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August 29, 2024

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Jo-Anne Galarneau
Executive Director and Board Secretary

Re: Application for Additions for Load Growth – Rigolet Unit 2065 Replacement and Fuel Storage Upgrades – Revision 1

Please find enclosed Revision 1 of Newfoundland and Labrador Hydro's ("Hydro") application for approval of capital expenditures for the replacement of Rigolet Unit 2065 and fuel storage upgrades originally filed with the Board of Commissioners of Public Utilities on August 9, 2024.

Hydro has included a Revision History indicating the locations and reasons for the revisions. The revisions have been shaded grey, for ease of reference.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/kd

Encl.

ecc:

Board of Commissioners of Public Utilities
Jacqui H. Glynn
Katie R. Philpott
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Labrador Interconnected Group
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Dennis M. Browne, KC, Browne Fitzgerald Morgan & Avis
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Regulatory Email

Revision History

Revision No.	Revision Date	Location	Reason
1	29-Aug-2024	Legal Application, Section 6, p. 2.	Amendment of project length description.
1	29-Aug-2024	Legal Application, Section 7, p.2.	Correction of costs breakout by year to include 2027 costs, reducing 2026 costs.
1	29-Aug-2024	Schedule 1, Section 1.0, p. 1/14.	Correction of installation date of Unit 2065.

Additions for Load Growth

Rigolet Unit 2065 Replacement and Fuel Storage Upgrades

Original Submission: August 9, 2024
Revision 1: August 29, 2024

An application to the Board of Commissioners of Public Utilities

IN THE MATTER OF the *Electrical Power Control Act, 1994*, SNL 1994, Chapter E-5.1 ("*EPCA*") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 ("*Act*"), and regulations thereunder; and

IN THE MATTER OF an application by Newfoundland and Labrador Hydro ("Hydro") for approval of capital expenditures for replacement of Rigolet Unit 2065 and fuel storage upgrades, pursuant to Subsection 41(3) of the *Act*.

To: The Board of Commissioners of Public Utilities ("Board")

THE APPLICATION OF HYDRO STATES THAT:

A. Background

1. Hydro, a corporation continued and existing under the *Hydro Corporation Act, 2007*, is a public utility within the meaning of the *Act*, and is subject to the provisions of the *EPCA*.

2. In mid-2023, Hydro received a request for new electrical service for a community building in Rigolet, an isolated community on the coast of Labrador where Hydro provides electrical service to 185 residential and commercial customers. Electricity is supplied by a diesel generating plant owned and operated by Hydro.

3. This additional load cannot currently be accommodated by the existing diesel generation plant in the community as it would cause Hydro to operate above 98% of its firm capacity, which risks violation of its Rural Isolated Systems Generation Planning Criteria. Additional expected load growth indicates a violation of the planning criteria by 2030.

B. Application

4. To accommodate the new request for load, additional diesel generation and an expansion of the fuel storage system are required at the Rigolet Diesel Generating Plant. If these upgrades are not completed, there is a significant risk that Hydro will violate its planning criteria and as a result, be incapable of fully supplying power to the community of Rigolet or require emergency

fuel deliveries by air to avoid fuel shortages. As such, Hydro is recommending the replacement of Unit 2065, along with the existing horizontal fuel tanks at the Rigolet Diesel Generating Plant to support future load growth and maintain system reliability for the community.

5. Hydro's proposal is to replace Unit 2065 with a larger 545 kW genset. As is detailed in Schedule 1, while a 455 kW genset replacement would address the currently forecasted load issues, it would not be sufficient in a circumstance where further currently unforecasted load were to arrive. Installing the larger replacement now has a minimal cost impact, with material mitigation of future risk and cost. While the 455 kW genset has a marginally lower cost, the 545 kW genset is the preferred option in consideration of future reliability of service.

6. [ ] This is a four-year project. The project description and schedule are detailed in Sections 2.0 and 5.2 of Schedule 1, respectively.

7. The estimated capital cost of the project is $3,429,219 with approximately $50,071 in 2024, $226,357 in 2025, [ ] $1,604,808 in 2026, and $1,547,983 in 2027.

8. Hydro submits that the proposed capital expenditure is necessary to ensure that Hydro can continue to provide service that is safe and adequate, and just and reasonable as required by Section 37 of the *Act.*

C. Newfoundland and Labrador Hydro's Request

9. Hydro requests that the Board make an Order pursuant to Section 41(3) of the *Act* approving the capital expenditures necessary for the replacement of the Rigolet Unit 2065 and fuel storage upgrades, as more particularly described in this application and the attached Schedule 1.

D. Communications

10. Communications with respect to this Application should be forwarded to Shirley A. Walsh, Senior Legal Counsel, Regulatory for Hydro.

DATED at St. John's in the province of Newfoundland and Labrador on this 29th day of August 2024.

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Counsel for the Applicant
Newfoundland and Labrador Hydro,
500 Columbus Drive, P.O. Box 12400
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Schedule 1

Additions for Load Growth – Rigolet Unit 2065 Replacement and Fuel Storage Upgrades

Additions for Load Growth – Rigolet Unit 2065 Replacement and Fuel Storage Upgrades

Location: Rigolet

Investment Classification: System Growth

Asset Category: Generation

Executive Summary

The community of Rigolet is located on the north coast of Labrador, where Newfoundland and Labrador Hydro ("Hydro") provides electrical service to 185 residential and commercial customers. Electricity is supplied by a diesel generating plant owned and operated by Hydro. The diesel generating plant consists of three diesel generating units ("genset")[1] with a current firm capacity of 775 kW.[2] There are three fuel storage tanks which maintain a total of 783,144 litres of usable fuel.

In mid-2023, Hydro received a request for electrical service for a new Department of Health and Social Development ("DHSD") building in Rigolet. Hydro's forecast for this facility shows that by 2025 the new building will increase the peak demand in Rigolet by 51 kW and increase the annual fuel consumption by approximately 37,000 litres, resulting in a 7% increase in peak community load and 5% increase in annual fuel consumption. Based on the spring 2023 scenario forecast which includes the new service request, the diesel generating plant will be loaded to 98% (within 13 kW) of its firm capacity planning criteria once the new service is connected with the three existing units in operation. Violations of the planning criteria are anticipated by 2030 with routine load growth, in the absence of any upgrades to the system.

Hydro completed an evaluation to determine the most economically viable solution to address the generation and fuel storage deficits in Rigolet, which included the following alternatives:

- Deferral;
- Renewable generation with storage;

[1] A diesel genset consists of a diesel engine coupled with an alternator.
[2] Firm capacity refers to capacity of the plant in the event of the failure of the largest genset (i.e., (455+320+545)-545 = 775 kW).

- Replace Unit 2065 with a 455 kW rated diesel genset, and replace fuel storage tanks;
- Replace Unit 2065 with a 545 kW rated diesel genset, and replace fuel storage tanks;
- Advance the direct Rigolet Diesel Generating Plant replacement;[3] and
- Advance the replacement of the Rigolet Diesel Generating Plant with a transmission interconnection to the Labrador Interconnected System.

The preferred alternative is the installation of the 545 kW genset. This solution provides 90 kW of additional capacity at a marginal incremental cost, and decreases the risk of further genset upgrades in the event of additional unforecasted load growth in the community such as a further increase in General Service customers or additional housing development. While analysis indicates that a 455 kW unit would provide sufficient firm capacity to meet Hydro's current load forecast, a unit of this size may not provide sufficient capacity to accommodate the load associated with a large general service request. In contrast, a 545 kW unit would provide additional firm capacity that would allow Hydro to meet growing load in the community and ensure that Hydro is able to connect new services in a timely and cost-effective manner, and the incremental cost associated with a 545 kW unit provides a Risk-Spend Efficiency of 23.8 per million dollars.[4]

To mitigate the risk of violating its firm capacity planning criteria in the event of unforecasted load growth, Hydro is proposing the replacement of Unit 2065 at the Rigolet Diesel Generating Plant with a 545 kW rated genset and the replacement of the three existing horizontal fuel storage tanks with larger tanks in the range of 60,000–80,000 litres to increase fuel storage capabilities.[5] The replacement of Unit 2065 with a 545 kW unit will increase the firm capacity at the Rigolet Diesel Generating Plant from 775 kW[6] to 1,000 kW. This increase in firm capacity will be sufficient to accommodate the connection of the new DHSD building in 2025, and will provide additional capacity to support both expected and unexpected future load.

[3] The Rigolet Diesel Generating Plant replacement is currently scheduled to begin in 2028 with completion in 2032; advancing this project would result in the start date being shortly after project approval is received, with completion by the fourth quarter of 2028.
[4] Hydro considers the pre-implementation risk score to be an impact of 3 and likelihood of 3, with a risk score of 9, and the post-implementation risk to be an impact of 3 and a likelihood of 2, with a risk score of 6.
[5] The final size will be dependent on the available physical space onsite and shipping constraints to Rigolet.
[6] Current firm capacity at the Rigolet Diesel Generating Plant is 775 kW, or (455+320+545)-545 = 775 kW. If a 545 kW unit is installed, the firm capacity will increase to 1,000 kW, or (455+545+545)-545 = 1,000 kW.

This project is scheduled to begin in 2024 with completion planned for 2027, at an estimated cost of $3,429,200.

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List of Appendices

1.0 Introduction

Hydro provides electrical service to residents in isolated rural communities within the province through the use of electrical distribution systems paired with isolated diesel generating plants. Isolated diesel generating plants are designed to ensure that firm power can be delivered in the event of failure of the largest generating unit.

As new customers are added to distribution systems or existing customers use more electrical power, both the peak demand and energy requirements of communities grow. To support additional peak demand and energy requirements, Hydro must ensure the continued supply of reliable power, which may require capital upgrades to the electrical system.

In mid-2023, Hydro received a request for a new electrical service for a community building in Rigolet, an isolated community on the coast of Labrador where Hydro provides electrical service to 185 residential and commercial customers. Electricity is supplied by a diesel generating plant owned and operated by Hydro. The Rigolet Diesel Generating Plant contains three units, one of which is proposed for replacement. Unit 2065 is a 320 kV, 1,800 rpm diesel genset installed in 2002, Unit 2081 is a 455 kW, 1,800 rpm diesel genset, and Unit 2101 is a 545 kW, 1,800 rpm diesel genset. The additional requested load cannot currently be accommodated by the existing diesel generating plant in the community as it would cause Hydro to operate above 98% of its firm capacity and fuel storage levels, which risks violation of its Rural Isolated Systems Generation Planning Criteria.[7] The load profile in Rigolet is expected to grow throughout the next 20 years.

To accommodate the new request for load, additional diesel generation and an expansion of the fuel storage system are required at the Rigolet Diesel Generating Plant. If these upgrades are not completed and the additional load is connected, there is a risk that Hydro will violate its planning criteria and be incapable of supplying power to the community of Rigolet should its largest unit be out of service during peak load periods, or require emergency fuel deliveries by air to avoid fuel shortages. As such, Hydro is recommending the replacement of Unit 2065, and the existing horizontal fuel tanks at the Rigolet Diesel Generating Plant to support future load growth and maintain system reliability for the community.

The layout of the Rigolet distribution system, including the location of the diesel generating plant and new DHSD building, is shown in Figure 1.

[7] Hydro's Rural Isolated Systems Generation Planning Criteria can be found in Appendix A.

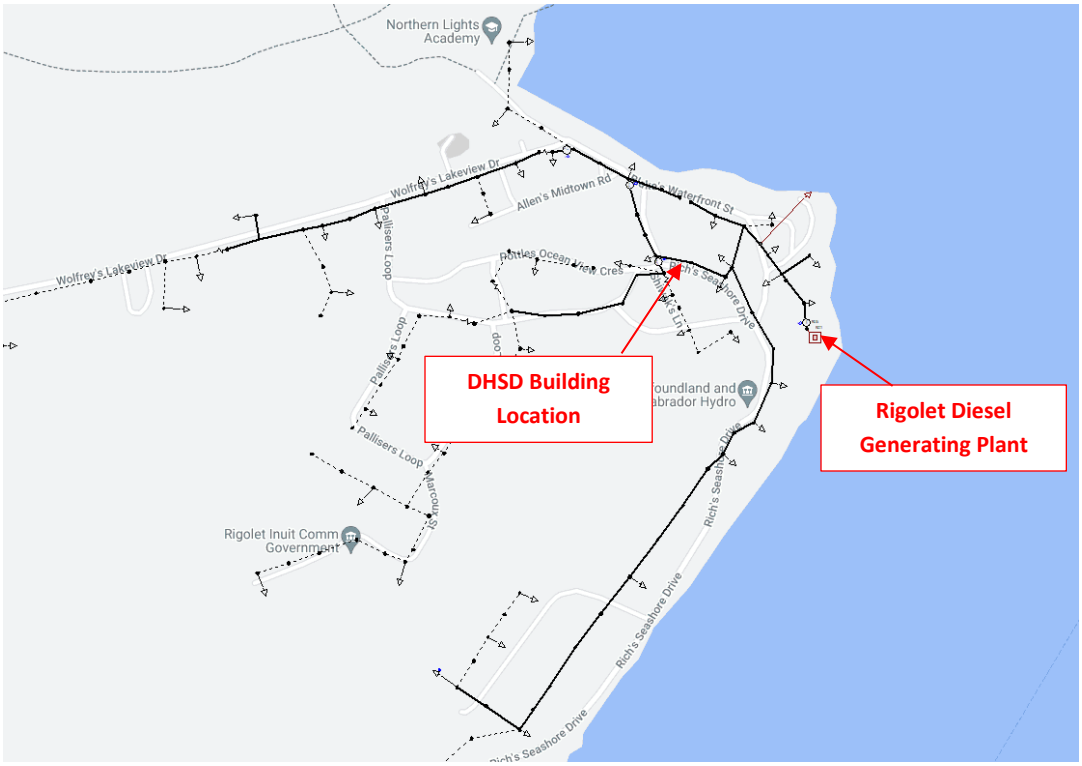

Figure 1: Layout of the Rigolet Distribution System

Considering that the customer has requested the additional power to be supplied in 2025, and that submission of this proposal within its 2025 Capital Budget Application would delay approval until the end of 2024 or early 2025, Hydro determined that the risk of criteria violations on the existing system if not upgraded and the obligation to provide service to its customers that is safe and reliable is significant enough to warrant a Supplementary Capital Budget Application to enable work to commence in 2024.

2.0 Project Description and Justification

This project is justified by the requirement to meet the growing electricity needs in the community of Rigolet. Based on Hydro's load forecast provided in Section 3.3, it has been determined that there will be a violation of Hydro's firm capacity and bulk fuel storage planning criteria at the Rigolet Diesel Generating Plant by 2030. Additional details on the planning criteria violations are included in Section 4.0.

Hydro is proposing to replace Unit 2065, a 320 kW diesel genset with a 545 kW diesel genset. Additionally, three of the existing horizontal fuel tanks must be replaced with larger 60,000–80,000 litre

fuel storage tanks.[8] Replacement of the existing tanks is required within the next five years, and clustering the replacement and upgrade to larger tanks within this project ensures that Hydro has sufficient fuel storage available to meet the forecast shown in Table 3.

3.0 Asset Overview

3.1 Asset Background

The Rigolet Diesel Generating Plant was constructed in 1976 and is nearing 50 years old. There are three diesel gensets located in the plant with ratings shown in Table 1. These existing gensets provide a total and firm capacity of 1,320 kW and 775 kW, respectively.

Table 1: Rigolet Diesel Plant Units

Unit ID	Rating (kW)	Year Installed	Number of Overhauls Remaining[9]
2101	545	2018	3
2065	320	2002	2
2081	455	2022	4

Fuel storage at the Rigolet Diesel Generating Plant consists of two vertical and three horizontal fuel tanks with capacities as shown in Table 2. The existing horizontal fuel tanks are approximately 27 years old and are expected to reach the end of their useful service lives within the next 5–8 years.

Table 2: Rigolet Fuel Storage Tanks

Tank ID	Type	Total Capacity (Litres)	Usable Capacity[10] (Litres)	Year In-Service[11]
12C	Horizontal	22,902	21,069	1998
12D	Vertical	305,284	280,861	1985
12E	Horizontal	46,051	42,366	1998
12F	Horizontal	46,051	42,366	1998
12G	Vertical	430,956	396,479	2015
Total		**851,244**	**783,141**	

[8] The tank size will be dependent upon further evaluation of the available physical space on site and shipping constraints to Rigolet.
[9] Units are overhauled every 20,000 hours.
[10] The usable capacity of fuel storage tanks is typically 92% of the total storage capacity. This is due to dead space at the bottom of the tank where the pump cannot reach, and room for fuel expansion at the top of the tank.
[11] Installation of the existing horizontal fuel tanks occurred in 1997; the tanks were placed in service in 1998.

3.2 Historical Load Information

The Rigolet distribution system has experienced consistent peak load and energy sales for the past five years.[12] The annual energy consumption and historical peak load of the Rigolet system from 2013 to 2022 are shown in Chart 1.

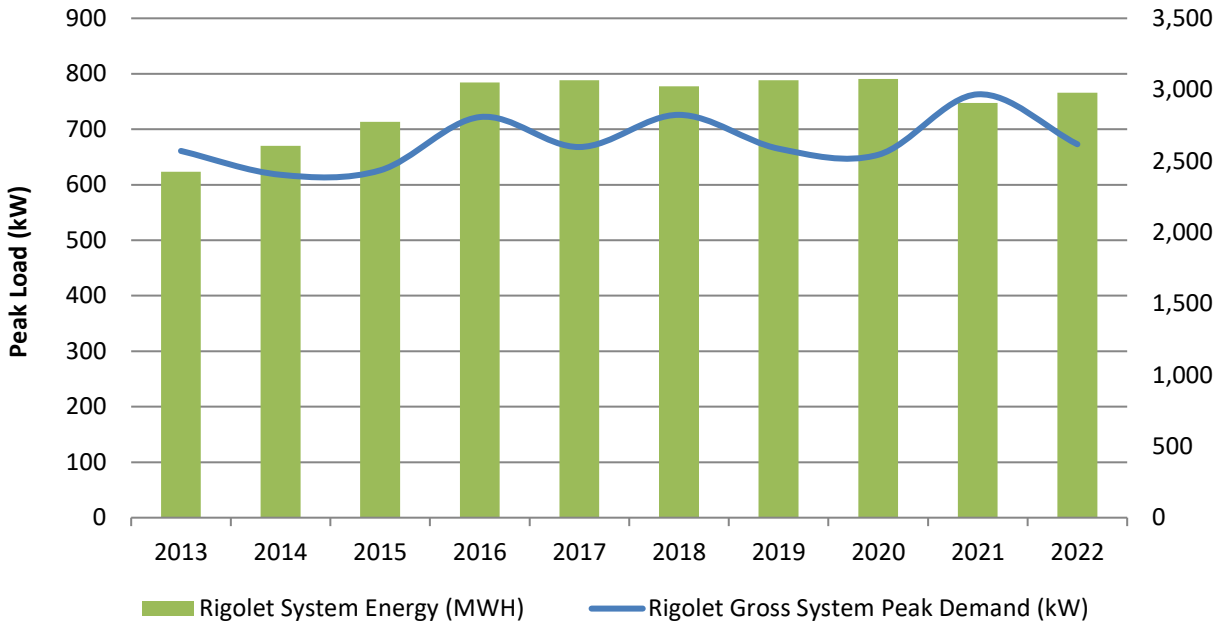

Chart 1: Historical Peak and Energy Consumption

3.3 Forecasted Load Growth

In mid-2023, Hydro received a request for electrical service for a new 13,500 ft^2 building, with a total connected load of 355 kW, to replace the existing DHSD building owned by the Nunatsiavut Government.[13]

Based on the analysis outlined in Section 4.0, Hydro concluded that connecting the new DHSD building in 2025 would pose a reliability risk to the existing Rigolet distribution system. Hydro met with members of the Nunatsiavut Government in 2024 to present the conclusions of this analysis.[14]

[12] Between 2013 and 2016 the system experienced growth in both peak load and energy sales.
[13] The new DHSD building will be located on the site of the existing DHSD building.
[14] During the meeting, it was decided to form a joint working group consisting of members from both Hydro and the Nunatsiavut Government to discuss load growth in their communities. The objective of the working group is to promote and provide a means of sharing information related to load growth within Nunatsiavut communities, with the goal of improving energy security, and the provision of safe, cost-conscious, reliable electricity.

In response to the service request for the new DHSD building, the Rigolet load forecast initially completed in spring 2023 was updated to include a scenario forecast, accounting for the additional demand and energy consumption associated with the new service.

Once connected, it is expected that the new service will increase the forecasted peak load in Rigolet by 51 kW and the annual fuel requirements by 5%, or approximately 37,000 litres. As a result, Hydro is evaluating the appropriate number of tanks and their capacity to ensure it can meet the long-term fuel storage requirements.[15] Table 3 presents the Rigolet spring 2023 Base Case (5 years), which represents the forecast without the new service request, and Scenario Case (20 years), representing the demand and fuel forecast including the new service request.

Table 3: Rigolet – 2023 Base Case and Scenario Forecast

	Base Case Forecast		Scenario Case Forecast	
Year	Gross System Peak (kW)	Fuel Storage Requirement (Litres)	Gross System Peak (kW)	Fuel Storage Requirement (Litres)
2023	696	722,400	696	731,000
2024	709	727,600	726	758,900
2025	711	730,300	762	767,900
2026	714	733,100	765	770,600
2027	716	735,800	767	773,300
2028	719	738,500	770	776,900
2029	-		774	780,800
2030[16]	-		777	784,700
2031	-		781	788,600
2032	-		785	792,600
2033	-		789	796,600
2034	-		793	800,500
2035	-		797	804,500
2036	-		800	808,600
2037	-		804	812,600
2038	-		808	816,700
2039	-		812	820,700
2040	-		816	824,900
2041	-		820	829,000
2042	-		824	830,000
2043	-		824	831,000

[15] The fuel storage provided by upgrading the three existing tanks to 60,000 litres would result in only a 6% buffer against the 2043 scenario case forecast shown in Table 3.

[16] Rigolet Diesel Generating Plant firm capacity is (545+455+320)-545 = 775 kW.

Conservation and Demand Management ("CDM") is considered within the development of Hydro system load forecasts to either help support the primary justification or are used when determining equipment size. These forecasts are based on historical energy and demand trends from each area under consideration and inherently include the impact of ongoing CDM programs that have been present in Hydro's systems over the past number of years. As such, additional CDM is not expected to have a significant impact on this system.

4.0 Analysis

Hydro's Rural Isolated Systems Generation Planning Criteria has the following requirements:

- **Firm Capacity Criteria:** 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.
- **Bulk Fuel Storage Criteria:** Sufficient fuel shall be stored on site, such that the energy requirements of the system can be met for nine consecutive months.

Hydro performed analysis to compare the revised peak demand and fuel forecasts for Rigolet against this planning criteria, which is summarized in Table 4.

This analysis indicates that if the new service is connected in 2025, the Rigolet Diesel Generating Plant will be operating at 98.3% (within 13 kW) of its firm capacity criteria, and 98.1% (within 16,000 litres) of its fuel storage criteria. There is a material risk that the Rigolet distribution system could experience an additional 13 kW of load growth[17] that would trigger a planning criteria violation by 2027. This material risk requires Hydro to delay the connection of the new service request until the firm capacity of the plant is increased beyond 775 MW.

[17] An additional 13kW of load growth is equivalent to two electrically heated homes (average peak impact of 7.5 kW per home) connecting to the distribution system.

Table 4: Rigolet Peak Demand and Fuel Forecast – Spring 2023[18]

	Firm Capacity Requirement			Fuel Storage Requirement		
Year	Gross Peak (kW)	Firm Capacity (kW)	Rated Capacity (%)	Fuel Storage Requirements (Litres)	Fuel Storage Capacity (Litres)	Rated Capacity (%)
2023	696	775	89.8	731,000	783,144	93.3
2024	726	775	93.7	758,900	783,144	96.9
2025	762	775	98.3	767,900	783,144	98.1
2026	765	775	98.7	770,600	783,144	98.4
2027	767	775	99.0	773,300	783,144	98.7
2028	770	775	99.4	776,900	783,144	99.2
2029	774	775	99.9	780,800	783,144	99.7
2030	777	775	100.3	784,700	783,144	100.2

4.1 Evaluation of Alternatives

When planning criteria violations are present, various technically viable alternatives must be evaluated to determine the least-cost reliable solution. The following alternatives were considered to address the potential firm capacity and bulk fuel storage criteria violations in Rigolet:

- Alternative 1: Deferral;
- Alternative 2: Renewable generation with storage;
- Alternative 3a: Replace Unit 2065 with a 455 kW genset and replace fuel storage tanks;
- Alternative 3b: Replace Unit 2065 with a 545 kW genset and replace fuel storage tanks;
- Alternative 4a: Advance the direct Rigolet Diesel Generating Plant replacement;[19] and
- Alternative 4b: Advance the replacement of the Rigolet Diesel Generating Plant with an interconnection to the Labrador Interconnected System.

4.1.1 Alternative 1: Deferral

As described in Section 4.0 of this report, the connection of the new DHSD building cannot occur until the proposed project is executed due to the material risk of planning criteria violation and the resulting

[18] Numbers may not add due to rounding.

[19] The Rigolet Diesel Generating Plant replacement is currently scheduled to begin in 2028 with completion in 2032; advancing this project would result in the start date being shortly after project approval is received, with completion by the fourth quarter of 2028.

risks to reliable service. However, deferral of this project would result in further delay of connection of the new DHSD building. Hydro has a statutory obligation to supply electric energy to customers. As such, deferral is not a viable option.

4.1.2 Alternative 2: Renewable Generation with Storage

Renewable energy sources such as wind, solar, or run-of-river hydro generation installed in isolated systems are considered non-firm energy sources due to their intermittent nature.

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 Rigolet.

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" ("IRP")." 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.
>
> 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.[20]

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

In 2022, Hydro interconnected and integrated a 15 kW roof-top solar project in Rigolet. In 2023, this project produced an offset of approximately 4,000 litres worth of energy primarily outside of the nine-month period when fuel deliveries are unavailable. The 4,000 litres represents less than 1% of the energy consumed in Rigolet. To date, Hydro has not been incorporating the impact of these small-scale renewable energy projects as reliability concerns remain. Since 2017, Hydro has been working with the Nunatsiavut Government on the Nain Wind Microgrid Project, the first high-penetration renewable energy project in Nunatsiavut. Once complete, and proven successful, Hydro expects that further renewable energy systems will be implemented across Nunatsiavut communities, including Rigolet. The complexity and timelines associated with projects of this magnitude do not lend themselves to being a viable alternative to the fuel storage upgrades necessary to allow the connection of the DHSP building; however, Hydro remains committed to evaluating and supporting such future projects.

4.1.3 Alternative 3a: Replace Unit with a 455 kW Genset and Replace Tanks

This alternative would involve the replacement of Unit 2065 with a 455 kW genset, and three of the horizontal fuel tanks with larger tanks that have a capacity between 60,000–80,000 litres.[21] This project will increase the firm capacity of the Rigolet Diesel Generating Plant from 775 kW to 910 kW, and the total fuel storage from 783,000 litres to upwards of 898,000 litres.[22]

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

[21] The final tank size will be dependent on the available physical space on site and shipping constraints to Rigolet.

[22] The upper range of 843,000 litres or 898,000 litres, depending on the final tank size.

The genset replacement scope of this alternative includes the design, procurement, and installation of a new genset, exhaust stack, exhaust insulation jacketing for all three units, radiator, after cooler, and all other equipment necessary to facilitate the proper function of the new unit. Additionally, any assessments or modifications required to existing plant systems[23] as a result of the proposed genset replacement will be included.

The fuel storage scope of this alternative includes the design, procurement, and installation of new tanks, which will be double-walled and vacuum-monitored according to Hydro's standard specifications.

4.1.4 Alternative 3b: Replace Unit with a 545 kW Genset and Replace Tanks

This alternative would involve the replacement of Unit 2065 with a 545 kW genset, and three of the existing horizontal fuel tanks with larger tanks that have a capacity between 60,000–80,000 litres.[24] This project will increase the firm capacity of the Rigolet Diesel Generating Plant from 775 kW to 1,000 kW, and the total fuel storage from 783,000 litres to upwards of 898,000 litres.[25]

The genset replacement and fuel storage scope of this alternative will be the same as Alternative 3a, except that Unit 2026 would be replaced with a larger 545 kW unit.

4.1.5 Alternative 4a: Advance the Direct Replacement

The scope of this alternative would include advancing the replacement of the existing Rigolet Diesel Generating Plant with the construction of a new diesel plant. The Rigolet Diesel Generating Plant replacement is currently scheduled to begin in 2028, with completion in 2032. Advancing this project would result in the start date being shortly after project approval is received, with completion by the fourth quarter of 2028. The scope to replace the diesel plant is estimated to be $35.2 million and would include the construction of a new diesel plant building, fuel storage yard, and substation.

4.1.6 Alternative 4b: Advance the Replacement with Labrador Interconnected System Interconnection

This alternative involves advancing the replacement of the existing Rigolet Diesel Generating Plant with the construction of a 69 kV interconnection from the Labrador Interconnected System in Happy Valley-

[23] Modifications could include ventilation, protection, controls, etc.
[24] The final tank size will be dependent on the available physical space on site and shipping constraints to Rigolet.
[25] The upper range of 843,000 litres or 898,000 litres, depending on the final tank size.

Goose Bay to Rigolet. This project would include the construction of a new 187 Km 69 kV transmission line to Happy Valley-Goose Bay and two terminal stations, with one at each end of the line.

4.2 Least-Cost Evaluation

Hydro completed a least-cost evaluation to determine the most economically viable alternative to address the generation and fuel storage deficits in Rigolet. Key inputs into this analysis included capital costs, operating and maintenance costs, existing asset retirement costs, and salvage values of assets removed from service over the study period.

As alternatives 1 and 2 were not considered appropriate, as indicated above, the economic analysis was broken out into two separate least-cost evaluations as follows:

1) **Analysis 1 – Diesel Generating Unit Sizing Study:** This study analyzed Alternatives 3a and 3b to determine appropriate genset sizing.
2) **Analysis 2 – Future Project Advancement Study:** This study was completed to determine if either Alternative 4a or 4b were more cost effective than the appropriate Analysis 1 alternative.

4.2.1 Analysis 1: Diesel Generating Unit Sizing Study

The least-cost evaluation performed to determine the appropriate unit size includes the following assumptions:

1) A study period of eight years was chosen, as the Rigolet Diesel Generating Plant is scheduled to be replaced by 2032.
2) Unit replacement costs:
   - 455 kW: $2,041,200.
   - 545 kW: $2,132,000.
3) Existing unit overhaul costs:
   - Unit 2081: $140,200.
   - Unit 2065: $236,600.
   - Unit 2101: $187,400.
4) 455 kW and 545 kW unit overhaul and replacement frequencies:
   - 1,800 rpm unit: overhaul every 20,000 hours, replacement every 100,000 hours.

5) Timing of unit replacements and overhauls for both existing and new units are based on simulation results or if the unit reaches 35 years of operation.

6) The fuel consumption data of recently purchased gensets, as shown in Table 3, was used to estimate the fuel consumption for the proposed 455 and 545 kW units.

Table 5 presents the Cumulative Present Worth ("CPW") of the two alternative unit sizes and the difference in CPW between each alternative over an eight-year study period.

Table 5: Least-Cost Evaluation Summary of Alternative 3a and 3b Over an Eight-Year Study Period ($)[26]

Alternatives	CPW	CPW Difference between Alternative and the Least-Cost Alternative
Alternative 3a: Replace Unit 2065 with a 455 kW rated genset and replace fuel storage tanks	7,113,868	
Alternative 3b: Replace Unit 2065 with a 545 kW rated genset and replace fuel storage tanks	7,239,565	125,696

While Alternative 3a is the least-cost option, Alternative 3a and Alternative 3b have an approximate cost difference of only $126,000 CPW for the eight-year study period, which represents 3.7% of the overall project capital cost. While a 455 kW unit would provide sufficient firm capacity to meet Hydro's current load forecast, a unit of this size would not provide sufficient capacity to accommodate the load associated with one additional large general service request. In contrast, a 545 kW unit would provide an additional firm capacity that would allow Hydro to meet the growing load in the community and ensure that Hydro is able to connect new services in a timely and cost-effective manner, as an upgrade to a larger unit at a later date is estimated to be in excess of $2 million. The incremental cost associated with a 545 kW unit provides a Risk-Spend Efficiency of 23.8 per million dollars.[27] Alternative 3b provides 90 kW of additional capacity at a marginal incremental cost, and decreases the risk of further genset upgrades in the event of unexpected load growth in the community. Alternative 3b is the preferred alternative when balancing cost with reliable service.

[26] Numbers may not add due to rounding.

[27] Hydro considers the pre-implementation risk score to be an impact of 3 and a likelihood of 3, with a risk score of 9, and the post-implementation risk to be an impact of 3 and a likelihood of 2, with a risk score of 6.

4.2.2 Analysis 2: Future Project Advancement Study

The following assumptions were included in the least-cost evaluation conducted to determine if Alternative 4a or 4b were more cost-effective than the chosen alternative of Analysis 1:

- Alternative 4a – Advancing the Replacement of the Rigolet Diesel Generating Plant with a New Diesel Generating Plant:
  - Screening-level estimates were used;
  - A 20-year study period was used;
  - Fuel tanks were not included in the estimated cost;
  - Operating and maintenance ("O&M")costs for the new plant were assumed to be the same as the existing plant;
  - Current overhaul costs were applied for similar units in service; and
  - The construction of the new diesel generating plant was estimated to cost $35,200,000.
- Alternative 4b – Advancing the Replacement of the Rigolet Diesel Plant with a Transmission Interconnection to the Labrador Interconnected System:
  - Screening-level estimates were used for the analysis;
  - Transmission line O&M costs were assumed to be $50,000 per year;
  - The construction of the new 187 km, 69 kV transmission line from Happy Valley-Goose Bay to Rigolet was estimated to cost $86,640,000;
  - Costs for the construction of terminals stations in Happy Valley-Goose Bay and Rigolet were not included in the estimate;
  - Vegetation management costs were included in the analysis, and assumed to start ten years after the line is constructed; and
  - Vegetation costs assume the line will have road access.[28]

[28] Costs associated with vehicle access were included instead of helicopter access as a sensitivity test for this alternative.

Table 6: Least-Cost Evaluation Summary of Alternative 3b, 4a, and 4b Include Diesel Generating Plant Replacement and Interconnection ($)

Alternatives	CPW	CPW Difference between Alternative and the Least-Cost Alternative
Alt 3b: Replace Unit 2065 with a 545 kW and replace fuel tanks[29] (Plant replaced in 2032)	35,571,370	
Alt 4a: Advancing the replacement of the Rigolet Diesel Generating Plant with a new Diesel Generating Plant in 2028	39,150,508	3,579,138
Alt 4b: Advancing the replacement of the Rigolet Diesel Generating Plant with a Transmission Interconnection to the Labrador Interconnected System	57,297,807	21,726,437

The CPW of Alternative 4a and Alternative 4b are $3,579,138 and $21,726,437 higher than Alternative 3b. As such, Alternative 3b is the preferred and proposed alternative to address the anticipated planning criteria violations in Rigolet.

4.3 Recommended Alternative

As described above, Alternative 3b is the preferred solution. It provides 90 kW of additional capacity at a marginal incremental cost and decreases the risk of further genset upgrades in the event of currently unforecasted additional load growth in the community, it is considered the preferred alternative. A 545 kW unit, as proposed in Alternative 3b, can be installed in the existing footprint of the engine hall and will increase the firm capacity of the Rigolet Diesel Generating Plant from 775 kW to 1,000 kW. The existing fuel tanks 12C, 12E, and 12F will also be replaced with horizontal tanks in the size range of 60,000–80,000 litres.[30] This expansion in generation and fuel storage will allow for the new community building in Rigolet to be connected to the distribution system in 2027 and enable future growth without incurring further costs associated with additional projects for load growth.

4.3.1 Risk of Asset Stranding

With the Rigolet Diesel Generating Plant scheduled to be replaced in 2032, Hydro acknowledges that there is a risk of assets becoming stranded; however, this risk is considered to be low as the horizontal

[29] Alternative 3b assumes replacement of the Rigolet Diesel Generating Plant with a new diesel generating plant in 2032.
[30] The final tank size will be dependent on the available physical space onsite and shipping constraints to Rigolet.

fuel tanks and the gensets could be reused in several other Hydro-owned diesel generating plants.[31]

5.0 Scope of Work

The project scope includes the replacement of Unit 2065 at the Rigolet Diesel Generating Plant with a 545 kW rated diesel genset, and the replacement of the three existing horizontal fuel storage tanks with larger tanks to increase fuel storage capabilities.

The replacement of Unit 2065 with a 545 kW genset will increase the firm capacity of the plant from 775 kW to 1,000 kW, which is sufficient to accommodate the connection of the DHSD building in 2025, and will provide additional capacity to support future load growth.

The increased fuel storage requirements will be met by replacing the existing tanks 12C, 12E, and 12F with horizontal tanks in the size range of 60,000–80,000 litres.[32] The design, procurement, and installation of these new tanks will be double-walled and vacuum-monitored, as per Hydro's specifications for diesel fuel storage tanks.

5.1 Project Budget

This is expected to be a four-year project, commencing in 2024 with completion in 2027.

The estimate for this project is shown in Table 7.

Table 7: Project Estimate ($000)[33]

Project Cost	2024	2025	Beyond	Total
Material Supply	0.0	0.0	1,050.8	**1,050.8**
Labour	40.9	152.8	732.7	**926.4**
Consultant	0.0	15.5	53.0	**68.5**
Contract Work	0.0	0.0	556.8	**556.8**
Other Direct Costs	2.6	23.2	210.0	**235.8**
Interest and Escalation	2.2	15.7	289.1	**307.1**
Contingency	4.3	19.2	260.3	**283.8**
Total	**50.1**	**226.4**	**3,152.8**	**3,429.2**

[31] There are 14 units within Hydro's system which are of similar size to the three gensets in Rigolet; these units are located in the Mary's Harbour, Port Hope Simpson, St. Lewis, Black Tickle, Hopedale, Cartwright, and Postville diesel generating plants.
[32] The exact size of the tanks will depend on available physical space on site and potential shipping constraints to Rigolet.
[33] Numbers may not add due to rounding

5.2 Project Schedule

The schedule for this project is shown in Table 8.

Table 8: Project Schedule

Activity	Start Date	End Date
Planning:		
Develop project scope statement and baseline schedule.	October 2024	January 2025
Design:		
Detailed genset design.	November 2024	January 2025
Procurement:		
Procure materials, tender.	January 2025	September 2026
Construction:		
Genset installation.	June 2026	December 2026
Commissioning:		
Acceptance inspection.	November 2026	July 2027
Closeout:		
Project closeout.	October 2027	November 2027

6.0 Conclusion

Hydro has completed an analysis that demonstrates the current diesel-generating plant in Rigolet is at risk of violating its firm capacity and bulk fuel storage planning criteria, which could jeopardize system reliability. The load growth triggering these violations is primarily attributed to a single large service request for a new community building in Rigolet.

Hydro's proposed solution is the replacement of Unit 2065 with a 545 kW rated genset and the installation of new horizontal fuel storage tanks in the range of 60,000–80,000 litres. A 545 kW genset provides 90 kW of additional capacity at a marginal incremental cost and decreases the risk of further genset upgrades in the event of additional unforecasted load growth in the community, such as an increase in General Service customers or additional housing development. This project is estimated to cost $3,429,200 and begin in 2024, with scheduled completion in 2027.

Appendix A

Rural Isolated Systems Generation Planning Criteria

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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Revision	Prepared by	Reason for change	Effective Date
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

Document Control

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Affidavit

IN THE MATTER OF the *Electrical Power Control Act, 1994*, SNL 1994, Chapter E-5.1 ("*EPCA*") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 ("*Act*"), and regulations thereunder; and

IN THE MATTER OF an application by Newfoundland and Labrador Hydro ("Hydro") for approval of capital expenditures for replacement of Rigolet Unit 2065 and fuel storage upgrades, pursuant to Subsection 41(3) of the *Act*.

AFFIDAVIT

I, Robert Collett, of St. John's in the province of Newfoundland and Labrador, make oath and say as follows:

1) I am Vice President, Engineering and Newfoundland and Labrador System Operator for Newfoundland and Labrador Hydro, the applicant named in the attached application.
2) I have read and understand the foregoing application.
3) To the best of my knowledge, information, and belief, all of the matters, facts, and things set out in this application are true.

SWORN at St. John's in the province of Newfoundland and Labrador this 29th day of August 2024, before me:

AMANDA HURLEY
A Commissioner for Oaths
in and for the Province of
Newfoundland and Labrador
My Commission expires on December 31, 2029

Commissioner for Oaths

R. Collett

Robert Collett