Q. Reference: *2024 Resource Adequacy Plan*; Technical Conference #3: Scenarios and Sensitivities/Modelling Approach and Considerations, October 16, 2024, Slide 98.

Hydro's Scenario 4 (Minimum Investment Required Expansion Plan) is driven by meeting three resource planning criteria:

1. Probabilistic Capacity
   - The Island Interconnected System should have sufficient generating capacity to satisfy a LOLH expectation target of not more than 2.8 hours per year.
2. Firm Energy Requirement
   - The Island Interconnected System should have sufficient generating capability to supply all its firm energy requirements with firm system capability.
3. LIL Shortfall Assessment
   - The Island Interconnected System should have sufficient generating capacity to limit the loss of load to a manageable level in the case of a LIL-shortfall event.

a) Please explain how a 150 MW battery would compare to a 150 MW combustion turbine in terms of meeting Hydro's Probabilistic Capacity criteria and LIL Shortfall Assessment criteria. In the response, please consider factors including: (i) battery storage duration; (ii) the ability to recharge the battery; and (iii) the potential for customer outages.

b) In the event of an extended outage to the LIL (i.e. six weeks or more) during the coldest period of the year (i.e. January and February), please explain whether a 150 MW battery would be limited in its ability to supply customers compared to a 150 MW combustion turbine. In the response, please explain any limitations associated with recharging the battery under such an outage.

c) Please estimate the cost of a battery that would provide the same reliability benefits as the 150 MW combustion turbine proposed by Hydro in its Minimum Investment Required Expansion Plan. In estimating the cost of the battery, please quantify the storage capability of the battery that would be equivalent to the planned 150 MW combustion turbine and associated fuel storage.

A. In general, the effectiveness of batteries in reducing loss of load events is based on two factors, (i) the storage capacity of the batteries, and (ii) the ability of batteries to recharge in low load periods.

Under normal conditions, the system is not energy-limited, which means that batteries can supply load in peak hours and charge in off-peak hours. The effectiveness of batteries in supplying firm capacity is expressed as its Effective Load Carrying Capacity ("ELCC"). ELCC is dependent on system conditions and is a function of battery storage capacity and penetration. In general, ELCC will decrease with battery penetration, so as additional batteries are added to the system, each additional battery has a lower effective capacity. ELCC will increase with an increase in battery storage capacity. A battery with an 8-hour capacity will have a higher ELCC than a battery with a 4-hour capacity. The cost of a battery system is approximately proportional to the storage capacity, so the cost of an 8-hour battery would be approximately double that of a 4-hour battery. Further analysis would be required to determine if the incremental reliability benefit would warrant doubling the capital cost to increase storage duration from four hours up to eight hours.

As discussed in Newfoundland and Labrador Hydro's response to PUB-NLH-339 of this proceeding, in a situation where the Labrador-Island Link ("LIL") is out of service for an extended period, such as the shortfall analysis, the system will likely be energy-limited. This will result in batteries not having adequate energy to recharge in off-peak hours. When this is the case, there is minimal benefit to adding additional storage capacity, as the batteries will typically not reach their fully charged capacity in the off-peak period. This is demonstrated in the 2024 Resource Adequacy Plan,[1] where there is a marginal decrease in unserved energy associated with an 8-hour battery compared to a 4-hour battery. The results of this analysis are summarized in Table 1.

[1] "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. 6.2.1.1.5.

Table 1: Unserved Energy Comparison over Six-Week LIL Shortfall

Scenario	Description	Unserved Energy w/ 4- Hour Battery (GWh)	Increase in Unserved Energy[2] (%)	Unserved Energy w/ 8-Hour Battery (GWh)	Increase in Unserved Energy[3] (%)
A	3, 47.2 MW CTs[4] + No Batteries	1,752	-	1,752	-
B	2, 47.2 MW CTs + 1, 47.2 MW Battery	1,780	1.6	1,757	0.3
C	1, 47.2 MW CT + 2, 47.2 MW Batteries	1,921	9.6	1,881	7.3
D	No CTs + 3, 47.2 MW Batteries	3,036	73.3	2,894	65.2

Based on the analysis in the 2024 Resource Adequacy Plan, batteries would perform similarly to CTs for capacities up to 50 MW in a shortfall situation. However, beyond that, the effectiveness is significantly reduced due to energy limitations. Because of this, it would not be technically feasible to install adequate battery capacity to match the effectiveness of a 150 MW CT in a shortfall scenario. This analysis only looks at the potential shortfall in one scenario, and more analysis is required to determine battery effectiveness across different system conditions.

Both the ELCC and the effectiveness of batteries during a shortfall scenario will be studied further – the ELCC study is anticipated to begin early in 2025. Hydro intends to advance feasibility studies to ensure a full understanding of battery energy storage system solutions and how they would effectively be incorporated into the Reference Case Expansion Plan within the 2026 Resource Adequacy Plan.

[2] Percent increase in unserved energy of 4-hour batteries compared to Scenario A.
[3] Percent increase in unserved energy of 8-hour batteries compared to Scenario A.
[4] Combustion turbine ("CT").