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September 8, 2020

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: Charlottetown Generator Failure – Allowance for Unforeseen Items Final Report

Please find enclosed Newfoundland and Labrador Hydro's final report regarding the above-noted.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/

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

Charlottetown Diesel Generator Failure

Final Report

September 08, 2020

A report to the Board of Commissioners of Public Utilities

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Contents

1.0 Introduction

Unit 2102 is a mobile generating unit that was installed in Charlottetown in October 2019 after the fire which destroyed the existing diesel generating station. It was taken out of service on July 20, 2020 after the unit caused an outage to the communities of Charlottetown and Pinsent's Arm. Following an inspection of the genset,[1] which determined that it had suffered a catastrophic failure of its generator, Hydro initiated a project to replace the generator portion of the genset utilizing the Allowance for Unforeseen Items account.[2]

The generator replacement was completed and the unit was released for service on August 8, 2020. This report details the activities completed to support the continued reliable operation of the Charlottetown diesel generating station and the associated costs.

2.0 Background

2.1 Existing System

Newfoundland and Labrador Hydro ("Hydro") has 23 diesel generating stations, 18 of which are prime power stations[3] serving a total of approximately 4,400 customers. The Charlottetown Diesel Generating Station has three mobile generating units: Unit 2088 (910 kW), Unit 2089 (725 kW), and Unit 2102 (910 kW).

At the time of the Charlottetown fire, Unit 2102 was sourced from the Lower Churchill Project as part of Hydro's initial response. The unit has remained on site since that time to meet Hydro's firm supply requirements while Hydro is assessing the long-term supply solutions for this area. Hydro is assessing the acquisition of Unit 2102 and, should it determine it to be prudent, will submit an application for approval to the Board of Commissioners of Public Utilities. Should Hydro decide to not acquire the genset unit, the generator acquired through this allowance for unforeseen expenditure will be removed from the genset unit and retained by Hydro. The generator is compatible with other gensets in Hydro's fleet.

[1] Diesel generating unit ("genset").
[2] Hydro notified the Board of Commissioners of Public Utilities of its intention to utilize the Allowance for Unforeseen Items account for completion of this project on July 28, 2020.
[3] Prime power stations are not interconnected to the grid and rely on the power supplied by the diesel generation units for capacity and energy.

Diesel generating stations are designed such that firm power[4] can be delivered in the event of failure of the largest generating unit. As such, the forecasted peak load can be met during the failure of a genset; however, all remaining units are required to be in service to meet that load. As a result of the failure of the generator on Unit 2102, adequate firm supply was not available to serve the load of both towns, including the shrimp plant.[5] While the shrimp plant is operating, two units are required to be online. As such, without a functioning third unit, an outage to either of the two remaining units would have resulted in customer outages. Unit 2102 is shown in Figure 1.

Figure 1: Unit 2102

2.2 Operating Experience

Unit 2102 has been on site since the existing generating station was destroyed by a fire in October 2019. It was not used during winter as the load in winter is lower than in the summer months due to the seasonal nature of the shrimp plant. Approximately one month prior to its failure, Unit 2102 was operating on a lone basis and caused an outage. The communities were brought back online using the other two gensets and maintenance crews investigated the reason for the outage. Tests were completed and resulted in no obvious findings so the unit was initially put back in service. On July 20, 2020, Unit

[4] Firm power is calculated as the summation of the capacity of all units minus the capacity of the largest unit.
[5] The shrimp plant employs upwards of 100 people and is the economic driver in the area. The shrimp plant operates seasonally through the summer and fall months.

2102 tripped offline again, triggering a second outage. Investigations following this instance determined that the generator had failed due to shorted windings which could not be repaired.

Since replacing the generator, there have been no issues with Unit 2102. It has run constantly to serve the shrimp plant load, which is expected to be sustained until late fall.

2.3 Operational Impact

Unit 2102 is one of the two larger units in the Charlottetown Diesel Generating Station and is currently relied upon to meet the firm supply requirements for the communities. When the generator failed on July 20, 2020, the communities were supplied by the remaining two units on site, Unit 2088 and Unit 2089. While these two units could meet peak load demands when operated together, if either unit is off-line for maintenance,[6] it has to be scheduled when the shrimp plant is not producing to avoid customer outages. An in-service failure of either remaining unit would result in customer outages.

3.0 Alternatives Considered

Hydro considered three alternatives: (i) repairing the generator, (ii) renting a mobile unit, and (iii) purchasing a replacement generator.

Repair

Repairing the generator would have required relocating it to St. John's to be rebuilt by a third-party contractor with a minimum duration of three weeks before the unit was returned to service. As a third unit is required to support reliable supply for the communities, repair was not a viable alternative With the shrimp plant resuming operations in Charlottetown two days after the failure occurred, an expedited return to service of Unit 2102 was necessary.

Rental

Rental of a mobile unit was also considered; however, the monthly cost of rental (approximately $25,000/month) would exceed the cost of purchasing a replacement generator by a material amount as the unit would be required until a permanent facility is constructed to provide service to Charlottetown, which is expected to take several years.

[6] Routine oil changes are performed approximately every 500 hours.

Replacement

Hydro confirmed the availability of a suitable replacement generator from the original equipment manufacturer and was assured delivery could be made within a favorable timeframe. Based on the requirement for an expedited solution and in consideration of the costs associated with the viable alternatives, Hydro determined that replacing the generator was the least-cost, viable alternative. In addition to the value that the generator will provide customers while in use in Unit 2102 at Charlottetown, the generator will continue to provide value to Hydro's customers once it is no longer required to serve Charlottetown as a critical spare.

4.0 Project Description

4.1 Project Scope

Following an internal inspection of the generator on Unit 2102, Hydro determined that a complete generator replacement was required. A suitable replacement generator was sourced and the C32 generator was shipped to Charlottetown and installed by Hydro maintenance staff.

To install the new generator in Unit 2102 the following work tasks were completed:

- Uncoupling of Unit 2102's engine and generator to allow for removal of the generator;
- Removal of the failed generator from the mobile container;
- Installation of the new generator in mobile container;
- Recoupling of the existing engine and the new generator and all associated cables, wires etc.; and
- Commissioning of the new generator, including load sharing with the other units.

Project work was performed to make the new generator available for service as soon as possible. All identified work was completed and Unit 2102 was released for service on August 8, 2020.

4.2 Project Timeline

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

Table 1: Project Milestones

Project Milestone	Completion Date
Generator failure	20-Jul-2020
Inspection complete	27-Jul-2020
Order placed for new unit	30-Jul-2020
Generator delivered to Charlottetown	4-Aug-2020
Generator installation complete	7-Aug-2020
Unit released for service	8-Aug-2020

5.0 Project Costs

Expenditures for this project are shown in Table 2.

Table 2: Project Expenditures

Project Expenditure	Cost ($)
Material	$73,500
Total	$73,500[7]

The project expenditures presented reflect costs reported to date. This value may change marginally as final invoicing is received from all vendors.

6.0 Conclusion

Following the failure of Unit 2102 on July 20, 2020, Hydro evaluated a number of options to address the failure. It was determined that replacing the generator was the least-cost, viable alternative. Hydro sourced a replacement generator from the original equipment manufacturer and the replacement unit was installed and released for service on August 8, 2020. The cost of the replacement was approximately $73,500.

[7] Excludes labour costs related to removal and installation; these costs, for the purposes of this project, will be treated as an operational expense as the genset to which the generator is being coupled is not owned by Hydro.