Q. Reference: *2024 Resource Adequacy Plan*; Technical Conference #2: Issue #3: Existing Generation and Transmission, October 1, 2024, Slide 36.

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).

Please quantify and explain the benefits of both: (i) the new transmission line, and (ii) dynamic line rating as they relate to supplying the Avalon Peninsula during a LIL bipole outage.

A. The Bay d'Espoir ("BDE") to Soldiers Pond ("SOP") 230 kV transmission system is critical to the Island Interconnected System during a Labrador-Island Link ("LIL") bipole outage. Once the Holyrood Thermal Generating Station ("Holyrood TGS") is retired, the BDE to SOP transmission system must supply the majority of the Avalon Peninsula demand since there are no LIL imports delivered to SOP during a bipole outage. Appreciable transmission constraints will limit the amount of BDE to SOP flow which is defined based on the loss of specific 230 kV lines between BDE and SOP causing thermal overloads or low-voltage conditions. A LIL bipole outage would be considered a double contingency or N-2 event. The loss of 230 kV between BDE and SOP during a LIL bipole outage would be considered an N-2-1 event. While such contingencies would not be considered under Newfoundland and Labrador Hydro's ("Hydro") Transmission Planning Criteria, Hydro would need to adhere to the criteria specified for the LIL shortfall analysis established as part of the *Reliability and Resource Adequacy Study Review* proceeding and would also need to avoid transmission line thermal overloads. These criteria are defined to ensure that customer outages must be managed and limited to 100 MW to ensure load rotations are possible in the event of a LIL bipole outage scenario. Please refer to Hydro's response to PUB-NLH-338 of this proceeding for further details on this limit.

Thermal overloads on transmission lines are not acceptable and pose a risk to public safety. An overheated conductor can sag below its critical clearance height, increasing the likelihood of contact. Such violations could be avoided by curtailing customer load. However, as discussed above, these outages must be limited to 100 MW. The $150 million expenditure is to ensure adherence to the 100 MW load shed limit and prevent thermal overload violations following the

loss of Transmission Lines TL217, TL202, TL207 or TL206 by addressing three of the most restrictive transmission constraints.[1] The three transmission upgrade projects are summarized in Table 1.

Table 1: Transmission Violations (BDE to SOP) during LIL Bipole Outage

Contingency	Violation	Solution	Benefit of Upgrade	Cost ($ Million)
Loss of TL217	Thermal Overload of TL201	New Transmission Line from WAV[2] to SOP	Increased power transfer from WAV to SOP	140
Loss of TL202 or TL206	Thermal Overload of TL202 or TL206	DLR[3] system installed on TL202/TL206	Increased power transfer from BDE to SSD[4]	8.5
Loss of TL207	Thermal Overload of TL203	DLR system installed on TL203	Increased power transfer from SSD to WAV	1.5

The increased transfer capacity of the transmission corridors BDE to SSD (TL201/TL217), SSD to WAV (TL203/TL207) and WAV to SOP (TL202/TL206) will reduce the amount of customer load shedding that would be required on the Avalon Peninsula during a LIL Bipole outage at high load conditions following the retirement of the Holyrood TGS.

The expected improvements in system reliability associated with these transmission upgrades for Scenario 4 ("S4")[5] which is the Minimum Investment Required Expansion Plan, and Scenario 1 ("S1")[6] which is the Reference Case Expansion Plan, including sensitivities, are presented in Table 2.

[1] This solution was presented as "Option 4" within the study by TransGrid Solutions Inc. For further information please refer to the "2024 Resource Adequacy Plan – An Update to the Reliability and Resource Adequacy Study," Newfoundland and Labrador Hydro, rev. August 26, 2024 (originally filed July 9, 2024), app. C, sec. 7.3.2.
[2] Western Avalon ("WAV").
[3] Dynamic Line Rating ("DLR").
[4] Sunnyside ("SSD").
[5] Scenario 4 (Minimum Investment Required or S4): Represents the scenario requiring the minimum investment (least amount of resource additions) based on a high level of LIL reliability (1% LIL bipole equivalent forced outage rate ("EqFOR")) that can reasonably be expected in the long-term and the lowest load growth (Slow Decarbonization) that can be reasonably anticipated on the Island Interconnected System. This scenario is intended to bookend the Expansion Plan scenarios by identifying the Minimum Investment Required on the Island Interconnected System.
[6] Scenario 1 (Reference Case or S1): Represents the expected case, or the scenario that incorporates assumptions that are considered most reasonable at this time by combining the Reference Case load forecast for the Island Interconnected System and the expected LIL bipole EqFOR of 5%. The expected case has historically formed the foundation of the recommended Expansion Plan.

Table 2: Reliability Improvements with Transmission Upgrades – LIL Bipole Outage ($150 Million)

Scenario	Year	Required Avalon Load Shed during LIL Bipole Outage – Peak Conditions (MW)		Peak Gross Avalon Demand Served (%)		Increase in Peak Gross Avalon Demand Served (%)	Percent Reduction in Avalon Load Shed (%)
		Without Transmission Upgrades	With Transmission Upgrades	Without Transmission Upgrades	With Transmission Upgrades		
S1AEF	2031	157	82	85.4	91.9	6.5	47.8
	2034	150	88	85.9	91.7	5.8	41.3
S1AEI	2031	152	79	85.0	92.2	7.2	48.0
	2034	203	129	80.9	87.9	7	36.5
S4AEF	2031	289	177	71.0	82.2	11.2	38.8
	2034	160	89	84.4	91.3	6.9	44.4
S4AEF (ADV)	2031	123	52	87.5	94.7	7.2	57.7
	2034	160	89	84.4	91.3	6.9	44.4
S4AEI	2031	289	152	71.0	84.7	13.7	47.4
	2034	326	190	68.5	81.6	13.1	41.7

For ease of reference, Table 3 outlines the expansion plan scenarios as included in Appendix C of the 2024 Resource Adequacy Plan.

Table 3: Expansion Plan Scenarios

Sensitivity	Description
A	Fixed wind profile to meet firm energy criteria
AB40	Same as Sensitivity A with an assumed battery ELCC[7] of 40%
AB80	Same as Sensitivity A with an assumed battery ELCC of 80%
AC	Same as Sensitivity A and removes forced combustion turbine ("CT") fuel burn-off in consideration of the potential for contract negotiation and/or shelf life extension negating this requirement
AD	Same as Sensitivity A with the exception of increasing all Hydro capital costs by 50% in consideration of potential cost overruns
AE	Same as Sensitivity A and removes batteries as a resource option
AEC	A combination of Sensitivities A, AC, and AE to determine the impact of removing forced CT fuel burn-off in consideration of restricting batteries as a resource option
AEF	Same as Sensitivity AE with the additional restriction of limiting CT additions to 150 MW in consideration of current diesel fuel limitations on the Island
AEG	Same as Sensitivity AE with the exception of increasing CT fuel costs by 50% in consideration of potential future volatility in fuel costs
AEH	Same as Sensitivity AE with the exception of increasing CT capital costs by 50% in consideration of potential cost overruns
AEI	Same as Sensitivity AE with the addition of the potential Newfoundland Power 25 MW CTs in the years 2028, 2029, and 2030.[8]

[7] Effective Load Carrying Capability ("ELCC").

[8] As a result of Newfoundland Power Inc.'s ("Newfoundland Power") intention to retire gas turbines in Wesleyville and Greenhill, Newfoundland Power has informed Hydro that it is exploring the addition of a total of 75 MW of CTs, with 25 MW becoming operational in 2028, another 25 MW in 2029, and the final 25 MW in 2030.

This analysis indicates that the transmission upgrade (which is a third line from WAV to SOP and DLR for TL202 and TL206) for a total cost of approximately $150 million is recommended for all scenarios analyzed, as it is the lowest-cost option to meet Island demand in combination with the expansion plans applied during a LIL bipole outage to keep Avalon load shed requirements below 100 MW.

Further improvements would require additional investments beyond those recommended in the analysis presented in the 2024 Resource Adequacy Plan.[9]

Hydro is exploring whether lower-cost measures can be taken to maximize transfer capacity through existing assets, including the implementation of a Remedial Action Scheme ("RAS") and/or DLR technology as technically equivalent options to the $150 million transmission upgrades.[10] A RAS would be designed to instantly shed customer load following a contingency event to avoid a transmission line overload and/or abnormal voltage conditions. The thermal rating of a transmission line is typically calculated based on a series of conservative inputs to account for the worst-case weather conditions. Using real-time data, DLR technology would allow Hydro to be less conservative and operate a line to its true capacity based on the weather and conductor conditions at that moment in time. Hydro is evaluating these options to determine if they are technically viable (individually or combined) for the BDE to SOP transmission system.

[9] "2024 Resource Adequacy Plan – An Update to the Reliability and Resource Adequacy Study," Newfoundland and Labrador Hydro, rev. August 26, 2024 (originally filed July 9, 2024), app. C, sec. 7.3.
[10] DLR Technology has been installed on TL201.