assumptions affect the expansion planning process, modeling and Recommended Portfolio (#17).*

Holyrood TGS: Near-Term Assumptions

Bridging Plan versus Expansion Plan

- The Bridging Plan is Hydro's near-term plan to ensure the reliability of the system continues until new generation has been approved, constructed, and commissioned.
- Holyrood TGS is a key asset included in the near-term Bridging Plan until 2030, or until new generation has been reliably integrated into the system.
- To clarify, the Holyrood TGS is not considered part of the Minimum Investment Required Expansion Plan.
  - The planning reserve margin for the long term was calculated assuming the Holyrood TGS is retired.

Holyrood TGS: Near-Term Assumptions

- Holyrood TGS is included as an asset in the model for the Near-Term Reliability Report.
  - Report is filed annually with the Board of Commissioners of Public Utilities (“Board”) in November.
  - FOR of 20% with a 34% sensitivity.
  - Assumes all three units retire on April 1, 2030.
    - Holyrood TGS Unit 3 assumes conversion to sync condense.
- Near-term assumptions have no bearing on the Minimum Investment Required Expansion Plan.

Holyrood TGS: Costs to 2030

Assessment of the 2024 Resource Adequacy Plan:

- *Provide detail on modeling assumptions and cost information for the Holyrood units through 2030 (#11).*
  - Holyrood TGS modelling assumptions to 2030 provided in previous slide.

Holyrood TGS: Operational Overview

- Three generating units that operate independently, with shared common systems.
- Constructed in two stages:
  - 1970 - Units 1 and 2; and
  - 1979 - Unit 3.
- Unit 3 will have life as a synchronous condenser many years beyond the generation life of the plant.
- Not designed for frequent stops/starts.
- Minimum operation is 70 MW per unit.
  - Extended operation below 70 MW has proven to cause derating due to fouling.
- Normal operating season during the winter period.

Holyrood TGS: Costs to 2030

The table below presents a comparison of the cumulative costs from 2024 to 2030 that was reported in the 2021 Hatch Life Extension Condition Assessment report compared to current cost assumptions:

	Hatch Study 2024-2030 ($000)	Hydro 2024F Update 2024-2030 ($000)	% Change
Operating	176,029	174,278	-0.99%
Capital	140,006	156,889	12.06%
No. 6 Fuel	700,791	438,216	-37.47%
Cumulative Total	**1,016,826**	**769,383**	**-24.33%**

- Operating Expenditures through 2030 are escalated based on Hydro's 2024 forecast.
- Capital Expenditures for 2025–2030 are consistent with the 2025 Capital Budget Application.
- Forecasted fuel costs through 2030 align with Hydro's 2023 Load Forecast and Production Plan.

Holyrood TGS: Fuel Cost Forecast

Hatch Condition Assessment Report Assumptions:

- Total operating time per year of four months, based on historical power generation requirements.
- Average power generated (MW) per unit based on historical plant data from 1997–2022, which indicated a range of 77 MW to 94 MW per unit.
- Fuel cost was based on $104.22 CAD/barrel.

Hydro's Current Assumptions:

- Forecasted fuel costs through 2030 align with Hydro's 2023 Load Forecast and Production Plan.
- The forecast assumes that two Holyrood units are generating at 70 MW each for the winter months; from mid-October to the end of March annually.

Holyrood TGS: Operating Expenses

- The total forecast for the operating period aligns with the Hatch Life Extension Condition Assessment Study estimated to be $175 million.
  - Forecast for 2024 is approximately $26 million.
- Operating budget drivers:
  - Salaries; and
  - System Equipment Maintenance.
- With no projected change in operation, no significant change in budget is expected.

Holyrood TGS: Capital Programs and Projects

- Capital programs make up the majority of the capital expenditures at the Holyrood TGS.
- Key drivers for the cost difference between the five-year capital plan and the 2021 Hatch Life Extension Condition Assessment Study:
  - Escalation was not considered in the Hatch Study;
  - Cost and availability of materials ;
  - Cost of contract labour;
  - Aging assets; and
  - Changes in the scheduling of projects.

Holyrood TGS: Capital Programs and Projects

2025–2030 Activities

- Continue with capital programs on their current schedule.
- Continue Condition Assessments of critical assets.
- Execute refurbishments/upgrades as required to maintain the Holyrood TGS reliability.

By continued execution of the Holyrood TGS Capital Program, Hydro seeks to ensure sustainment and viability of the Holyrood TGS through 2030, as highlighted by Hatch:

"....continued O&M practices including inspections, predictive maintenance, reliability assessment programs, and ongoing life cycle maintenance investments, support the evaluating the viability of continued use of assets in full generation mode...."

– Hatch Life Extension Condition Assessment Study, 2021

Holyrood TGS: Bridging Plan Justification

Assessment of the 2024 Resource Adequacy Plan:

- *Examine the justification for the assumed sustaining of the Holyrood units through 2030 (#12).*

Holyrood TGS: Bridging Plan Justification

- The retirement of the Holyrood TGS represents the retirement of 490 MW of generating assets from the Island Interconnected System.
- The loss of one unit at Holyrood TGS was simulated to occur during winter 2024 in the 2023 Near-Term Reliability Report, which made a material difference to the annual Loss of Load Hours result.

Scenario	2024	2025	2026	2027	2028
LIL at 700 MW, LIL Bipole FOR = 5%,[1] Holyrood TGS FOR = 20%	2.89	1.30	1.46	1.69	1.87
Simulating Loss of a Holyrood TGS Unit During Winter 2024	7.53	-	-	-	-

- It is Hydro's stance that the risk to system reliability is too high to retire a unit without new generation being added to the system.
- In the interim, Hydro will continue to balance cost and reliability by managing the operation of units and standby mode.

[1] In the first winter post-commissioning (Winter 2023–2024), LIL EqFOR assumed to be 10%.

Holyrood TGS: Retirement Timeline and Potential for Early Retirement

Assessment of the 2024 Resource Adequacy Plan:

- *Assess impacts of earlier retirement dates for one or more of the Holyrood units (#13).*
  - The implementation of 150 MW of new generation in 2029, allowing for the retirement of one Holyrood Unit will be included as a scenario in the November 2024 Near-Term Reliability Report.
- *Clarify the specific expected timing of Holyrood's retirement relative to the commissioning of replacement generation (#15).*

Holyrood TGS: Retirement Timeline

- From a modelling perspective, it was assumed that Holyrood TGS Units 1 and 2 retire on April 1, 2030, with Unit 3 permanently converting to sync condense.
  - In reality, there will be a period of overlap between new generation assets coming online and the retirement of the Holyrood TGS.
- Likely one to two years of a transition period will be required to ensure all new assets have been integrated into the system successfully.
  - The operating parameters during this period will vary. There is potential to have one or two units online for a duration, followed by a period of standby.
- The exact timeline for the retirement of the Holyrood TGS units will be dependent on:
  - The costs and reliability of Holyrood TGS during the Bridging Period;
  - The pace of actual load growth;
  - The performance of the LIL;
  - The advancement of new generation; and
  - Winter readiness in advance of each winter season.

Holyrood TGS: Early Retirement and Potential Operating Cost Savings

- There are many variables to consider when assessing potential operating cost reductions related to the early retirement of a Holyrood TGS unit(s).
- It is anticipated that the retirement of one unit would not result in material operating cost savings beyond fuel.

High-Level Assumptions:

- Labour costs are unlikely to change significantly by going from three units to two.
- Potential for reduction in annual maintenance and associated costs.
  - For example, with the retirement of one unit, contract boiler maintenance could be expected to reduce by one-third (approximately $2 million), and other maintenance would likely reduce by an estimated 20–25%.

Holyrood TGS: Early Retirement and Potential Capital Cost Savings

- Anticipated decrease in capital costs related to annual overhaul programs.
  - For example, boiler condition assessment and In-Service Failures would likely result in approximately $2.5 million to $3 million annual reduction (approximately 12.5% of the budget).

- Other overhaul programs such as turbine/generators and major pumps could also result in savings, depending on the schedule.
  - For example, the retirement of a unit could save approximately $5 million in turbine and major pump overhauls, depending on timing.

- Capital cost reductions are anticipated to be higher than operating costs; however, not a material portion of the total cost of operation.

Holyrood TGS: Early Retirement and Potential Net Savings

- By replacing the capacity of a base-loaded unit with a new 150 MW Combustion Turbine that is only required for peaking, it is anticipated to result in:
  - Reduction in fuel costs; and
  - Decrease in export market revenue.
- Potential net savings as outlined in Section 4.4.2.4 of Appendix C:

Year	Slow Decarbonization ($ million)	Reference Case ($ million)	Accelerated Decarbonization ($ million)
2027	13.9	12.7	12.2
2028	15.0	14.4	13.8
2029	10.1	9.2	9.2
Total	**39.1**	**36.3**	**35.2**

Holyrood TGS: Extension Beyond 2030

2024 Resource Adequacy Plan - Issues List:

- *Has NLH appropriately considered the extension of the Holyrood plant beyond 2030 if required? What are the capital and operating costs associated with Holyrood remaining in service until 2030 and longer if necessary? How have these costs been considered in the analysis?*

Assessment of the 2024 Resource Adequacy Plan:

- *Consider the possibility Holyrood remains an asset beyond 2030, and model the costs and impacts of retaining one or all of the Holyrood units (#16).*

Holyrood TGS: Extension Beyond 2030

- Study is underway with Hatch to refresh the Operating, Capital and Fuel assumptions of the 2021 Condition Assessment Life Extension Study.
- Scope of the refresh study:
  - Review condition assessments completed since 2021;
  - Review of thermal In-Service Failures;
  - Discussions with Holyrood TGS resources regarding operational issues; and
  - Update capital, operating and fuel costs.
- Hydro expects to file the refresh study in Q4 2024.
- The 2021 Condition Assessment Life Extension Study recommends completing a detailed condition assessment of assets closer to 2030, should an extension beyond the Bridging Period be required.

Holyrood TGS: Extension Beyond 2030

- Holyrood TGS remains the Bridging Plan until new generation is approved, constructed, and placed in service.
  - As an aging asset, the Holyrood TGS will continue to require investment and attention through the Bridging Plan period to maintain the current level of reliability.
- Hydro is endeavoring to not to operate the Holyrood TGS beyond 2030; however, system requirements may dictate some support from Holyrood TGS beyond that timeframe.
- In the event that Holyrood TGS is required beyond 2030, the Hatch study update will help inform the impact on costs.
  - A condition assessment would be required closer to 2030 should a unit(s) be needed beyond the 2030 time frame.
  - Operating the Holyrood TGS would not be compliant with the draft Clean Electricity Regulations, and the retirement of the plant would have to take place by 2035.
- The potential for extension of Holyrood TGS unit(s) beyond 2030 will not impact the need for the capacity resource options identified in the Minimum Investment Required Expansion Plan.

Holyrood TGS: Generation Planning Assumptions

2024 Resource Adequacy Plan - Issues List:

- *Are the forced outage rates for existing generation used in the planning analysis (referred to specifically in Issue 6) reasonable?*
- *(Issue #6) Regarding forced outage rates:*
    - *For Holyrood Thermal Generating Station, NLH proposed to use DAUFOP as the metric and a value of 20% in the base case and a sensitivity of 34% for "near-term planning." Is this a reasonable approach? And has NLH reasonably justified and explained the impact of the "near-term" sensitivity?*

Assessment of the 2024 Resource Adequacy Plan:

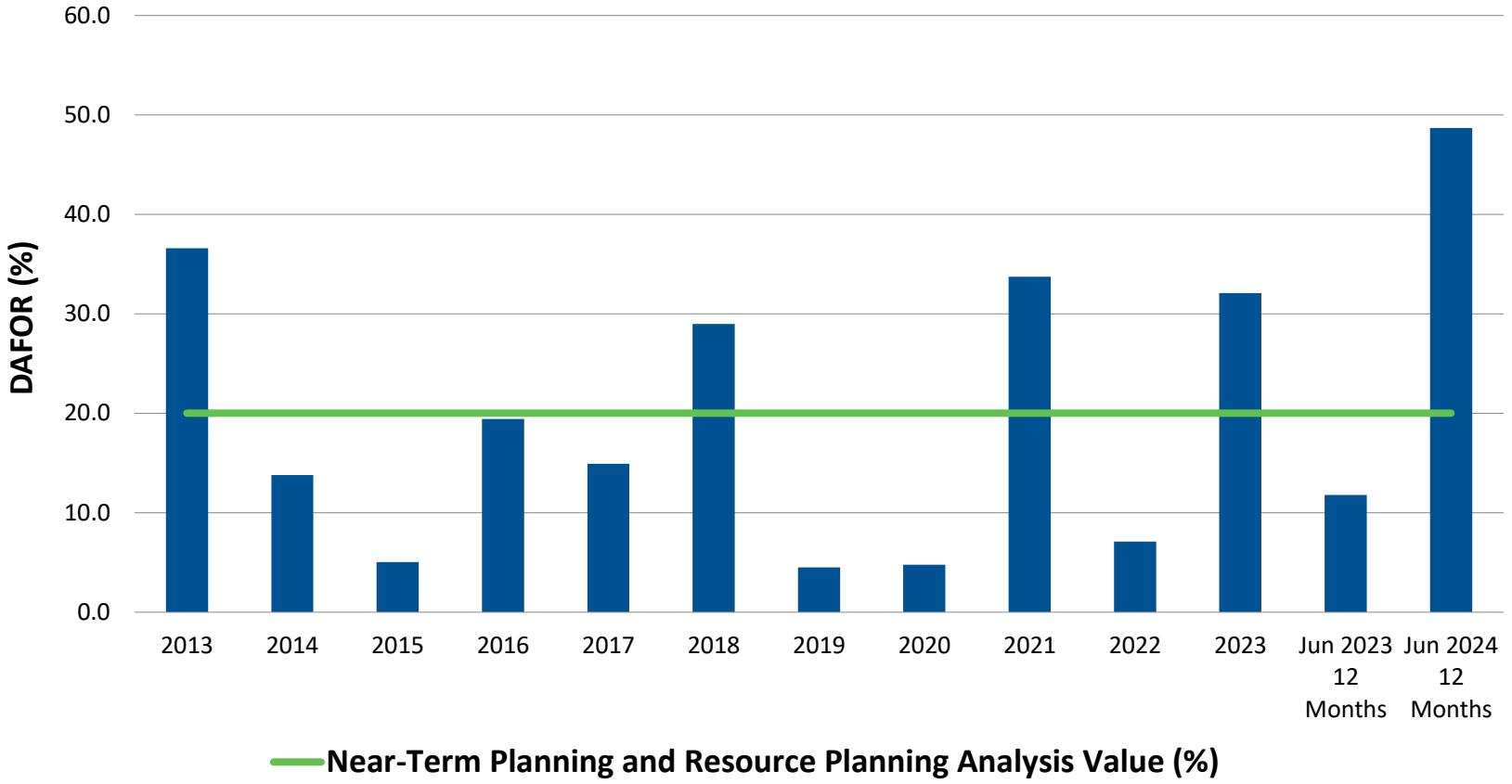
- *Consider sensitivity analysis in the Resource Planning Model using higher forced outage rates, especially for generating assets such as Holyrood (#18).*
- *Explain the interaction between the expected operation of the thermal units, the expected sustaining capital expenses to maintain those assets, and the assumed forced outage rates (#19).*

Holyrood TGS: Forced Outage Rate Assumptions

- Based on Electricity Canada reporting guidelines
  - Participation in Committee on Outage Statistics (G-CCOS).
  - Considers information in the Generation Equipment Reliability Information report.
- Derated Adjusted Utilization Forced Outage Probability (“DAUFOP”) versus Derated Adjusted Forced Outage Rate (“DAFOR”)
  - The model does not differentiate between metrics and uses assigned percentages.
  - Different calculations using the same input data.
    - DAUFOP – Stand-by; DAFOR – Base-load.
- Continued operation as base load – DAFOR
- Holyrood TGS is not included in the Expansion Plan beyond 2030.
  - No long-term assumptions as it is assumed retired.

Holyrood TGS: Historical Performance

- **20% Base Case**
  - Reflects “average” performance over many years.
- **34% Sensitivity**
  - Winter 2021–2022 and Winter 2023–2024
  - Considers variability in Holyrood TGS FORs.



Holyrood TGS: Interdependencies between Operations, Capital, and FORs

- The 2022 Reliability and Resource Adequacy Study highlighted concerns with the emergency standby operation of the Holyrood TGS.
  - Unit performance is impacted by start/stop operations;
  - Maintenance and capital work are often impacted by the frequency of stops and starts; and
  - Hydro tries to limit unnecessary stops and starts on each unit.

- Hydro intends to run the Holyrood TGS units base-load, not to use these units as an emergency standby.

- As the operational philosophy is not changing, neither is the sustaining capital and operating investment strategy.
  - Work will continue to ensure continued levels of reliability from Holyrood TGS through the Bridging Period.

Holyrood TGS: Hydro's Position

- The Bridging Period was introduced in the 2022 Reliability and Resource Adequacy Study.
- Hydro acknowledges the cost of extending the Holyrood TGS operation, but the risk to system reliability is too high to retire a unit(s) before new generation is in place.
- Assumes that Holyrood TGS will retire in 2030; however, likely some overlap will occur with new generations being added to the system.
- The use of the Holyrood TGS in the near term does not impact the resource options put forward as part of the Minimum Investment Required Expansion Plan.

Transmission Constraints

Transmission – On-Avalon Constraint and Cost Estimates

2024 Resource Adequacy Plan - Issues List:

- *Regarding the on-Avalon transmission constraint:*
  - *Was the TransGrid study sufficient, or should it be updated/supplemented?*
  - *Has NLH provided a reasonable set of cost estimates for the potential and recommended transmission upgrades identified in the TransGrid study, and have those estimates been supported?*

Transmission Constraints

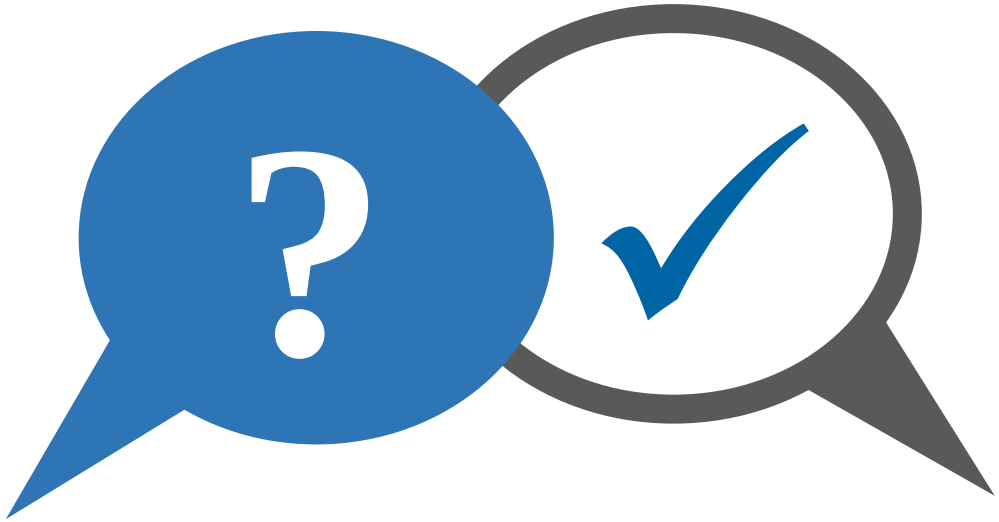
- Constraints are due to transmission bottlenecks between Bay d'Espoir and the Avalon Peninsula during a LIL Bipole Outage.

- Transmission upgrade costs are projected to be $150 million and include:
  - New Transmission Line: Western Avalon to Soldiers Pond; and
  - Dynamic Line Rating Technology (LineVision).

- There are opportunities to reduce potential expenditures
  - Remedial Action Schemes and reactive power support may be employed to potentially avoid the new transmission line.

- Transmission expansion studies are directly linked to generation expansion planning efforts and are ongoing.

Questions?



Panel 2: Labrador-Island Link

Experts Present Today – Panel 2

- **Walter Parsons**, Vice President, Transmission Interconnections & Business Development
- **Chad Wiseman,** Director, Commercial
- **Dena Kavanagh,** Sr. Manager, AC Terminals & HVDC Specialties
- **Maria Veitch,** Transmission Engineer
- **Robert Collett**, Vice President, Engineering & NLSO
- **Samantha Tobin**, Sr. Manager, Resource & Production Planning
- **David Goosney**, Team Lead, Resource Planning
- **Samantha Smith**, Generation Performance Engineer
- **Phil DiDomenico**, Managing Consultant, Daymark (Virtual)
- **Kathy Kelly**, Vice President and Principal Consultant, Daymark (Virtual)

Labrador-Island Link – Reliability

2024 Resource Adequacy Plan - Issues List:

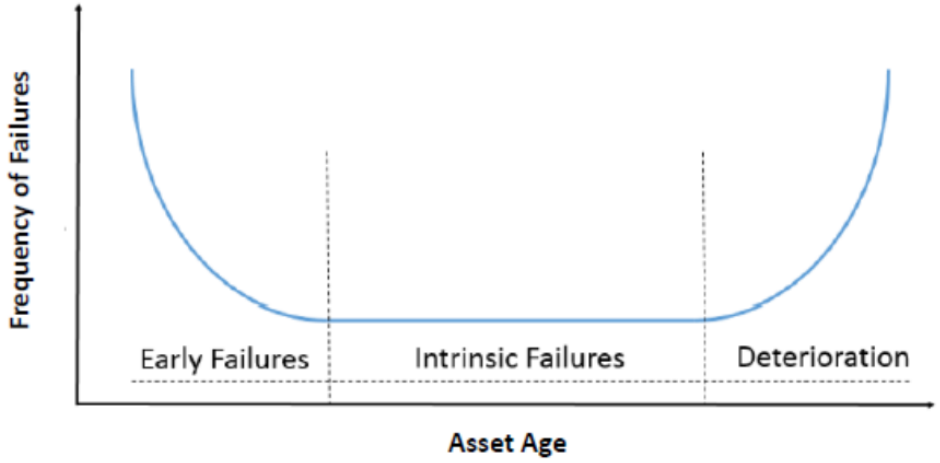
- *What enhancements, if any, are possible to improve the reliability and forced outage rate for the LIL?*
- *What is the updated status of ongoing work to improve LIL reliability?*
- *Should the LIL be regarded as an energy-only line for planning purposes?*

Assessment of the 2024 Resource Adequacy Plan by Bates White:

- *Model a broad range of bipole equivalent forced outage rates for the LIL (#20).*
- *Assess projected cost and benefits of all investments made to improve LIL performance (#21).*
- *Continue to address all Haldar recommendations and update the RAP process with findings (#22).*

LIL Operational Experience

- Since commissioning, the LIL has been providing capacity and energy to the system.
- Reliability in the early operation of any large asset is expected to be lower than the anticipated long-term level of reliability.
- There have been some issues associated with LIL components and repairs are required to achieve and maintain the anticipated level of LIL reliability.
- Findings to date that have been addressed (turnbuckles, galloping, top plate) will increase the reliability as compared to current results.
- Learnings from previous outages continue to mature the emergency response approach.



LIL Context Within Minimum Investment Required

- The Minimum Investment Required Expansion Plan assumes a highly reliable LIL with an EqFOR of 1%.
- LIL EqFOR greater than 1% further supports the Minimum Investment Required Expansion Plan and equates to further capacity that will be required for the Island Interconnected System.
- Hydro is working to resolve near-term issues.
    - Not expected to have an impact on long-term reliability.
- Hydro continues to report on LIL performance in its regular regulatory reporting.

LIL Near-Term Operational Update

- Status on items previously reported in the LIL Quarterly Update:
  - Direct current current transformers (“DCCT”);
  - Cable switching transients;
  - High-power testing; and
  - Software commissioning

- Near-term operations have no bearing on the Minimum Investment Required Expansion Plan.

Status of LIL Ongoing Remedial Work

Recommendation	Description	Status Update in 9-Jul Report	Current Status Update
Ice Monitoring	• Installation of real-time weather station. • Installation of on-line ice and galloping monitoring equipment.	• To be installed in 2025.	• 2025 Capital Project for installation of weather station in 2025. • Contract for monitoring equipment awarded in 2024, to be installed in 2025.
Damper Study	• Damper specification update.	• Scheduled to be completed by Q4 2024 with cost estimates to follow, if necessary, at a later date.	• Damper specification complete, further study to determine damper options, and placement.
Tower Modifications	• Design for strengthening electrode cross arm. • Electrode suspension assembly assessment and design. • Design for OPGW tower peak strengthening.	• Ongoing with all engineering assessments and the majority of cost estimates scheduled to be complete in Q4 2024.	• Ice loading assessment complete. Tower design to be awarded in 2024, and completed 2024/Q1 2025. • Electrode suspension assembly assessment and design to be awarded in 2024, and completed 2024/Q1 2025.

Status of LIL Ongoing Remedial Work

Recommendation	Description	Status Update in 9-Jul Report	Current Status Update
Line Modifications	• Installation of mid span structures to reduce load on towers • Remove the electrode line from the towers (in specific sections) to reduce load on towers.	• Ongoing with all engineering assessments and the majority of cost estimates scheduled to be complete in Q4 2024.	• Assessment and cost estimate to be completed Q4 2024.
Suspension Clamp Design	• Install 3 alternative clamps on the line to assess the performance by completing yearly inspection.	• Scheduled for completion in 2024.	• Complete - installation and inspection completed on 10 structures.
Air Flow Spoiler installation	• Install air flow spoilers at location where galloping has caused damage to the line.	• 40% complete to date - rest to be completed in 2024.	• 40% complete in 2023 - 65% to be completed by the end of 2024.
Turnbuckle replacement	• Replacing turnbuckles on all 327 deadend towers.	• 26% complete to date - majority to be completed in 2024.	• 70% complete to date - 100% to be completed in 2024.
Top Plate Fix	• Estimates completed for repair work on A3 tower, and non-A3.	• Estimates expected in 2024.	• Estimates for repair work received, A3 tower (90% of towers affected) will be repaired in 2024.

LIL EqFOR

- Conventional FORs for generating assets are not appropriate
  - However, the LIL system is viewed as an on-island generator in models.
- EqFOR measures the performance of the entire LIL end-to-end system, including:
  - Converter stations at Muskrat Falls and Soldiers Pond;
  - Overhead lines between Muskrat Falls and Soldiers Pond;
  - Transition compounds in Shoal Cove and Forteau Point; and
  - Subsea cables in the Strait of Belle Isle.
- It is an appropriate metric for LIL reliability because it relates operational data to the ability to supply the Island Interconnected System.
  - Generates meaningful model inputs.

LIL EqFOR

- EqFOR measures the percentage of time that the LIL system is unavailable at maximum rated capacity due to forced outages and derates.
  - Bipole outages reduce capacity to 0 MW.
    - Coinciding monopole outages reduce capacity to 0 MW.
  - Monopole outages reduce capacity to 675 MW under normal operation.
- Hydro reports LIL EqFOR on a quarterly basis.
  - Stat for July 1, 2023 to June 30, 2024 is well within the long-term range: 2.79% (based on 700 MW); 4.27% (based on 900 MW).
  - Next update is due on October 31, 2024.

LIL EqFOR in Days

Number of Forced Outage Days for a Given EqFOR(%)				
LIL EqFOR (%)	Assumes No Planned Outages	Assumes 3 Weeks Planned Outages	Assumes 5 Weeks Planned Outages	Assumes 10 Weeks Planned Outages
1	**3.7**	**3.4**	**3.3**	**3.0**
3	11.0	10.3	9.9	8.9
5	18.3	17.2	16.5	14.8
10	36.5	34.4	33.0	29.5

- LIL long-term reliability expected to range from 1%–10% EqFOR
  - Captures what Hydro considers reasonable forced outages.
  - Anticipating less than 3.7 forced days per year is impractical.
- Does not consider the extended outage due to extreme events – captured in the six-week shortfall analysis.

LIL Reliability vs. System Reliability

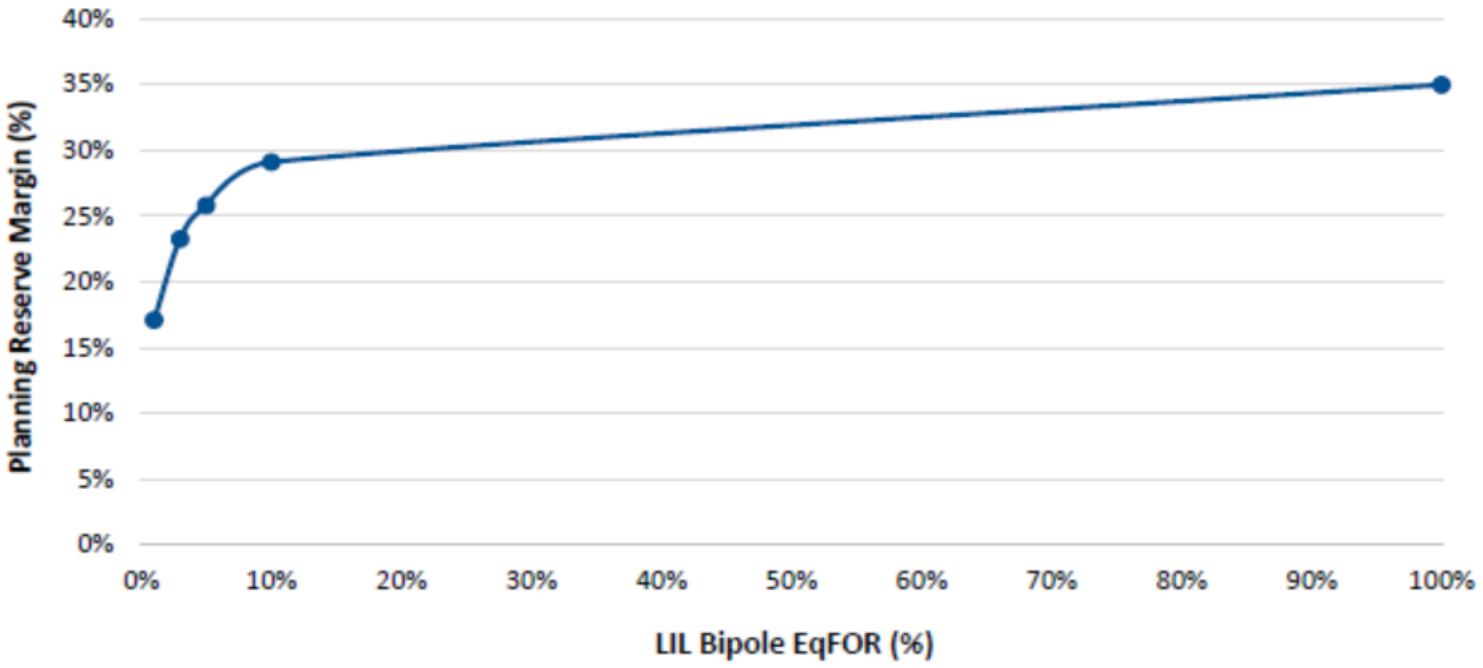
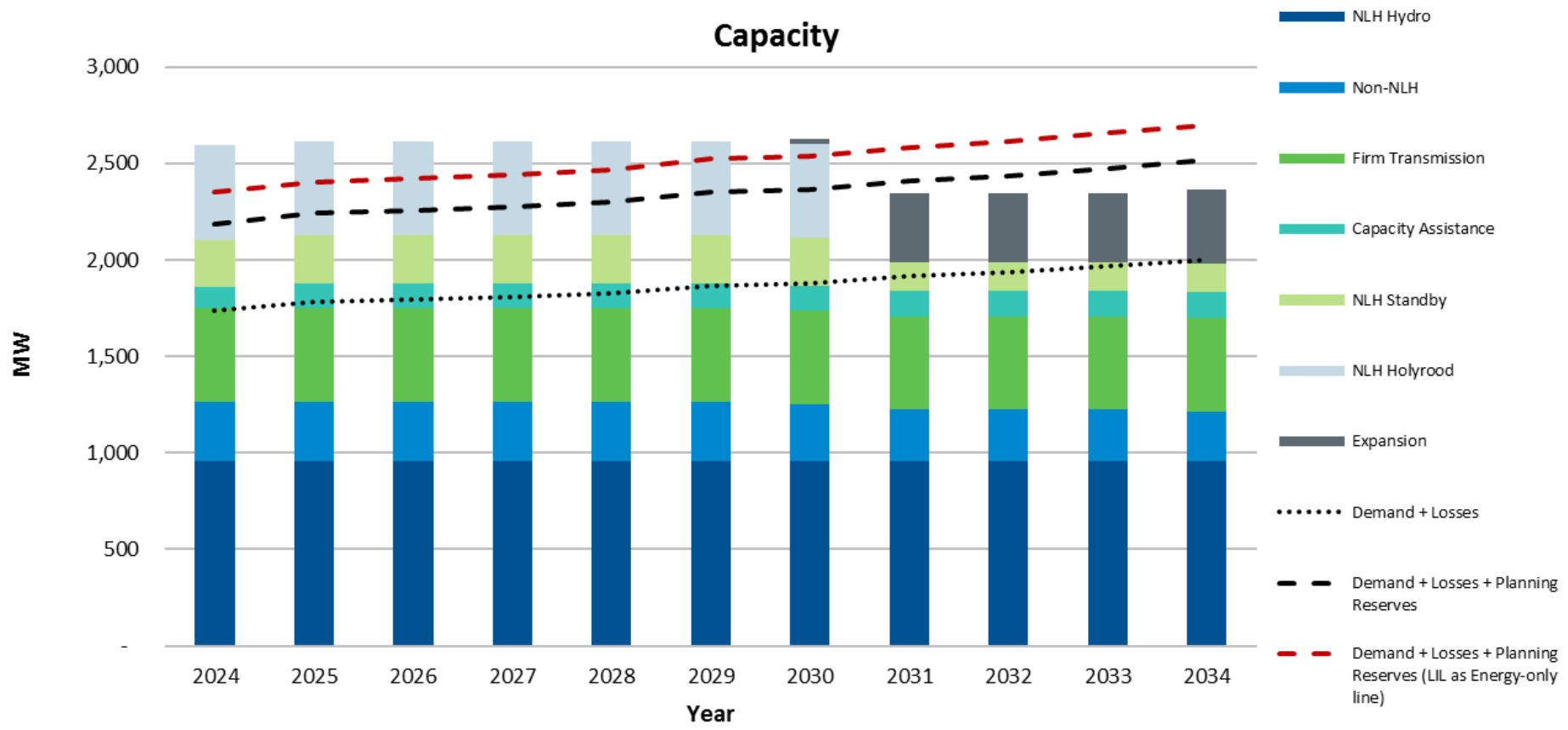


Figure 5: 2.8 LOLH Reserve Margin versus LIL Bipole EqFOR

Hydro has modeled a broad range of LIL bipole EqFOR: 1%, 3%, 5%, 10%.

LIL as an Energy-Only Line

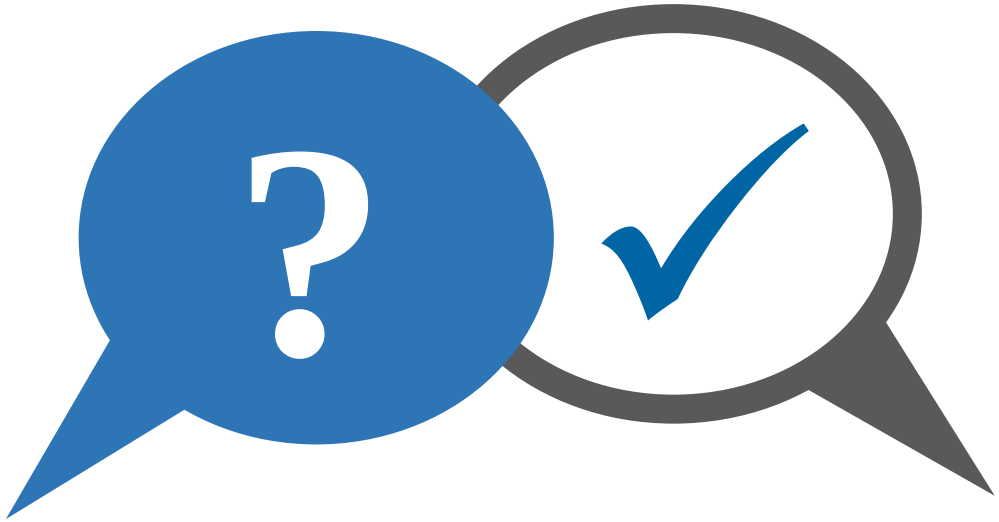


There is no justification to plan for LIL as an Energy-Only Line at this time.

LIL Reliability: Hydro's Position

- Provided an update in relation to LIL operations and ongoing remedial work.
- The LIL is a complex system resulting in the need to calculate its performance as an end-to-end system for reliability planning (EqFOR).
- Any ongoing remedial work would not reduce the requirements identified in the minimum investment required expansion plan.
- Hydro's stance remains that considering the LIL as an energy-only line is not appropriate at this time.
- Hydro will continue to analyze all impacts to system planning to inform the Board and parties accordingly.

Questions?



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