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a nalcor energy company

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March 23, 2021

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

Attention: Ms. Cheryl Blundon
Director of Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Port Hope Simpson Diesel Engine Failure – Allowance for Unforeseen Items Final Report

On September 14, 2020 Newfoundland and Labrador Hydro ("Hydro") advised the Board of Commissioners of Public Utilities of its intended use of the Allowance for Unforeseen Account for the replacement of a failed generating unit at the Port Hope Simpson Diesel Generating Station. The engine replacement was completed on February 21, 2021. As per the Capital Budget Guidelines, the final report regarding the expenditure is attached.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

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

ecc: **Board of Commissioners of Public Utilities**
Jacqui Glynn
PUB Official Email

Port Hope Simpson Diesel Engine Failure

Final Report

March 23, 2021

A report to the Board of Commissioners of Public Utilities

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1.0 Introduction

Newfoundland and Labrador Hydro ("Hydro") has 23 diesel generating stations, 18 of which are prime power stations[1] serving a total of approximately 4,400 customers. Diesel generating stations are designed such that demand can be met in the event of failure of the largest generating unit provided all other units remain in service. The Port Hope Simpson Diesel Generating Station ("Port Hope Simpson DGS") has three generating units: Unit 2099 (545 kW), Unit 2100 (725 kW), and Unit 2073 (455 kW).

On September 8, 2020,[2] Unit 2099 tripped offline while it was the only unit online serving the town load. Power was restored using Unit 2100. During the investigation into the outage, Hydro determined that a valve had dropped and contacted the piston, causing substantial damage to the engine. Unit 2099 had accumulated approximately 8,100 operating hours since it was installed in 2018. The unit had shown no signs of valve issues during its most recent planned maintenance. Hydro's assessment of the damage determined that the engine was not salvageable and the only viable alternative was to replace the engine. There were no safety issues related to this incident.

While Hydro is considering the potential retirement of the Port Hope Simpson DGS as part of its study of options to serve communities in Southern Labrador, immediate replacement of the failed unit was necessary to continue to reliably meet Hydro's Firm Capacity[3] requirements. Hydro expects that the new engine will be required in Port Hope Simpson until at least 2024, and will serve as a spare if it is deemed fit for continued service following the potential retirement of the Port Hope Simpson DGS.

A project was initiated for immediate replacement of the engine utilizing the Allowance for Unforeseen Items account. In correspondence dated September 14, 2020,[4] Hydro notified the Board of Commissioners of Public Utilities ("Board") of its intention to utilize the Allowance for Unforeseen Items account to fund costs associated with completing this project.

[1] Prime power stations are not interconnected to the grid and serve as the primary source of capacity and energy for isolated systems.
[2] As the engine failed after Hydro's 2021 Capital Budget Application was filed with the Board in August 2020 and immediate action was required to ensure reliability in Port Hope Simpson, this expenditure could not have been considered within Hydro's annual capital budget application.
[3] "Firm Capacity" refers to the plant's capacity with its largest unit out of service.
[4] Newfoundland and Labrador Hydro "Port Hope Simpson Engine Failure Allowance for Unforeseen Item Notification," letter, September 14, 2020.

The engine replacement was completed and the new unit was released for service on February 21, 2021. This report details the activities Hydro undertook to restore the capacity of the Port Hope Simpson DGS.

2.0 System Overview

2.1 Existing System

There are three units installed in the Port Hope Simpson DGS: Unit 2099 (545 kW), Unit 2100 (725 kW), and Unit 2073 (455 kW), providing a Firm Capacity of 1,000 kW. The failed engine in Unit 2099 is a CAT C18 that was installed in 2018 and had operated for approximately 8,100 hours prior to failure. Unit 2099 would have been due for overhaul once it reached 20,000 operating hours, which was forecast to occur in 2025.

2.2 Operating History

Unit 2099 had approximately two years of operating history and had operated reliably until its failure on September 8, 2020, when an exhaust valve dropped into the cylinder impacting the piston. Valve adjustments are made annually during planned maintenance and Unit 2099 showed no signs of issues during its most recent planned maintenance.

2.3 Operational Impact

Unit 2099 is the second largest unit in the Port Hope Simpson DGS and had operated for approximately 8,100 hours since its installation, making it the most utilized genset[5] in the plant. Following the generator failure on September 8, 2020, the community was supplied by the remaining two units in the plant, Unit 2100 and Unit 2073, until a retired engine from Unit 2093 in Mary's Harbour was installed[6] to provide backup when either of the other units had to be taken offline for routine maintenance, such as oil changes. This engine is only suitable for emergency backup use as it had exceeded its expected useful operating hours and therefore cannot reliably be used on a sustained basis. Without the installation of the engine from Unit 2093, subsequent failure of an additional unit or removal of a unit from service for planned maintenance would have put the Port Hope Simpson DGS in violation of its Firm Capacity requirements, and would likely have resulted in outages to the town.

[5] A "genset" is defined as the combination of a prime mover (engine) and an electrical generator.
[6] Costs associated with the installation and removal of the former Mary's Harbour Unit 2093 are operating expenses; they are not included in project costs outlined in Section 5.0.

3.0 Alternatives Considered

3.1 Repair

The investigation into the failure, in consultation with the Original Equipment Manufacturer, determined that the damage to the engine was irreparable. From a technical perspective, it would have been impossible to repair the damage to make the generator safe and reliable for continued, sustained operation for the remainder of the expected useful life of this engine. As such, repair was not a viable alternative.

3.2 Replacement with Spare Engine

To restore firm capacity of the Port Hope Simpson DGS in the short term, Hydro installed a spare engine, which had previously been removed from Unit 2093 in Mary's Harbour. This engine had exceeded the expected useful operating hours for a 1,800 RPM engine and was installed and used on an emergency basis only as it is not suitable for continued use on a sustained basis. Therefore, using this engine as a permanent replacement for the failed Unit 2099 engine was not a viable solution due to reliability concerns. Further, there were no other engines in Hydro's spares that would be suitable for replacing the failed engine in Unit 2099.

3.3 Replacement with New Engine

Replacement with a new engine was a viable alternative. Hydro was able to source a CAT C18 engine rated for 545 kW, which is a direct replacement for the failed Unit 2099 engine, for a total estimated project cost of $131,000.

3.4 Deferral of Replacement

Hydro's Firm Capacity criteria require Hydro to have adequate capacity to serve the town if its largest generator is offline. Without a third generator with approximately the equivalent capacity of Unit 2099, subsequent failure of an additional unit or removal of a unit from service for planned maintenance would put the Port Hope Simpson DGS in violation of Hydro's Firm Capacity requirements, likely resulting in outages to the town. Therefore, for reliability purposes, deferral of the replacement was not a viable option.

4.0 Project Description

4.1 Chosen Alternative

As it was the only viable alternative to maintaining safe and reliable service to customers in Port Hope Simpson, Hydro proceeded with the replacement of the Unit 2099 engine.

4.2 Project Scope

Work to procure a new engine commenced immediately after the investigation into the failure was completed and it was determined that replacement was the only viable alternative. A new engine was sourced from Toromont CAT which had a four-month lead time from its factory in Brampton, Ontario. To maintain reliability in Port Hope Simpson while waiting for delivery and installation of the replacement engine, a retired engine from a recent engine replacement of Unit 2093 in Mary's Harbour was installed and used on an emergency basis only.

To install the new engine in the Port Hope Simpson DGS, the following work tasks were completed:

- Unit 2099 engine was removed from the genset;
- The engine from Unit 2093 was temporarily installed into the genset;[7]
- The new engine arrived from the vendor;
- The temporary engine from Unit 2093 was removed;[8]
- The new engine was installed into the genset;
- Exhaust, coolant lines, fuel lines, electrical cabling and controls were installed; and
- The new engine was commissioned.

Hydro engaged its regional maintenance staff in Labrador to complete this work. All identified work was completed and Unit 2099 was released for service on February 21, 2021.

[7] Costs associated with this work are operating expenses and are not included in the capital project cost.
[8] Costs associated with this work are operating expenses and are not included in the capital project cost.

4.3 Project Timeline

The project milestones and completion dates are listed in Table 1.

Table 1: Project Timeline

Milestone	Completion Date
Engine Failure	September 8, 2020
Inspection Complete	September 10, 2020
Installation of Engine 2093	September 23, 2020
Order Placed for New Engine	October 2, 2020
New Engine Delivered to Port Hope Simpson	February 12, 2021
Mechanical Installation of New Engine Complete	February 20, 2021
Unit 2099 Released for Service	February 21, 2021

Figure 1: Unit 2099

5.0 Project Costs

The current expenditures for this project are shown in Table 2. The original estimate was $131,000. Current estimated actual expenses are approximately $113,000. Project expenditures provided in Table 2 reflect costs reported to date. This value may change marginally as final invoicing is received from all

vendors. Actual final costs will be reported in Hydro's Allowance for Unforeseen Capital Expenditures Monthly Reporting.[9]

Table 2: Project Expenditures

Project Expenditure	Cost ($)
Labour	10,000
Engine	98,500
Shipping	3,000
Other	1,200
Total	**112,700**

6.0 Conclusion

Unit 2099 suffered catastrophic engine failure on September 8, 2020. Hydro's inspection of the engine determined that there were no viable alternatives to replacement of the Unit 2099 engine. A new CAT C18 engine was installed by Hydro personnel and released for service on February 21, 2021.

[9] Filed with the Board on the tenth business day of each month.