

1 Q. **Reference: Volume II - Tab 23 – Diesel Genset Replacement Unit 2039 - St. Lewis**

2 The Application states on page 4, lines 12-14, that “Hydro has completed a sizing study for the
3 St. Lewis diesel generator unit 2039 replacement and has determined that replacing the unit
4 with a similar size genset at around 365 kW is appropriate based on load forecast and
5 operational efficiency.” Please provide the sizing study as well as the load forecast for the next
6 ten years.

7

8

9 A. Please refer to Newfoundland and Labrador Hydro’s response to PUB-NLH-020, Attachment 1.
10 The ten-year load forecast for the St. Lewis system is listed in Table 2 of Attachment 1.

RP-TN-024

Diesel Generator Replacement – St. Lewis Unit 2039

1 Purpose

As Requested by Engineering Services, the purpose of this study is to determine what size diesel unit should replace St. Lewis Unit 2039 to ensure Hydro can meet its statutory obligation to provide electricity to customers at the lowest possible cost consistent with reliable service.

2 Background

The community of St. Lewis is located on the south coast of Labrador where Hydro provides electrical service to approximately 130 customers. Electricity is supplied by a diesel generating plant operated and owned by Hydro. Currently, the plant contains three diesel units of various sizes as per Table 1. The load growth in St. Lewis is forecasted to remain steady with no expected load growth for the next 10 years. The load forecast is presented in Table 2.

Table 1: St. Lewis Diesel Units

Unit #	Unit Capacity
2039	365 kW
2080	455 kW
2015	250 kW (de-rated to 200 kW)

Table 2: St. Lewis Load Forecast - Spring 2021

St. Lewis Forecast(kW)	
2021	394
2022	393
2023	393
2024	394
2025	394
2026	394
2027	394
2028	394
2029	394

2030	394
2031	394

Unit 2039 is an 1800 RPM diesel generator and was installed in 1994; it has approximately 92,000 operating hours and has an expected service life of 100,000 operating hours. Unit 2039 is expected to accumulate 100,000 operating hours by 2023. Hydro’s current asset management strategy and planning criteria is to replace 1800 RPM gensets when they reach 100,000 hours of operation to ensure continued reliability.

Hydro is proposing the replacement of diesel generator Unit 2039 to maintain reliable operation of the St. Lewis Diesel Generation Plant. This Project is estimated to cost approximately \$ 1,200,000¹.



Figure 1: St. Lewis – Diesel Generators in Power House

3 State of Equipment

Unit 2039 has been overhauled six times, most recently in 2016. This is due to 2 unplanned failures. At the time of overhaul in 2016 the unit had accumulated 80,099 operating hours. As of the end of 2020 the unit has accumulated approximately 91,650 operating hours. As per Hydro asset management program 1800 RPM diesel gensets are replaced when they reach 100,000 operating hours. Unit 2039 is forecast for replacement in 2023.

¹ Project costs are estimated to be \$1.2M as per Long Term Asset Planning FEED Alignment document 2022 for unit 2039 replacement

Unit 2015 is a 250 kW unit but has been de-rated since 2014. This de-rating has reduced the firm capacity of the plant by 50 kW and increased the operating hours of unit 2039. The de-rating is caused by a generator voltage issue and Hydro plans on repairing the voltage issue in 2021 thus increasing the plants firm capacity.

4 Unit 2039 Replacement Analysis

The load profile, historic diesel plant operation and the forecast for St. Lewis (Figure 2) were analyzed to determine the most suitable size replacement for Unit 2039, the middle size unit of the 3 units installed and three options were considered:

1. Larger than largest existing unit (455 kW)
2. Smaller than existing smallest unit (250 kW)
3. Between smallest and largest existing unit (250 kW -> 455 kW)

Based on this information it was concluded that a replacement of the genset with a unit approximately the same size, between 300 – 400 kW, is the most appropriate.

4.1 Larger than largest existing unit (455 kW)

When recommending diesel generation unit sizes Hydro considers increasing the size of the largest unit in the diesel plant. A larger unit has the potential to allow for a reduction in the total number of diesel unit operating hours as the larger unit may be able to supply the community load by itself for period of time that would otherwise require multiple units to operate. When determining the unit size of a replacement to a unit that is not already the largest unit at the diesel plant, choosing a larger unit also increases the diesel plant firm capacity which may defer future requirements for addition firm capacity.

In the St. Lewis diesel plant however the largest unit (455 kW) is already greater than the peak community load meaning there would be very few occasions other than during maintenance or if there was an issue in the plant where multiple units would have to be online to service the community load. This means there is no benefit from an operating hour's point of view to increase the size of unit 2039 to a unit larger than 455 kW.

The St. Lewis diesel plant has a firm capacity rating of 565 kW. This rating is more than enough to meet the forecasted load of the community for the next 10 years. Therefore, installing a larger unit provides no benefit from a firm capacity point of view.

4.2 Smaller than existing smallest unit (200 kW)

Another option considered by Hydro when determine diesel generation unit size is the option to decrease the unit to a size smaller than the existing smallest unit. The potential benefit of decreasing unit size is that smaller units are typically less expensive to purchase and maintain and can be operated at lower load levels without operating below minimum generation limits. It is important to note that decreasing unit sizes also reduced the firm capacity of the diesel plant and could jeopardize system reliability.

In St. Lewis the minimum community load tends to be between 80 to 90 kW overnight during the summer and the existing smallest unit has a minimum generation limit of approximately 90 kW². Given the small amount of time operating between 80 and 90 kW, there is no need to install a smaller unit. This does however limit the system's ability to accept net metering customers as doing so would cause this genset to operate below its minimum generation limit more frequently. To increase the opportunity for additional net metering on this system by creating a 10 kW buffer between the minimum load and the minimum generation limit, the new genset would have to be less than 233 kW. This however is not recommended as it leaves little spare firm capacity to allow for unexpected load increases as the minimum new unit size required to ensure Hydro's firm capacity criteria are met is 194 kW. This would also limit the competitiveness of the tender process if Hydro specified such a limited range in genset sizes that could both ensure additional opportunity for net metering while maintaining a firm capacity buffer. Instead Hydro recommended that the new unit be at least 250 kW to maintain an appropriate firm capacity buffer to facilitate possible unexpected load growth.

Another reason installing a smaller unit is not recommended is because the existing smallest unit (unit 2015) is from the 1980's and is a mechanical type unit which is not as fuel efficient as modern electronic units. Installing a smaller unit would increase the annual hours of operation on unit 2015.

4.3 Between smallest and largest existing unit (250 kW -> 455 kW)

Based on the above options the recommended unit size is narrowed down between 250 and 400 kW. One additional consideration is that if unit 2039 is replaced with a unit between 300 and 400 kW then it would be large enough to allow Unit 2015 to be replaced with a smaller unit reducing the cost of its future replacement and potentially facilitate additional net metering customers.

Conclusion and Recommendations

Rural Planning has completed a study of the St. Lewis diesel generator replacement of unit 2039. Rural planning recommends replacing the unit with a similar size generator and due to the rationale listed above the unit should be between 300-400 kW in size. This size will offer the most operational efficiency of the diesel plant while not reducing the firm rating of the plant. Rural Planning also recommends when Unit 2015 is due to be replaced, it would be worth investigating installing a unit smaller than 200 kW. This size would still be large enough to handle the summer loads while allowing for penetration of renewables through Hydro's net metering policy.

² Unit 2039 has a 300 kW engine. As minimum loading is based on engine size, this unit has a minimum rating of approximately 90 kW (30% of 300 kW).

Document Summary

Document Owner:	Rural Planning
Document Distribution:	Forhad Ahmad, Damian Ryan, Scott Henderson, Tyler Stevens

Revision History

Revision	Prepared by	Reason for change	Effective Date
1	Wade Lucas	Initial Release	2021/02/19

Document Control

Regarding Rural Planning documents: The electronic version of this document is the CONTROLLED version. Please check the Rural Planning Document Management System SharePoint site for the official copy of this document. This document, when downloaded or printed, becomes UNCONTROLLED.

Copyright Information

Copyright © 2021 Rural Planning. All rights reserved. Printed in Canada.

Proprietary Notice: This document is the property of and contains information proprietary to Rural Planning. This document shall not be reproduced in whole or in part without prior written consent of an authorized representative of Rural Planning.