Q. **Reference: Application**

Please provide for the record a copy of Hydro's distribution planning guide explaining its planning approach, how integrated resource planning is incorporated including distributed generation and renewable forms of generation, and how reductions in harmful environmental emissions and government zero-carbon initiatives are taken into account.

A. Newfoundland and Labrador Hydro's ("Hydro") approach to distributed generation and renewable forms of generation is included in Hydro's Rural Isolated Systems Generation Planning Criteria. Please refer to CA-NLH-036, Attachment 1 for a copy of the planning criteria.

Energy storage technologies have not yet matured to the point that they are a viable alternative for firm, reliable, least-cost provision of power when compared to diesel generation. For Hydro to rely on wind, solar, or run-of-river hydro generation, energy storage technologies would need to bridge the period in which there may be limited availability of these energy sources. These periods may last for several days; as such, energy storage is not a viable option to use as a firm capacity in its Rural Isolated Systems.

Hydro's approach in its consideration of renewable energy and storage technologies has been verified as rational and prudent by Midgard Consulting Inc. ("Midgard") in its "Southern Labrador Communities – Integrated Resource Plan" ("Midgard IRP") filed with the Board of Commissioners of Public Utilities on March 31, 2023.[1] In the referenced report, Midgard stated:

> For a remote isolated system in a challenging environment, this is considered a rational and prudent approach. However, with recent technology improvements, it is conceivable that a battery storage system supported by only renewable resources could be scaled to assure dependable service. The determinant therefore becomes one of cost.

[1] "Long-Term Supply for Southern Labrador – Phase 1 – Midgard Consulting Inc. Report," Newfoundland and Labrador Hydro, March 31, 2023, att. 1.

Regardless of gradual unit cost decreases that have been observed over recent decades, battery systems remain economically impractical as a sole source of dependable utility-scale capacity for two reasons:

- Firstly, a system based solely on renewable resources requires significant surplus of installed renewable generating capacity because it must not only deliver the system load demand when fuel is available, it must also deliver surplus energy to the battery storage system during these same fuel availability periods. In addition, battery and inverter system losses mean that round trip (charge/discharge) cycle efficiency is less than unity – a battery system therefore represents a net load in excess of customer demand, and additional generation is required to supply these losses during the same periods of fuel availability.
- Secondly, battery systems large enough to bridge extended periods of renewable fuel "drought" are cost prohibitive.[2]

A simplified cost model developed to demonstrate the economics of both a solar-battery hybrid system and a wind-battery system is included in the Midgard IRP.

Although renewable energy resources are not considered viable alternatives for firm capacity, they can have an impact on the amount of fuel consumed by Hydro's diesel generation plants. Hydro's strategy for integrating renewable energy is not to develop wind or solar power in the region on its own behalf. Instead, Hydro is working with independent power producers in partnership with indigenous and community groups to interconnect and integrate their renewable generation and energy storage systems with Hydro's diesel generation plants and distribution systems.

[2] "Southern Labrador Communities - Integrated Resource Plan," Midgard Consulting Inc., March 28, 2023, att. 1, p. 65 of 103/3–17.

RURAL PLANNING STANDARD

Rural Isolated Systems Generation Planning Criteria

Doc # **RP-S-002**

Date: 2020/08/21

newfoundland labrador hydro
a nalcor energy company

Table of Contents

1 PURPOSE

The purpose of this document is to present Rural Isolated Generation Planning Criteria to be applied to the Diesel Generation Plants within the Province of Newfoundland and Labrador.

2 TERMS, ABBREVIATIONS, AND ACRONYMS

Firm Capacity means the amount of capacity that can be reasonably guaranteed from a generating unit at a particular instant when required. In the case of capacity planning, it describes the capacity that can be expected from a diesel generating plant during the system peak load.

Standby Power[1]: Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

Prime Power[1]: Output available with varying load for an unlimited time that is typically 90% of Standyby Power Rating. Average power output is 70% of the prime power rating. Typical peak demand is 100% of prime rated ekW with 10% overload capability for emergency use for a maximum of 1 hour in 12. Overload operation cannot exceed 25 hours per year.

Continuous Power[1]: Output available with non-varying load for an unlimited time that is typically 70% of Standyby Power Rating. Average power output is 70-100% of the continuous power rating. Typical peak demand is 100% of continuous rated ekW for 100% of operating hours.

[1] Based on the IOS8528 Standard

3 INTRODUCTION

A Rural Isolated System is an electric power system that is isolated from either the Island or Labrador Grid, and is typically supplied by diesel based generation. Hydro has established criteria related to the appropriate reliability, at the generation level, for the System that sets the timing of generation source additions. These criteria set the minimum level of reserve capacity and energy installed in the System to ensure an adequate supply for firm demand; however, short-term deficiencies can be tolerated if the deficiencies are of minimal incremental risk. As a general rule to guide Hydro's planning activities for Rural Isolated Systems the following have been adopted.

4 RURAL PLANNING CRITERIA

4.1 Capacity

Capacity for Rural Isolated Systems is provided by Diesel Generating Plants which house a number of Diesel Generator Sets (Gensets). The minimum number of units in a diesel plant is three, and typical plant size is from three to four units, although some (typically larger) plants contain more units. The prime power rating of the gensets is used to calculate the firm capacity in the rural isolated diesel plants. Gensets are assumed to be capable of achieving their respective nameplate ratings throughout their lifecycle.

In some cases power is also supplied to the system by alternative energy sources such as wind, solar, and small hydro. To date, wind and solar are considered as non-firm energy sources even when coupled with an energy storage system. That is, the wind and/or solar generation is not considered to provide firm capacity to the system during peak load. This is due to the random nature of the energy supply (wind/solar) which will not necessarily be present when it is needed. In the case of hydro-electric plants, run-of-river plants, are treated the same as wind or solar, and provide no firm capacity to the system during peak load. A hydro-electric plant with a storage reservoir will provide some degree of firm capacity to the system. The amount of capacity is dependant on the particular site and the design of the plant.

Hydro applies firm capacity criteria, which considers all the firm power sources available to the system, when determining the amount of capacity needed to supply the system's peak load according to the five year load forecast. The criterion used to guide Hydro's planning activities in relation to system capacity is described below.

4.1.1 Firm Capacity Planning Criteria

Hydro's generation reliability criterion for the Isolated Rural Systems is stated as follows: Hydro shall maintain firm generation capacity to meet the system peak load. Firm generation capacity is defined as the total installed capacity on the system not including non-firm energy sources as noted above minus the largest single unit. Exemptions or modifications to this criterion may be considered in the following situations:

- Additional generation may be prudent in situations where the introduction of a subtransmission system supplying multiple communities decreases existing system reliability.
- Less generation may be prudent in situations where non-firm generation has a historical record of operating at a low unavailability rate.
- Additional generation may be prudent in situations where major diesel plant modifications, such as the construction of a new diesel plant or major extension, are planned and the cost to add additional generation is of minor incremental cost.

Rationale:

The Firm Capacity Planning Criteria covers a first contingency situation. It is considered to provide a reasonable level of reliability to customers in the Rural Isolated Systems, and gives a good compromise between cost of service and reliability. Hydro has a long standing practice of using this criterion with good success. A survey conducted by Hydro in 2007 has confirmed that this criterion is similarly

practiced in other utilities. This criterion can be reasonably considered to be an industry standard practice.

4.2 Energy

Energy for Rural Isolated Systems is provided from either Type A (Arctic Grade), or Type B Diesel Fuel supplied by a local fuel vendor or stored on site by Hydro. Where cost-effective, Hydro will contract with a local fuel vendor for supply of diesel fuel to the diesel plants. In cases where this arrangement is not feasible, or not possible, Hydro will maintain long-term bulk fuel storage at the site. The amount of fuel to store is planned such that the diesel plant can supply energy requirements of the system over the winter period when fuel deliveries to the site are unavailable.

4.2.1 Vender Delivered Fuel:

In the case where Hydro relies on a contract with a fuel vendor, the following criteria are used to guide Hydro's planning criteria.

- Sufficient fuel shall be stored on site, such that the energy requirements of the system can be met for two weeks at all times of the year.
- The total available fuel storage capacity required on site shall meet the energy requirements of the system for a minimum of three weeks at all times of the year.

Assumptions:

- The local fuel vendor has enough storage to meet Hydro's winter fuel requirements.
- The local fuel vender is scheduled to fill up Hydro's storage at least once every seven days.
- If more than twenty-one days of storage is available, then deliveries may occur less often.
- If a location has a much higher, or lower risk of delay in fuel storage than then typical, additional, or less fuel storage may be required.

Rationale:

For planning purposes a fuel delivery of once every seven days is assumed because fuel carrying ferries operate on a weekly schedule. The Fuel Storage Planning Criteria covers the contingency situation of a one week delay in fuel delivery. If the vendor fills Hydro's storage every seven days and Hydro's fuel storage is large enough for at least twenty-one days of fuel then there should always be at least two weeks of fuel in storage. If the vendor cannot supply fuel on the seventh day due to an emergency (pipe failure, pump failure, or ferry delay, etc.) there is two weeks fuel available for backup.

Exception:

If the fuel vendor contracted by Hydro resides in the same community as the diesel plant the minimum required fuel storage capacity on site is reduced to reflect the decreased risk in fuel delivery as they are not affected by highway access or ferry schedules.

- Sufficient fuel shall be stored on site, such that the energy requirements of the system can be met for seven days at all times of the year.

- The total available fuel storage capacity required on site shall meet the energy requirements of the system for a minimum of ten days at all times of the year.

4.2.2 Bulk Fuel Storage

In the case where Hydro must maintain long-term bulk fuel storage, the following criteria are used to guide Hydro's planning activities.

- Island Isolated Systems; sufficient fuel shall be stored on site, such that the energy requirements of the system can be met for four consecutive months.
- Labrador Isolated Systems; sufficient fuel shall be stored on site, such that the energy requirements of the system can be met for nine consecutive months.

Assumptions:

- Final Fuel delivery via shuttle tanker is in late November.
- Hydro's fuel requirements are communicated to the vendor in the fall before the final fuel delivery.

Rationale:

The Fuel Storage Planning Criteria covers a first contingency situation. It is considered to provide a reasonable level of reliability to customers in physically isolated communities, and gives a good compromise between cost of service and reliability. Hydro has a long standing practice of using this criterion with good success. A survey conducted by Hydro in 2007 revealed that most other utilities surveyed only maintain short-term fuel storage and rely on deliveries from fuel vendors. Only one utility surveyed maintained long-term bulk fuel storage. It appears that fuel storage practices are region specific and dependant on the local resources available (i.e. road access, local fuel vendor, etc.).

4.3 Diesel Plant Equipment

In addition to generating capacity, and energy, Hydro plans the capacity of the major diesel plant equipment that is responsible for getting the power from the individual diesel units to the power distribution system. The components covered under this criterion are the Main Breaker, Main Bus, and Service Conductors and is defined as follows:

Diesel Plant Equipment Capacity Planning Criteria

No equipment shall be loaded above 100% of its rated capacity at rated ambient temperature.

Assumptions:

- The ratings are continuous ratings.

- Ambient temperature is thirty degrees Celsius.

4.4 Diesel Plant Substations

Capacity planning of diesel plant substations (step-up transformers) is covered under Hydro's Distribution Planning Criteria. The criteria are re-iterated here since the substation forms the critical interface between the diesel plant and the distribution system.

Substation Capacity Planning Criteria

Transformers at Substations shall not be loaded above 110% of the nameplate rating.

In the case of diesel plant substations; a spare shall be retained on site such that in the event of the loss of a single unit; the spare can be installed to restore power within a reasonable time frame. The standard substation is an aerial bank of three single-phase transformers connected in a three-phase bank. The maximum size aerial bank is 1500 kVA (3x500 kVA). This transformer size was selected since it is considered to be the largest size transformer that can be handled without assistance from a bucket truck, or crane.

If transformer capacity exceeding the maximum size aerial bank is required a three-phase padmount transformers may be used. Due to the size of these units and the remote nature of these plants, the equipment and personnel required to replace a three-phase transformer may not be available when needed. To prevent a prolonged system outage, in the event of a three-phase transformer failure, a second padmount transformer may be installed and available as a spare to use when required.

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1	Tyler Stevens	Updated and included in DMS	2020/08/21
2	Scott Henderson	Accepted Pending Fuel Vender Changes	2024-04-10

Document Approvers

Position	Signature	Approval Date
Team lead, Rural Planning	Scott Henderson	2024-04-10

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