Q. **Reference: 2024 Resource Adequacy Plan**

Please explain why a battery energy storage system has been excluded as a potential supply option for the Minimum Investment Required Expansion Plan.

A. Based on analysis performed by Newfoundland and Labrador Hydro ("Hydro") as part of the *Reliability and Resource Adequacy Study Review* ("RRA") proceeding, battery energy storage systems ("BESS") are emerging as a viable supply solution worthy of further consideration. However, there remain appreciable feasibility concerns surrounding BESS solutions related to capability in emergency scenarios such as an extended outage to the Labrador-Island Link ("LIL") bipole. Given concerns regarding BESS solutions in the event of a LIL shortfall scenario, such solutions were not included as capacity resources in the Minimum Investment Required Expansion Plan.

As part of the RRA proceeding, Hydro has established criteria where it must ensure that rotating outages are manageable in a shortfall scenario. Specifically, capacity shortfalls must be limited to 100 MW or less to ensure that effective load rotation is possible during the outage. Hydro must ensure that capacity solutions can provide reliable supply in such a scenario.

For a BESS solution to provide a reliability benefit to the system in the event of an extended outage, Hydro would need to ensure a reasonable state of charge at the onset of the event and the ability to recharge the BESS during an outage. There are feasibility considerations to address with both of these aspects.

Operational Complexities

To ensure the state of charge of a BESS at the onset of the event, Hydro would need to impose operational restrictions where battery banks would need to be fully charged during critical operating periods, such as during extreme weather. However, it would likely be during such periods that supply from the BESS could also be needed for system support on the alternating current system and the level of charge may be reduced. If a bipole outage were to occur unexpectedly, Hydro would still need to ensure the state of charge of the BESS. The capability of the BESS at the onset of a bipole outage would therefore need to be addressed. This is in contrast to a combustion turbine option where specifications would ensure the availability of units at full capacity for the duration of the outage.

Hydro would also be faced with feasibility considerations in managing the charge of a BESS solution during an emergency outage scenario and would need to ensure that any additional intervention activity could be effectively executed in concert with many competing priorities. Effective charge management requires a clear sense of forecasted reserves. In an emergency outage scenario, reserve forecasts could be both unreliable and unpredictable.

The operation of the Island Interconnected System is dynamic and complex, particularly in emergency situations such as an extended LIL shortfall; tight coordination is required with neighbouring jurisdictions as well as Newfoundland Power Inc. If a BESS were to be operated as a critical capacity solution in such a scenario, the state of charge would be an additional complicating factor that operators would need to manage. Solutions could potentially involve increasing the number of operators; however, Hydro would first need to ensure that the system could be safely and effectively managed in such a case.

Model Assumptions vs. Utility Experience

The practical considerations of the operational complexities described above are in contrast to the Plexos shortfall modeling exercise performed as part of the RRA. While Plexos is an effective tool for long-term expansion planning, operational aspects and utility experience must be considered when focusing on the simulated hourly dispatches for the days and weeks of an emergency shortfall scenario. During these intervals, models cannot fully represent the real-time factors, described above. For example, Plexos simulations have perfect foresight of reserves and employ this advanced knowledge to optimally manage BESS charging and discharging for the duration of the emergency. In this ideal case, study results indicated that there was not an appreciable reliability difference in the capacity contribution of a 47.2 MW combustion turbine and a 47.2 MW BESS. In reality, the operational considerations described above are of critical importance and could have a significant detrimental impact on the effectiveness of a BESS solution as a capacity resource.

Historical Experience

Hydro should also consider historic and catastrophic outage events both domestically and abroad where there were insufficient reserves to meet customer load for several days. With insufficient supply to meet customer loads, there is no capability or opportunity to charge a BESS. In such scenarios, Hydro would need to understand the feasibility considerations of BESS operation once the initial state of charge is depleted.

In summary, there are significant feasibility concerns relating to the use of a BESS solution in an emergency scenario. Hydro must ensure that all outages are manageable from a planning and operational standpoint. Capacity solutions must therefore be pragmatic and effective during normal operations and also during the most severe and/or catastrophic circumstances.

Assessment of BESS Feasibility

On the basis of the above, BESS solutions should not be incorporated as capacity resources into the Minimum Investment Required Expansion Plan. However, as a next step, Hydro is undertaking feasibility analyses to assess the operational considerations, benefits and limitations of BESS solutions. A full understanding of these aspects will allow for Hydro to confirm the feasibility of a BESS solution and ensure reliable integration into the provincial power system. If feasibility and reliable operation can be confirmed, Hydro would then be in a position to advance to a front-end engineering design stage.

Assessment of the feasibility of BESS solutions will include:

- Assessment of BESS capability to maintain system frequency and stability in the event of LIL bipole outage;[1] and
- BESS's role as a capacity resource in meeting the Reference Case Expansion Plan. This will include an ELCC[2] Study for batteries, wind, solar, and potentially demand response measures to ensure that Hydro appropriately captures how these resource options

[1] Hydro's priority to support system frequency is to expand its under frequency load shedding scheme as per Hydro's response to IC-NLH-014 of this proceeding. This would improve the amount of energy that can be sunk from the LIL to the Island Interconnected System during steady-state operations. Hydro will explore how a BESS could provide further support and further improve energy deliveries over the LIL.
[2] Effective Load Carrying Capability ("ELCC").

complement, or contradict, each other and model the resulting contribution to the Island Interconnected System accordingly.

Hydro's intention is to immediately advance the feasibility analysis to ensure a full understanding of BESS solutions and how they could be effectively incorporated into the Reference Case Expansion Plan with the 2026 Resource Adequacy Plan. The ELCC Study is anticipated to begin early in 2025.