Q. **Reference: Technical Conference 3 Presentation, slide 47) The graph shows available LIL capacity for Island use vs. Island load.**

a) Is the installed generating capacity at Muskrat Falls 824 MW?

b) How much of the Muskrat Falls generating capacity (ignoring LIL limitations) is available to meet Island load requirements after accounting for other commitments such as those to Nova Scotia?

c) Does the graph show that at Island loads of 1800 MW, the Muskrat Falls generating capacity available to supply Island needs is about 450 MW?

d) In light of LIL limitations, what is the maximum Muskrat Falls capacity available to the Island? In other words, at what load level in the chart does the graph become horizontal?

e) In the chart, as Island load increases from 1600MW to 1800MW, the net LIL amount available appears to increase from approximately 400MW to 450MW, which implies that only an extra 50MW is available via the LIL to meet the 200MW increase in island load. (i) Please explain why the relationship is not closer to one-to-one. (ii) For the figures given, where would the additional needed capacity of 150MW come from and at what cost? (iii) In light of the relationship between Island load and net LIL availability, what are the implications for the calculation of the marginal cost of capacity and the marginal cost of energy? (iv) Has Hydro's most recent marginal cost update taken the relationship in the chart into account?

f) Is the amount of Muskrat Falls generating capacity available to supply the Island limited by the amount of load available on the Island for load shedding? If so, at an Island load of 1800 MW and a LIL transfer capacity of 450 MW, how much load would have to be available for shedding?

g) Please describe Hydro's load shedding scheme. What is the total amount of load available for shedding on the Island, how does the NL System Operator know how much load is available for shedding at a given point in time and how is load shedding rotated among customers?

h) Is load shedding considered to be a smart grid application? Would the management, allocation and efficiency of the load shedding regime be improved if Newfoundland Power had smart meters? Why or why not?

i) What options are available to Hydro to increase reliable transfers of Muskrat Falls generation to the Island besides making reliability improvements to the existing line? For example: i) Could Hydro and Newfoundland Power increase the amount of load available for shedding? ii) Could Hydro build an additional transmission line between Muskrat Falls and the Island using the existing, or new converter stations? iii) Could Hydro split the poles of the existing LIL HVDC line onto separate towers with fall-free spacing between the towers? iv) Other options?

j) If Hydro were able to reliably transfer the full 824 MW of Muskrat Falls generating capacity to the Island rather than only 450 MW (assuming 1800 MW demand on the Island), would this delay the need for the CTs and Bay d'Espoir Unit 8 in the Reference Plan until after 2035, and if so, what cost savings would result?

A. **a)** Yes. The installed capacity of Muskrat Falls is 824 MW.

b) Excluding consideration of the limitations of the Labrador-Island Link ("LIL"), the maximum capacity of Muskrat Falls available to the Island would be 592 MW, which is equal to the maximum capacity of Muskrat Falls less losses and firm commitments to Nova Scotia.

c) Yes, at an Island load of 1,800 MW, the capacity available to the Island over the LIL is approximately 450 MW.

d) The capacity available to the Island from the LIL is dependent on two factors: 1) the maximum capacity of the LIL, which is dependent on the design and characteristics of the line, and 2) the LIL to Maritime Link relationship, which is a limit on how much energy from the LIL is available to the Island Interconnected System, and is a function of Island load. For the purposes of the 2024 Resource Adequacy Plan, the LIL maximum capacity is assumed to be 700 MW. The LIL to Maritime Link relationship is dependent on the Island load, with

more energy available to the Island at higher loads. At an Island load of between 1,900 and 1,950 MW, the amount of LIL capacity that is available to the Island is equal to 484 MW which is equal to the maximum capacity of the LIL, less losses and firm commitments to Nova Scotia. For Island loads above this level, the amount of LIL energy available to the Island is limited by the maximum capacity of the LIL and would remain at 484 MW. Below this level, it is limited by the LIL to Maritime Link relationship and would decrease as the Island load decreased.

e) (i) The relationship between Island load and the net amount available over the LIL is not closer to one-to-one because the net amount available over the LIL is more of a function of the amount of available under frequency loading shedding ("UFLS"), which is proportional to Island load (approximately 40%). In addition, the relationship between the net amount available over the LIL and the amount of available UFLS is also not exactly one-to-one, because other factors impact the frequency response of the system.

(ii) An increase in peak load would increase capacity requirements equal to the additional load plus the reserve margin. If the capacity requirements exceed the available existing capacity on the system, then a new capacity would need to be constructed. The cost of this capacity would be based on the least-cost expansion option.

(iii) The marginal cost of capacity considers the cost to serve the next MW of load and is not affected by the relationship between Island load and LIL availability. Hydro's most recent marginal cost of capacity update was based on the cost to construct Bay d'Espoir Unit 8. Hydro recently contracted with Christensen Associates Energy Consulting regarding updating Hydro's wholesale utility rate[1] which considers Hydro's marginal cost of energy. During this work, it was confirmed that the opportunity cost of the market value of exports is still applicable for Hydro's marginal cost of energy. Considering the marginal cost of energy is based on the opportunity cost of the market value of exports, the relationship between Island load and LIL availability does not currently have any implications to Hydro's marginal cost of energy.

[1] "Application for Adjustment to Wholesale Utility Rate," Newfoundland and Labrador Hydro, rev. September 25, 2024 (originally filed September 16, 2024).

(iv) Please refer to part (iii) of this response.

f) Yes, the amount of Muskrat Falls generating capacity available to supply the Island is limited by the amount of load available on the Island for load shedding. In an example that assumes the Emera Block (158 MW) is being exported and the available LIL capacity for LIL use is 450 MW, there could be up to approximately 565 MW of UFLS in the event of a LIL bipole trip (650 MW).[2]

The amount of UFLS could slightly vary depending on the generation dispatch on the Island system at the moment of the LIL bipole trip.

g) The UFLS scheme is set up in blocks that are triggered at particular frequency thresholds, as described in Table 1.

Table 1: UFLS Blocks[3]

UFLS Block	Frequency Threshold (Hz)	Estimated Block Size at Peak (MW)
Group 1[4]	59.0	40
Group 2	58.8	115
Group 3	58.6	106
Group 4	58.4	115
Group 5	58.2	110
Group 6	58.1	133
Group 7[5]	58.0	160
Total Expected UFLS LIL Bipole Trip (Groups 2 to 6)		**580**

h) The estimated block size will vary as the load changes.

Table 1 provides the expected amount of load shed (MW) at the time of the Island system peak. Newfoundland Power Inc. ("Newfoundland Power") feeders make up the large

[2] As measured at Muskrat Falls.
[3] Numbers may not add due to rounding.
[4] Group 1 has a 15 second delay. Simulations have demonstrated that Group 1 will not trip for a LIL bipole trip and is used primarily to protect Holyrood units from experiencing sustained low frequency.
[5] Group 7 will not be triggered for a LIL bipole trip and serves as a backup to ensure the system remains stable if frequency decreases more than expected. The Group 7 block is a safety net to avoid system instability.

majority of the load that is shed as part of the UFLS scheme, and the rotation of customers is at the discretion of Newfoundland Power and its governing policies.

i) UFLS would not be considered a smart grid application as it is currently implemented on the Island Interconnected System. UFLS is activated at the distribution feeder level using protective relays. The application for smart meters for UFLS would require a detailed feasibility analysis. Hydro would need to work with Newfoundland Power to assess operational considerations and confirm the practicality of load shedding at a customer level.

j) Please refer to Hydro's response to IC-NLH-014 of this proceeding for a listing of the mitigating measures that Hydro is actively investigating.

A second HVdc[6] link from Muskrat Falls to the Island link would likely have a rating of at least 900 MW and would serve as a backup supply for the LIL bipole. UFLS would not be required since the Island system would be completely unaffected by a LIL bipole trip, because the 900 MW would transfer to the new second link. The existing converters would not be capable of supporting this additional link and therefore new converters would be required. Consideration would also be required for extreme contingencies that could impact both links. The significant cost of the infrastructure required for such a link would render it unfeasible.

A LIL bipole trip is currently considered an N-2 or double contingency event. The suggested option of splitting the poles of the existing LIL HVdc line onto separate towers with fall-free spacing between the towers may improve LIL reliability. However, the possibility of a LIL bipole trip could still occur due to common modes of failure or extreme weather impacting both poles. There would therefore be no improvement in LIL power transfer capability. Such an option would not be feasible.

k) The requirement for new generation capacity is based on the reserve margin, which is a function of system reliability. In the modelling that Hydro has completed, most generation shortfall events occur during periods when the LIL is out of service. Because of this, increasing the capacity available over the LIL would have minimal reliability benefits to the

[6] High-Voltage Direct Current ("HVdc").

system. This would result in little or no change to the reserve margin, which would result in little or no change to the timing of the build decision.

In addition to this, increasing the capacity available over the LIL would not have any effect on the shortfall analysis, as it assumes that the LIL is out of service. However, increasing the amount of capacity available to the Island from the LIL would result in additional energy being available to the Island on an annual basis, and would decrease the requirements for additional firm energy.