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January 31, 2025

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: Quarterly Report on Asset Performance in Support of Resource Adequacy for the Twelve Months Ended December 31, 2024

Please find enclosed Newfoundland and Labrador Hydro's ("Hydro") Quarterly Report on Asset Performance in Support of Resource Adequacy for the Twelve Months Ended December 31, 2024.[1]

Effective this quarter to provide the Board of Commissioners of Public Utilities with additional information, Hydro has included an update on the Muskrat Falls Assets, provided as Appendix B to this report.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

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

Encl.

ecc:

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Newfoundland Power Inc.
Dominic J. Foley
Regulatory Email

[1] Formerly titled "Quarterly Report of Generating Units for the Twelve Months Ended []."

Quarterly Report on Asset Performance in Support of Resource Adequacy

For the Twelve Months Ended December 31, 2024

January 31, 2025

A report to the Board of Commissioners of Public Utilities

Contents

List of Appendices

1.0 Introduction

In this report, Newfoundland and Labrador Hydro ("Hydro") provides data on forced outage rates of its generating facilities and the Labrador-Island Link ("LIL"). The data provided pertains to historical forced outage rates and assumptions Hydro uses in its assessments of resource adequacy. This report covers the performance for the current 12-month reporting period of January 1, 2024 to December 31, 2024 ("current period").

This report contains forced outage rates for the current period for individual generating units at regulated hydraulic facilities,[1] the Holyrood Thermal Generating Station ("Holyrood TGS"), Hydro's combustion turbines, and the non-regulated Muskrat Falls Hydroelectric Generating Facility ("Muskrat Falls Facility"). In addition, equivalent forced outage rates are provided for the 900 MW LIL.[2] This report also provides, for comparison purposes, the individual asset forced outage rates for the 12-month reporting period of January 1, 2023 to December 31, 2023 ("previous period"). Further, total asset class data is presented based on the calendar year for the remainder of the ten most recent years—2014 to 2022—with the exception of the Muskrat Falls Facility[3] and the LIL.[4]

The forced outage rates of Hydro's generating units are calculated using two measures:

1) Derated adjusted forced outage rate ("DAFOR") for the continuous (base-loaded) units; and
2) Derated adjusted utilization forced outage probability ("DAUFOP") for the standby units.

DAFOR is a metric that measures the percentage of time that a unit or group of units is unable to generate at its maximum continuous rating due to forced outages or unit deratings. The DAFOR for each unit is weighted to reflect differences in generating unit sizes to provide a combined total and reflect the

[1] Regulated hydraulic facilities include the Bay d'Espoir Hydroelectric Generating Facility ("Bay d'Espoir Facility" or "BDE"), the Cat Arm Hydroelectric Generating Station ("Cat Arm Station" or "CAT"), the Hinds Lake Hydroelectric Generating Station ("Hinds Lake Station" or "HLK"), the Upper Salmon Hydroelectric Generating Station ("Upper Salmon Station" or "USL"), the Granite Canal Hydroelectric Generating Station ("Granite Canal Station" or "GCL"), and the Paradise River Hydroelectric Generating Station ("Paradise River Station" or "PRV").
[2] The LIL has been commissioned and is currently rated at 700 MW. As reported in its final 2024-2025 Winter Readiness Report, in consultation with neighbouring jurisdictions, Hydro postponed the 900 MW test until later in the winter, as there are numerous sensitivities to performing high-power tests during the early winter operating period. The system is already well-positioned for the winter with the LIL available for reliable operation up to 700 MW.
[3] The final generating unit at the Muskrat Falls Facility was released for commercial operation on November 25, 2021. Annual DAFOR performance data is available beginning in 2022.
[4] The LIL was officially commissioned on April 13, 2023. Annual equivalent forced outage rate ("EqFOR") data will not be available until 2024 year end.

relative impact a unit's performance has on overall generating performance. This measure is applied to hydraulic units and, historically, was used for the thermal units; however, it does not apply to combustion turbines because of their operation as standby units and their relatively low operating hours.

DAUFOP is a metric that measures the percentage of time that a unit or group of units will encounter a forced outage and not be available when required. DAUFOP is a measure primarily used for combustion turbines; however, this measure may be applicable to thermal units, should their operation move towards standby operation in the future. This metric includes the impact of unit deratings.

The forced outage rates include outages that remove a unit from service completely as well as instances when units are derated. If a unit's output is reduced by more than 2%, the unit is considered derated under Electricity Canada guidelines. These guidelines require that the derated levels of a generating unit be calculated by converting the operating time at the derated level into an equivalent outage time.

As the LIL is not a generating unit, the above noted forced outage rate measures do not apply to this asset. Instead, Hydro has determined an appropriate metric to be an EqFOR to measure the performance of this asset as it relates to the supply of electricity to the Island. This EqFOR measures the percentage of time that the LIL bipole is unable to deliver its maximum continuous rating[5] to the Island due to forced outages, derates, or unplanned monopole outages. The effect of deratings and unplanned monopole outages is converted to equivalent bipole outage time using the same methodology as outlined above for generating units.

In addition to forced outage rates, this report provides details for those outages which occurred in the current period that contributed materially to forced outage rates exceeding those used in Hydro's resource adequacy planning analysis for both the near and long-term.

[5] The LIL maximum continuous rating is 700 MW at present.

2.0 Assumptions Used in Hydro's Assessment of System Reliability and Resource Adequacy

Hydro continually assesses the reliability of its system and its ability to meet customer requirements, filing both near- and long-term assessments with the Board of Commissioners of Public Utilities.[6]

As part of the ongoing *Reliability and Resource Adequacy Study Review* proceeding, Hydro detailed the process undertaken for determining the forced outage rates most appropriate for use in its near-term reliability assessments and long-term resource adequacy analysis. Table 1 and Table 2 summarize the most recent forced outage rate assumptions, as determined using the forced outage rate methodology.[7] Forced outage rate assumptions will be re-evaluated on an annual basis to incorporate the most recent data available.

Table 1: Hydro's Reliability and Resource Adequacy Study Analysis Values – Generating Units (%)

Asset Type	Measure	Near-Term Analysis Value	Resource Planning Analysis Value
Hydraulic: Regulated	DAFOR	3.60	3.03
Hydraulic: Muskrat Falls	DAFOR	2.30	3.03
Thermal	DAUFOP	20.00[8]	20.00
Combustion Turbines			
Happy Valley	DAUFOP	4.65	4.65
Hardwoods and Stephenville	DAUFOP	30.00	30.00
Holyrood	DAUFOP	4.90	4.90

A three-year, capacity-weighted average was applied to the regulated hydraulic units (Bay d'Espoir Facility, Cat Arm Station, Hinds Lake Station, Granite Canal Station, Upper Salmon Station, and Paradise River Station) for a near-term analysis, resulting in a DAFOR of 3.60%, while a ten-year, capacity-weighted average was applied for use in the long-term resource planning model, resulting in a DAFOR of

[6] Hydro currently files an assessment of near-term system reliability and resource adequacy annually in November, the Near-Term Reliability Report. Hydro also files an assessment of longer-term system reliability and resource adequacy. The most recent filing was the "2024 Resource Adequacy Plan: An Update to the Reliability and Resource Adequacy Study," Newfoundland and Labrador Hydro, rev. 2 (originally filed July 9, 2024), ("2024 Resource Plan").

[7] Values indicated for Hydro's near-term analysis reflect those used in the 2024 Resource Plan and the "Reliability and Resource Adequacy Study Review – 2024 Near-Term Reliability Report – November Report," Newfoundland and Labrador Hydro, November 20, 2024 ("November 2024 Near-Term Report").

[8] The Holyrood TGS base assumption is 20.00%. The sensitivity assumption is 34.00%. A sensitivity value of 34.00% was chosen to reflect actual performance at the Holyrood TGS for the 2021–2022 winter operating period.

3.03%. The DAFOR value was based on historical data reflective of Hydro's maintenance program over the long-term.

For the Muskrat Falls Facility, the near-term forced outage rate was based on the forced outage rates of the units to date, to reflect the possibility of outages early in the lifetime of the Muskrat Falls Facility. In the long-term resource planning model, the regulated hydroelectric forced outage rate was used, as it is assumed that these assets will be maintained to the same standards as the remainder of the hydraulic fleet.

Historically, forced outage rates for the three units at the Holyrood TGS have been reported using the DAFOR metric, which is predominately used for units that operate in a continuous (base-loaded) capacity. As presented in Hydro's RRA Study 2022 Update,[9] there are reliability concerns associated with the operation of the units at the Holyrood TGS in an emergency standby capacity. When considering standby or peaking operations of units at the Holyrood TGS, DAFOR is no longer the most appropriate measure of forced outage rates; instead, UFOP[10] and DAUFOP should be considered. Given the frequency of deratings historically experienced by these units, DAUFOP is a more appropriate measure.

Analyses performed for a range of Holyrood TGS DAUFOP assumptions indicate the sensitivity of supply adequacy to changes in the availability of the Holyrood TGS. From this analysis, a forced outage rate of 20.00% was recommended in the near-term, with a sensitivity value of 34.00%. Hydro will continue to analyze the operational data to ensure that forced outage rate assumptions for the Holyrood TGS are appropriate.

At present time, the operation of the units at the Holyrood TGS remains base-loaded to ensure the availability of capacity for the power system, as the LIL is recently commissioned and in the early operational stages. This will remain the case as Hydro continues to monitor LIL performance and reliability. If the LIL is found to perform well for an extended period, and system conditions permit, Hydro will have the opportunity to incrementally remove the Holyrood TGS units from service. To

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[9] "Reliability and Resource Adequacy Study – 2022 Update," Newfoundland and Labrador Hydro, October 3, 2022 ("RRA Study 2022 Update"). <http://www.pub.nl.ca/applications/NLH2018ReliabilityAdequacy/correspondence/From%20NLH%20-%20Reliability%20and%20Resource%20Adequacy%20Study%20-%202022%20Update%20-2022-10-03.PDF>.
[10] Utilization forced outage probability ("UFOP").

ensure alignment with the assumptions used in the resource planning model (PLEXOS)[11] while appropriately reporting on current period versus historical performance, Hydro will continue to use the DAFOR performance measure and the 20.00% forced outage rate for the units at the Holyrood TGS.

As the combustion turbines in the existing fleet vary in age and condition, each was considered on an individual basis. For the Happy Valley Gas Turbine, a three-year, capacity-weighted average was applied to the unit for the near-term analysis while a ten-year capacity-weighted average was applied for use in the resource planning model. The DAUFOP values were based on historical data to reflect the unit's past performance. For the Holyrood Combustion Turbine the DAUFOP was calculated based on a scenario-based approach rather than historical data, due to the unit's minimal operating time and resultant small data set. For the Hardwoods and Stephenville Gas Turbines, a fixed DAUFOP consistent with values considered in Hydro's previous near-term reliability reports was used for the near-term and long-term analyses.[12] As presented in Hydro's 2024 Resource Plan, the Hardwoods and Stephenville Gas Turbines are proposed for retirement in 2030.

Now that the LIL is commissioned, multiple years of operational experience are required to better inform the long-term selection of a bipole forced outage rate. In the interim, the bipole forced outage rate will be addressed with a range of upper and lower limits as additional scenarios in the analysis - currently 10% and 1%, respectively. As LIL performance statistics become available in the coming years, the forced outage rate range may be narrowed. However, the current base-case assumption is a 5% LIL forced outage rate.

Table 2: Hydro's Reliability and Resource Adequacy Study Analysis Values – LIL (%)

Asset Type	Measure	Base Planning Analysis Value	Range of Planning Analysis Values
LIL	EqFOR	5	1–10

[11] The resource planning model does not differentiate between DAFOR and DAUFOP metrics; rather, it applies a forced outage rate only.

[12] "Reliability and Resource Adequacy Study Review – 2024 Near-Term Reliability Report – November Report," Newfoundland and Labrador Hydro, November 20, 2024.

3.0 Current Period Overview

Table 3 presents an overview of the current period performance, compared to previous period performance and most recent Planning Analysis values.

Table 3: DAFOR and DAUFOP Overview (%)

Asset Type	Measure	1-Jan-2023 to 31-Dec-2023	1-Jan-2024 to 31-Dec-2024	Near-Term Planning Analysis Value	Resource Planning Analysis Value
Hydraulic: Regulated	DAFOR	6.64	2.07	3.60	3.03
Hydraulic: Muskrat Falls Facility	DAFOR	2.49	1.70	2.30	3.03
Thermal	DAFOR/DAUFOP[13]	32.08	37.29	20.00	20.00
Combustion Turbines					
Hardwoods/Stephenville	DAUFOP	28.19	40.59	30.00	30.00
Happy Valley	DAUFOP	22.54	6.29	4.65	4.65
Holyrood	DAUFOP	4.51	0.00	4.90	4.90

As shown Table 3, regulated hydraulic DAFOR and the Muskrat Falls Facility DAFOR performance improved for the current period, while the thermal DAFOR performance declined for the current period, when compared to the previous period.

The DAUFOP performance for the Hardwoods and Stephenville Gas Turbines has declined in the current period, while the Happy Valley Gas Turbine and the Holyrood Combustion Turbine have improved in the current period, compared to the previous period.

Table 4 presents LIL data for the current period only; data is not available for the previous period as it was operating in a pre-commissioned state. Since the previous filing, the performance of the LIL has remained relatively consistent, with no significant impacts to the EqFOR because of any operational events that have occurred.

[13] The resource planning model does not differentiate between DAFOR and DAUFOP; rather, it requires the selection of a forced outage rate percentage.

Table 4: EqFOR Overview (%)

Asset Type	Measure	1-Jan-2023 to 31-Dec-2023	1-Jan-2024 to 31-Dec-2024	Base Planning Analysis Value	Range of Planning Analysis Values
LIL	EqFOR	N/A[14]	3.37[15]	5	1–10

4.0 Hydraulic Unit DAFOR Performance – Regulated Hydro

Detailed results for the current period and the previous period are presented in Table 5 and Chart 1. These results are compared to Hydro's near-term and resource planning analysis values for forced outage rates, as used in the 2024 Resource Plan and the November 2024 Near-Term Report. Any individual unit with forced outage rates which exceed the established near-term and/or resource planning analysis values is discussed herein.

Table 5: Hydraulic Weighted DAFOR – Regulated Hydro

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ended Dec 2023 (%)	12 Months Ended Dec 2024 (%)	Near-Term Analysis Value (%)	Resource Planning Analysis Value (%)
All Hydraulic Units – Weighted	**954.4**	**6.64**	**2.07**	**3.60**	**3.03**
Hydraulic Units					
BDE Unit 1	76.5	0.00	0.00	3.60	3.03
BDE Unit 2	76.5	0.16	0.00	3.60	3.03
BDE Unit 3	76.5	0.00	2.75	3.60	3.03
BDE Unit 4	76.5	0.21	0.53	3.60	3.03
BDE Unit 5	76.5	0.00	4.37	3.60	3.03
BDE Unit 6	76.5	29.04	7.67	3.60	3.03
BDE Unit 7	154.4	0.00	3.87	3.60	3.03
CAT Unit 1	67	0.09	0.98	3.60	3.03
CAT Unit 2	67	0.18	0.07	3.60	3.03
HLK Unit	75	0.92	1.44	3.60	3.03
USL Unit	84	63.78	1.40	3.60	3.03
GCL Unit	40	2.55	1.07	3.60	3.03
PRV Unit	8	0.00	8.36	3.60	3.03

[14] The LIL was not commissioned until April 14, 2023.
[15] This EqFOR is calculated on a base LIL capacity of 700 MW. On a base capacity of 900 MW, the EqFOR is calculated to be approximately 4.93%. Following the completion of the 900 MW test, all calculations will be adjusted to reflect the change in assumptions.

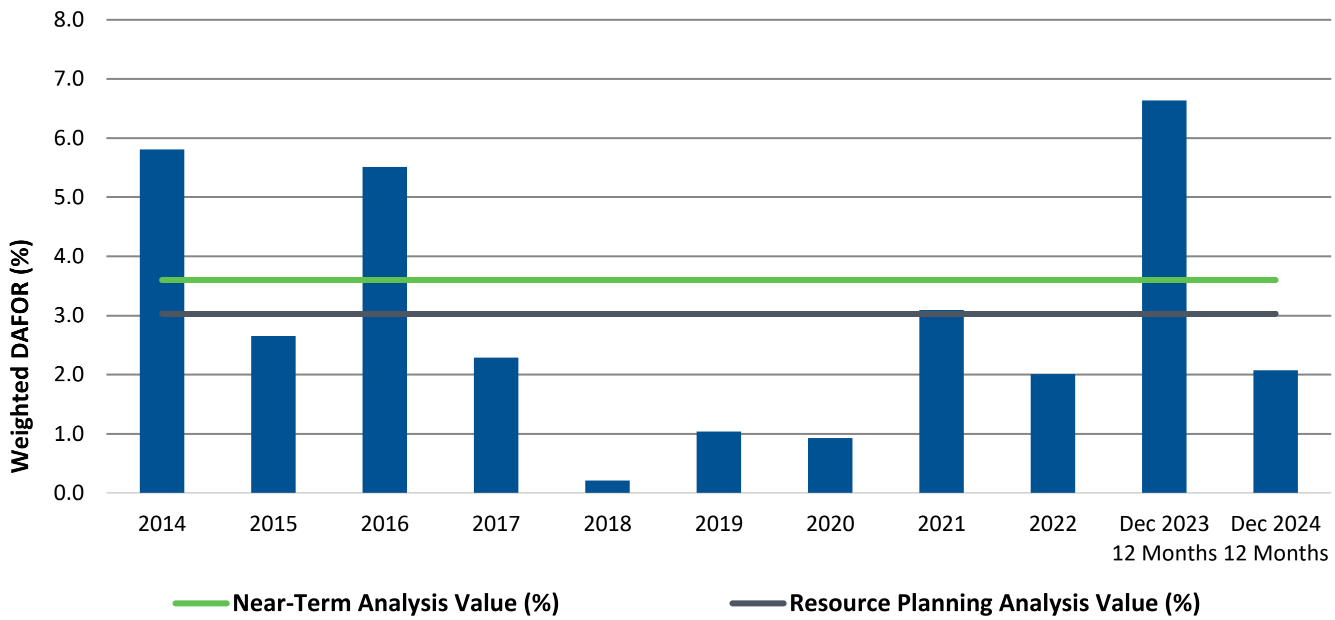

Chart 1: Hydraulic Weighted DAFOR – Regulated Hydro

4.1 Bay d'Espoir Facility

4.1.1 Bay d'Espoir Unit 5

Considering individual hydraulic unit performance, the Bay d'Espoir Unit 5 DAFOR of 4.37% is above the resource planning analysis value of 3.03% and the near-term planning analysis value of 3.60% for an individual hydraulic unit. The DAFOR was materially impacted in the current period by a forced extension to the planned annual outage, which occurred in May 2024, as previously reported.[16] The unit has been operating without issue since it returned to service on May 25, 2024.

4.1.2 Bay d'Espoir Unit 6

Considering individual hydraulic unit performance, the Bay d'Espoir Unit 6 DAFOR of 7.67% is above the resource planning analysis value of 3.03% and the near-term planning analysis value of 3.60% for an individual hydraulic unit. As previously reported, this increase in DAFOR was primarily the result of the forced extension to the planned outage, which occurred in May 2024 as a result of foreign material impact to several stator bars.[17] To return the unit to service and allow the necessary preparation time

[16] "Quarterly Report on Asset Performance in Support of Resource Adequacy for the Twelve Months Ended June 30, 2024," Newfoundland and Labrador Hydro, sec. 4.1.1, pp. 8-9.
[17] Ibid, sec. 4.1.2, pp. 9-10.

for a larger work scope, all affected stator bars were repaired and the unit returned to operation on May 30, 2024.

Again, as previously reported, given the new age of this asset, the extent of damage and the significant operational stresses imposed on the damaged bars, the appropriate long-term solution recommended by the original equipment manufacturer to prevent premature aging and failure of the asset was to proceed with the replacement of approximately 10 stator bars at the next available outage opportunity. A scheduled outage on Unit 6 commenced on July 5, 2024 to complete approved capital replacement work in the switchyard to replace a circuit breaker (B3T6); Hydro completed the necessary work to replace the affected stator bars and the unit was returned to service on August 23, 2024.

4.1.3 Bay d'Espoir Unit 7

The Bay d'Espoir Unit 7 DAFOR of 3.87% for the current period is above the resource planning analysis value of 3.03% and the near-term planning analysis value of 3.60% for an individual hydraulic unit. This increase in DAFOR was the result of a forced outage, which occurred on August 2, 2024, when leaks were discovered in the generator bearing coolers following the completion of the scheduled annual outage on Unit 7. Initial investigation revealed that all four bearing coolers had experienced tube failures. A subsequent investigation into the root cause of these failures is ongoing. Hydro used two available spare coolers in inventory and worked with a local fabricator to assemble the outstanding coolers, using the undamaged tubes from the four original coolers, to return the unit to service on August 15, 2024 and initiated procurement of two new coolers.

Since the previous filing, Hydro has received the new coolers and completed an outage to replace the coolers in December 2024; all coolers currently installed on the unit are new.

4.2 Paradise River Facility

The Paradise River unit DAFOR of 8.36% is above the resource planning analysis value of 3.03% and the near-term planning analysis value of 3.60% for an individual hydraulic unit. This increase in DAFOR was the result of a leak in the penstock expansion joint located in the lower level of the plant. This leak developed in August 2024 and resulted in a two-week forced outage. The packing in the expansion joint was replaced in the affected area and the unit was returned to service on August 24, 2024.

Since the previous filing of this report, the Paradise River unit experienced a forced outage on December 5, 2024 when the unit was made unavailable due to a low bearing oil level alarm. Subsequent investigation revealed the instrumentation to be erroneous. The unit was returned to service on December 7, 2024, and Hydro plans to replace the instrumentation during the next planned outage.

5.0 Hydraulic Unit DAFOR Performance – Muskrat Falls

Detailed results for the current period and the previous period are presented in Table 6 and Chart 2. These results are compared to Hydro’s near-term and resource planning analysis values for forced outage rates, as used in the 2024 Resource Plan and the November 2024 Near-Term Report. Overall, the plant performance for the Muskrat Falls Facility shows improvement over the previous period, with the performance of all individual units meeting the established near-term and resource planning analysis values.

Table 6: Hydraulic Weighted DAFOR – Muskrat Falls

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ended Dec 2023 (%)	12 Months Ended Dec 2024 (%)	Near-Term Analysis Value (%)	Resource Planning Analysis Value (%)
Muskrat Falls Units - weighted	**824**	**2.49**	**1.70**	**2.30**	**3.03**
Muskrat Falls Units					
Muskrat Falls 1	206	6.62	6.26	2.30	3.03
Muskrat Falls 2	206	1.06	0.45	2.30	3.03
Muskrat Falls 3	206	2.56	0.09	2.30	3.03
Muskrat Falls 4	206	0.01	0.02	2.30	3.03

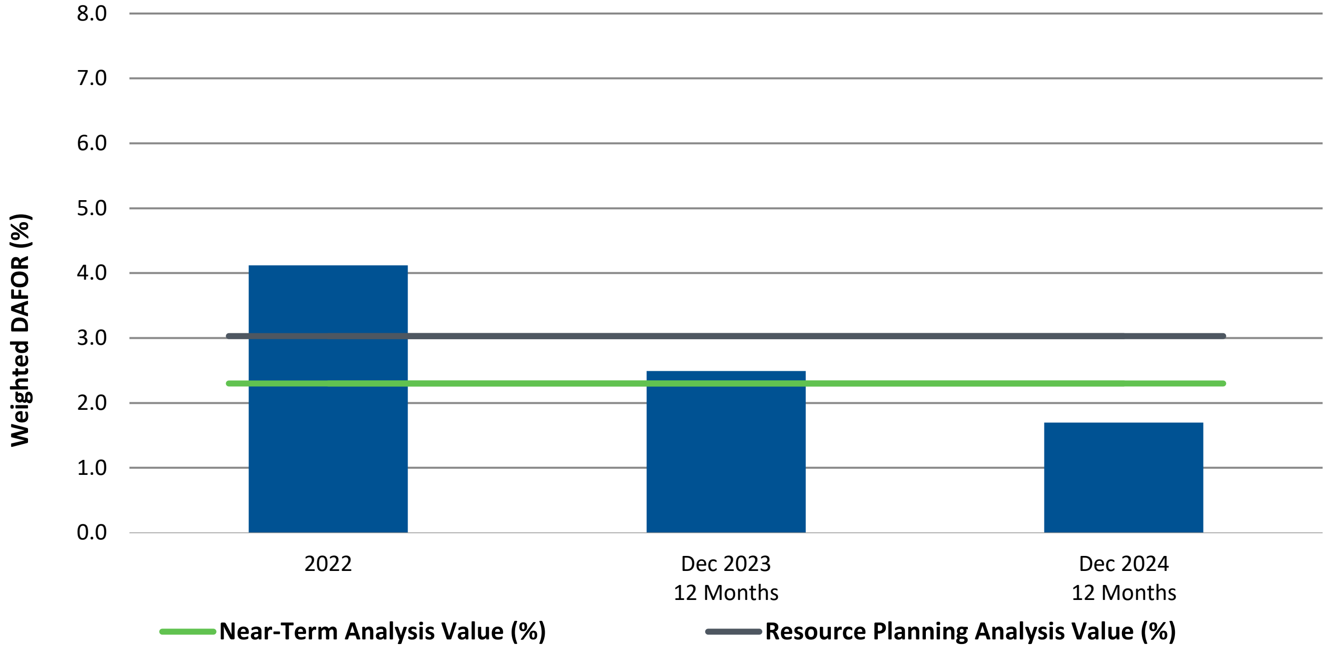

Chart 2: Hydraulic Weighted DAFOR – Muskrat Falls

5.1 Muskrat Falls Unit 1

The Muskrat Falls Unit 1 DAFOR of 6.26% is above the resource planning analysis value of 3.03% and the near-term planning analysis value of 2.30% for an individual Muskrat Falls unit. This increase in DAFOR was the result of the forced extension of the planned outage, which lasted from September 29 to October 16, 2024. As reported in Hydro's Final 2024-2025 Winter Readiness report,[18] loose concrete was observed in the turbine scroll case during the planned annual outage. As a result of some concrete passing through the turbine, further inspection indicated scuffing on the lower operating ring, which required repair. ROV[19] inspections of intake civil works identified where the concrete had dislodged, and a specialized team travelled to site to complete necessary assessment and remediation work. Unit 1 was returned to service on October 16, 2024, with final repairs to the intake civil works planned during the annual outage in 2025.

[18] "Reliability and Resource Adequacy Study Review – 2024–2025 Winter Readiness Planning Report – Final Report," Newfoundland and Labrador Hydro, December 10, 2024.
[19] Remote operated vehicle ("ROV")

6.0 Thermal Unit DAFOR Performance

Detailed results for the current and previous periods are presented in Table 7 and Chart 3. These results are compared to Hydro's near-term and resource planning analysis values for forced outage rates, as used in the 2024 Resource Plan and the November 2024 Near-Term Report. Any individual unit with forced outage rates which exceed the established near-term and/or resource planning analysis values is discussed herein.

Table 7: Thermal DAFOR

Generating Unit	Maximum Continuous Unit Rating (MW)	12 months Ended Dec 2023 (%)	12 months Ended Dec 2024 (%)	Near-Term Planning and Resource Planning Analysis Value (%)
All Thermal Units – Weighted	**490**	**32.08**	**37.29**	**20.00**
Thermal Units				
Holyrood TGS Unit 1	170	19.39	45.60	20.00
Holyrood TGS Unit 2	170	46.04	59.51	20.00
Holyrood TGS Unit 3	150	27.48	4.11	20.00

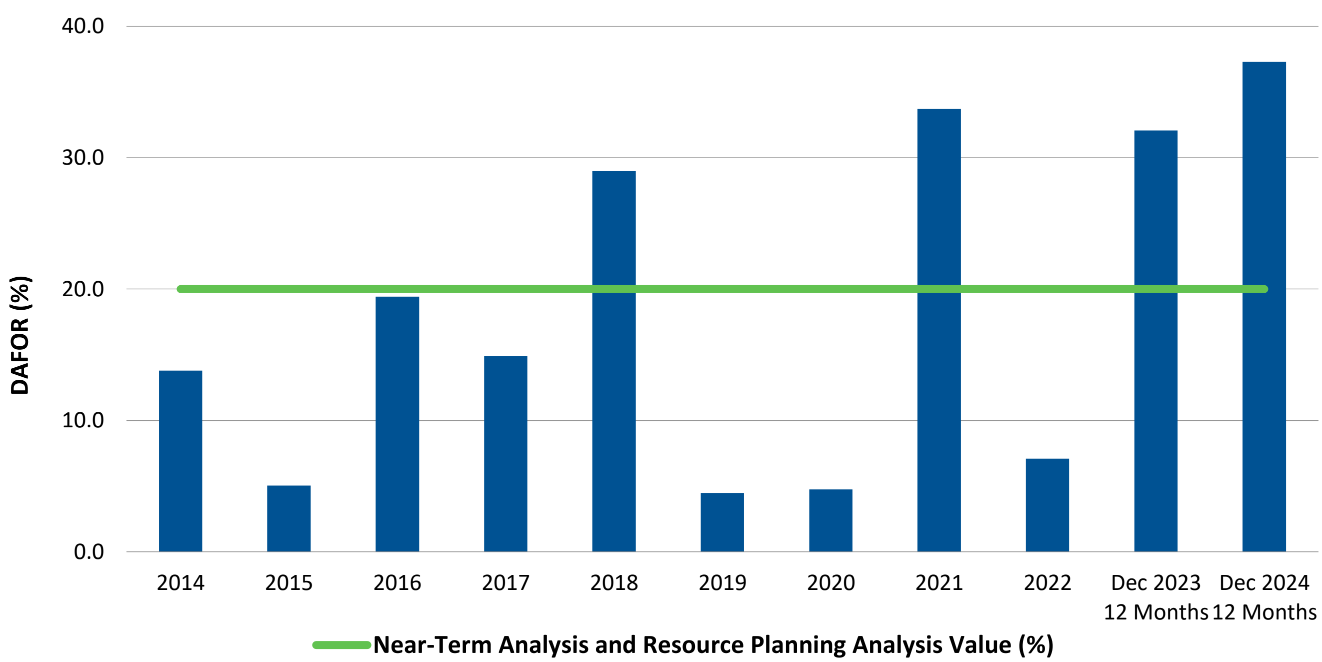

Chart 3: Thermal DAFOR

For the current period, the weighted DAFOR for all thermal units of 37.29% is above the 20.00% near-term and resource planning analysis values. The individual unit DAFOR outcome for the current period of 4.11% for Unit 3 at the Holyrood TGS is below the 20.00% analysis value. The performance of Unit 1 and Unit 2 at the Holyrood TGS is discussed in Section 6.1 and 6.2.

6.1 Holyrood TGS Unit 1

Considering individual thermal unit performance, the DAFOR of 45.60% for Unit 1 at the Holyrood TGS is above the near-term and resource planning analysis value of 20.00% for a unit at the Holyrood TGS, and shows a decline in performance over the previous period. This elevated DAFOR is the result of a forced extension to the planned unit outage to overhaul the Unit 1 turbine and replace the L-0 and L-1 blades at the General Electric ("GE") shop in the United States.[20] The blades were replaced; however, it was found that additional work was required to restore the bearing journals, which resulted in extension to the outage. All work has been complete and the rotor was shipped back to Holyrood site in late 2024. While all outstanding capital work related to this project is now complete, issues arose during start-up activities related to the main turbine stop valve. The OEM is currently onsite to complete data analysis and identify a solution to enable the unit to return to service.

6.2 Holyrood TGS Unit 2

Considering individual thermal unit performance, the DAFOR of 59.51% for Unit 2 at the Holyrood TGS is above the near-term and resource planning analysis value of 20.00%, and shows a decline in performance over the previous period. As previously reported, this elevated DAFOR is a result of a forced extension to the planned unit outage to overhaul the Unit 2 turbine and replace the L-0 blades at the GE shop in the United States.[21] Subsequent turbine rotor inspection at the GE shop identified additional and unexpected cracking on the L-1 blades, resulting in the required replacement of that set of blades.[22] The unit was reassembled in early 2024 and was officially released for service on May 17, 2024.

The elevated DAFOR in the current period has been significantly impacted by the aforementioned forced outage extension, which lasted approximately eight months, including five months in the current period.

[20] "2024 Capital Budget Application," Newfoundland and Labrador Hydro, rev. September 21, 2023 (originally filed July 12, 2023), sch. 6, prog. 2.
[21] Approved in Board Order No. P.U. 17(2022).
[22] These are the low pressure next-to-last stage ("L-1") blades, a separate stage of blades from the last stage ("L-0") blades.

This forced extension, in addition to the regularly scheduled annual outage in 2024 and stand-by time, has resulted in minimal operation of the unit in the current period, elevating the DAFOR mathematically.

7.0 Combustion Turbine DAUFOP Performance

DAUFOP Performance for the Hardwoods, Stephenville and Happy Valley Gas Turbines as well as the Holyrood Combustion Turbine for the period are presented in the charts and tables below.

Table 8: Hardwoods/Stephenville Gas Turbine DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months Ended Dec 2023 (%)	12 months Ended Dec 2024 (%)	Near-Term Planning and Resource Planning Analysis Value (%)
Gas Turbines	**100**	**28.19**	**40.59**	**30.00**
Stephenville	50	49.08	77.24	30.00
Hardwoods	50	6.94	0.00	30.00

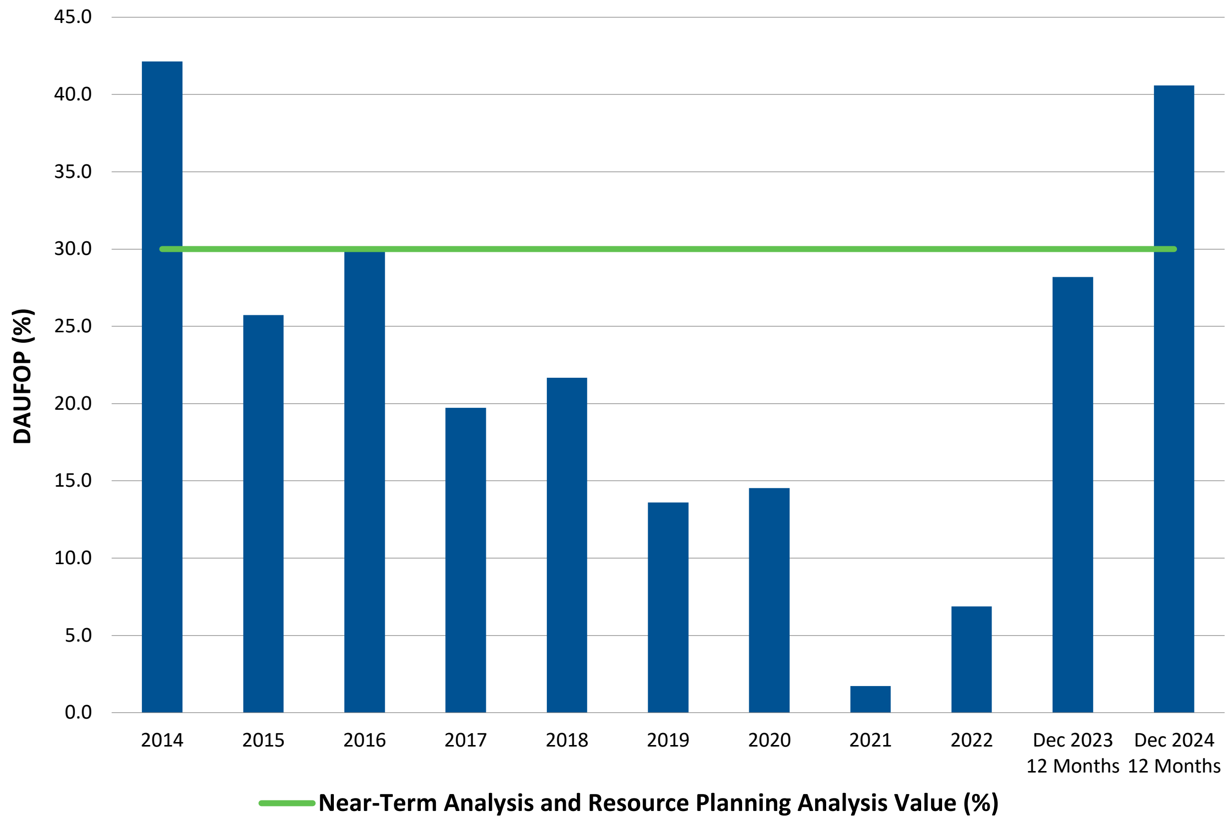

Chart 4: Gas Turbine DAUFOP: Hardwoods/Stephenville Units

The combined DAUFOP for the Hardwoods and Stephenville Gas Turbines was 40.59% for the current period, as shown in Table 8 and Chart 4. This is above the near-term and resource planning analysis value of 30.00%. The Stephenville Gas Turbine DAUFOP for the current period is 77.24%, which is above the near-term and resourcing planning assumption of 30.00%. The Hardwoods Gas Turbine DAUFOP for the current period is 0.00%, which is below the near-term and resource planning assumption of 30.00%. On a per-unit basis, the Stephenville Gas Turbine has declined in performance, while the Hardwoods Gas Turbine has improved in performance when compared to the previous period. As the forced outage rate for the Stephenville Gas Turbine exceeds the established near-term and resource planning analysis values, a discussion on same is included in Section 7.1.

Table 9: Happy Valley Gas Turbine DAUFOP

Gas Turbine Unit	Maximum Continuous Unit Rating (MW)	12 months Ended Dec 2023 (%)	12 months Ended Dec 2024 (%)	Near-Term Planning and Resource Planning Analysis Value (%)
Happy Valley	25	22.54	6.29	4.65

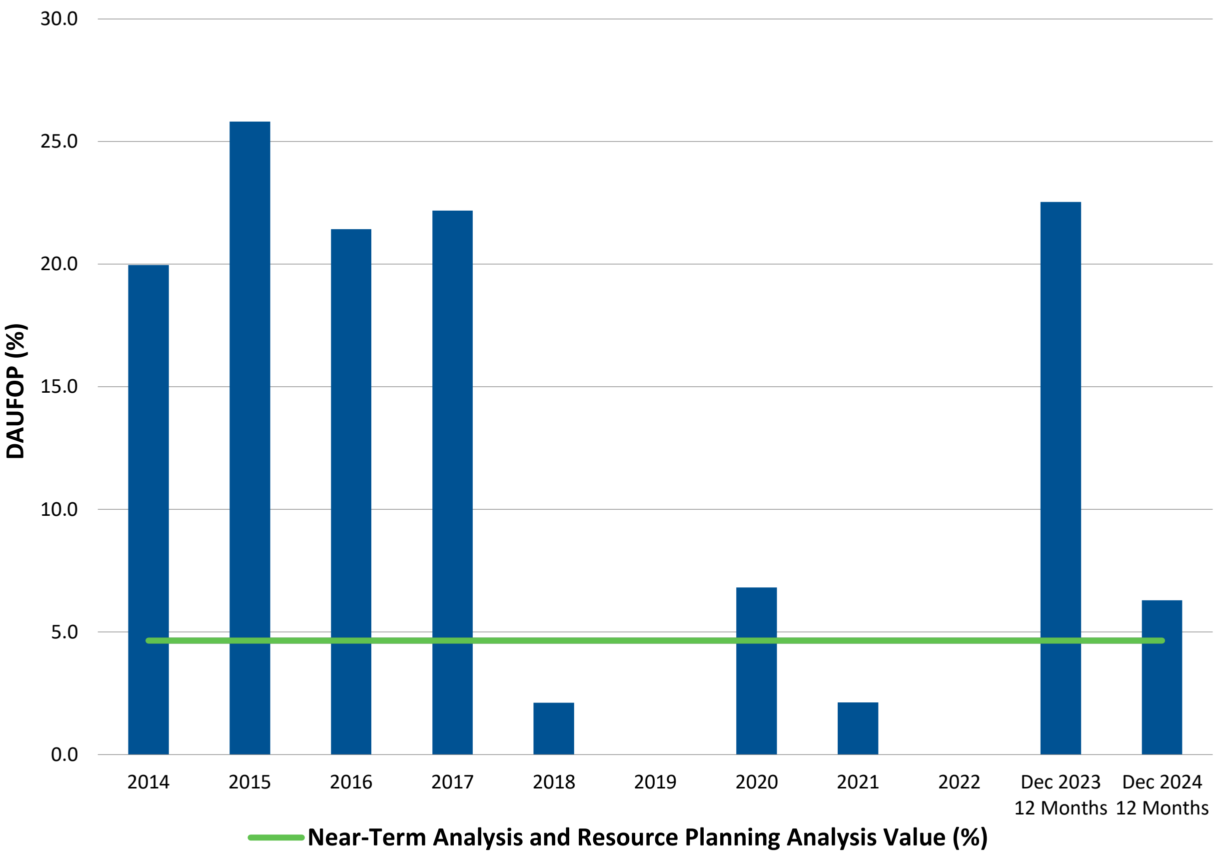

Chart 5: Gas Turbine DAUFOP: Happy Valley Unit

The DAUFOP for the Happy Valley Gas Turbine was 6.29% for the current period, as shown in Table 9 and Chart 5. This is above the near-term and resource planning analysis value of 4.65% and indicates an improvement in performance over the previous period. As the forced outage rate for the Happy Valley Gas Turbine exceeds the established near-term and resource planning analysis values, a discussion on same is included in Section 7.2.

Table 10: Holyrood Combustion Turbine DAUFOP

Combustion Turbine Unit	Maximum Continuous Unit Rating (MW)	12 Months Ended Dec 2023 (%)	12 Months Ended Dec 2024 (%)	Near-Term Planning and Resource Planning Analysis Value (%)
Holyrood	123.5	4.51	0.00	4.90

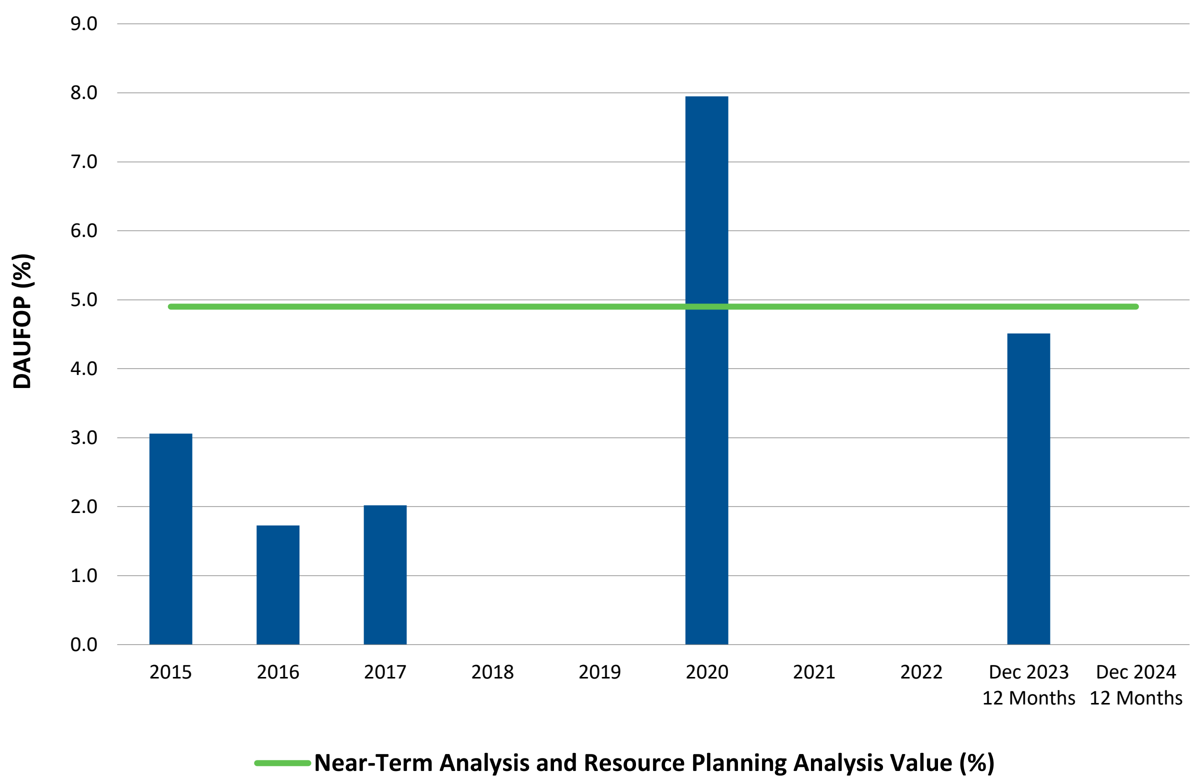

Chart 6: Combustion Turbine DAUFOP– Holyrood Unit

1 The Holyrood Combustion Turbine DAUFOP of 0.00% for the current period is below the near-term and
2 resource planning analysis value of 4.90%, and indicates an improvement in performance when
3 compared to the previous period, as show in Table 10 and Chart 6.

7.1 Stephenville Gas Turbine

The Stephenville Gas Turbine DAUFOP was 77.24% for the current period, which is above the near-term and resource planning analysis value of 30.00%. This decline in performance is a result of the failure of the alternator cooling fan, as previously reported, which occurred on July 14, 2023.[23]

Commissioning has successfully been completed and the unit returned to service on September 27, 2024.

7.2 Happy Valley Gas Turbine

The Happy Valley Gas Turbine DAUFOP was 6.29% for the current period, which is above the near-term and resource planning analysis value of 4.65%. This performance is the result of a forced outage in the first quarter of 2024, which was previously reported.[24] There have been no new forced outages since the previous filing.

8.0 Labrador-Island Link EqFOR Performance

The EqFOR for the LIL was 3.37% for the current period, as shown in Table 11. This is well within the range of values used by Hydro in the resource planning analysis scenarios.

Table 11: LIL EqFOR (%)

Asset Type	Measure	12 Months Ended Dec 2023 (%)	12 Months Ended Dec 2024 (%)	Base Planning Analysis Value	Range of Planning Analysis Values
LIL	EqFOR	N/A	3.37	5	1–10

[23] Additional information was provided in the "2023–2024 Winter Readiness Planning Report," Newfoundland and Labrador Hydro, December 11, 2023, sec. 2.2, p. 8 and sec. 7.4.1, p. 38. <http://www.pub.nl.ca/indexreports/winterreadiness/From%20NLH%20-%202023%E2%80%932024%20Winter%20Readiness%20Planning%20Report%20-%20Final%20Report%20-%202023-12-11.PDF>

[24] Quarterly Report on Performance of Generating Units for the Twelve Months Ended March 31, 2024," Newfoundland and Labrador Hydro, April 30, 2024, sec. 7.2, p. 19.

The availability of the three Soldiers Pond synchronous condensers ("SC") is critical to the reliable delivery of electricity to the Island Interconnected System via the LIL. No operational issues concerning the Soldiers Pond SCs resulted in outages or derating to the LIL in the current period.

A fulsome update on the total number of hours of operation for the Soldiers Pond SCs for the rolling 12-month period is provided in in Appendix A of this report.

Appendix A

Soldiers Pond Synchronous Condensers

Table A-1: Quarterly Rolling 12-Month Operating Hours for Soldiers Pond Synchronous Condensers

Unit	Operating Hours[1]	% Availability[2]
SC1	7,627.02	86.8%
SC2	8,258.70	94.0%
SC3	8,366.92	95.3%

Further information on the operation of the Soldiers Pond SCs is provided in Appendix B.

[1] Hydro has provided its best estimate of operating hours for each unit for the 12 months ended December 31, 2024 based on an assumption of 24/7 operation of all three SCs, and known outages (both planned and unplanned) recorded in its database.
[2] Synchronous Condenser availability is calculated on the basis of the unit's operating hours, and therefore assumes that the unit is operating when available.

Appendix B

Muskrat Falls Assets Update

Reporting period up to December 31, 2024

1.0 Introduction

The Muskrat Falls Assets, made up of the LIL, the Labrador Transmission Assets ("LTA") including the Soldiers Pond Synchronous Condensers, and Muskrat Falls have all been commissioned in recent years and are in the early years of their asset lifespan.

As is normal for the early operation of assets, Hydro has encountered some challenges with equipment due to manufacturing issues or defective components. Such issues are expected early in the equipment's life. Equipment failure rates plotted over time generally exhibit a 'bathtub-shaped curve.' Incidents of failure tend to be high when equipment is new and again near the end of the equipment's useful life, depending on equipment type. In addition to routine ongoing preventative maintenance activities and sustaining capital programs for each of these assets, there are a number of one-off capital projects, corrective maintenance activities and engineering studies ongoing with the purpose of addressing and repairing these early life issues, with the ultimate goal of improving asset reliability over time to expected levels.

Hydro provides the following update to the Board on the status of these activities and other information as requested by the Board.

2.0 Muskrat Falls Hydroelectric Generating Facility

Muskrat Falls was commissioned in November 2021. The plant continues to outperform similar units across Canada. As reported in its most recent Rolling 12 report, the Muskrat Falls total plant DAFOR performance through the end of the fourth quarter of 2024 was 1.70%, which was significantly better than the Electricity Canada average of 5.70% for similar units across Canada.

Capital Projects

Muskrat Falls – Repair Unit 2 Turbine

As recommended by the original equipment manufacturer ("OEM") and reported by The Liberty Consulting Group in its June 2023 monitoring report, vibration issues observed on Unit 2 require permanent corrective action, including full unit dismantling, to be completed under warranty by the turbine OEM. There have been no issues with vibration, or the identification of other characteristics through internal inspections, which would indicate a problem similar to that of Unit 2 on Units 1, 3, or 4.

This project is to repair the Unit 2 turbine, which will result in the unit being unavailable for the 2024–2025 winter season. The expected return to service date for this generating unit is mid-May 2025, and the issue is anticipated to be resolved following completion of this project.

3.0 Soldier's Pond Synchronous Condensers

Hydro continues to address the remaining items that were noted in punchlist reports submitted with the commissioning certificate and outstanding warranty claims. Regular meetings between the CEOs of Hydro and GE Power are ongoing to ensure all outstanding issues are resolved to satisfaction.

Operations Items

Brush Gear

Hydro's Engineering team, with the OEM for the brush equipment and synchronous condensers, has been working to identify the root cause of the brush performance issues. Multiple actions have been taken to improve the reliability of the brush gears for the 2024–2025 winter, including:

- 12 brushes per ring removed (24 total) on each unit to increase the current density (heat) on remaining brushes in an effort to improve patina development[1] and overall brush gear performance;
- Maintaining the machine hall temperature near 20°C;
- Nord-lock washers installed on holders to lessen the likelihood of brush holders vibrating loose and contacting the running face of the slip ring;
- Humidity levels being measured and trended by Hydro's Engineering team to ensure brushes are operating in ideal conditions to support patina development;
- Managing system voltages to increase load on synchronous condensers (i.e., increase current density); and

[1] During operation a protective film, or patina, is automatically formed on the surface of the slip ring, at the interface point between the brush face and ring surface. When formed properly, this film reduces brush wear to the lowest possible level, and is essential to ensure optimum operation of the brushes.

- Regular inspections performed to identify changes in performance, allowing for early intervention prior to damages.

In spring 2024, the existing slip ring was removed from synchronous condenser 1 ("SC1"), and sent for machining to correct a runout causing excessive brush vibration. At this time, a modified brush with the ability to operate in a higher vibration environment was also provided by the OEM and installed. These modifications have resulted in improved performance to date. Hydro's Engineering and Operations teams will continue to monitor the overall impact of these changes, with the potential to complete this work on SC2 and SC3 in 2025. Additionally, GE has been working with a different brush gear manufacturer, and has proposed a different brush assembly with a more robust spring design to lessen the likelihood of spring failure. This design will be installed on SC3 for performance evaluation in early spring 2025.

4.0 Labrador-Island Link

Since commissioning in April 2023, LIL has been in service and successfully providing power to the provincial grid. Since the last update, the LIL has been operating at various power transfer levels up to 620 MW, as required by the system. In total, approximately 904 GWh were delivered over the LIL from October 1, 2024 to December 31, 2024. Hydro continues to ensure the availability of generation at the Holyrood Thermal Generating Station; however, energy and capacity delivered over the LIL are used to minimize thermal generation whenever possible.

In the early stages of its operation, as is normal for the operation of assets early in life, the current reliability of the LIL is anticipated to be lower than in the long-term, due to failures associated with new assets (e.g., due to manufacturing issues or defective components). In addition to routine ongoing corrective and preventative maintenance activities and sustaining capital programs, there are a number of capital projects identified to repair these issues.

Operations Items

Forced Outages

During the quarter, the LIL experienced one forced outage as follows:

Outage Date	Description/Cause	Customer Impact	Investigation Status
October 18, 2024	During a planned 500 MW trip test of Pole 1 and Pole 2, both poles tripped due to a protection setting at Soldiers Pond. The Pole 2 trip test was conducted first and operated as intended. The trip occurred when the Pole 1 emergency stop was activated, and Neutral Bus Overvoltage Protection Asserted on both poles.	• 150 MW of under frequency load shedding for Newfoundland Power Inc. which was restored in less than one hour. • 15 MW for Corner Brook Pulp and Paper Limited, who were restored later that day, in agreement with the customer.	Investigation complete. Corrective actions implemented. 500 MW trip tests performed successfully.

Cable Switching Transients

As reported in Hydro's November 2024–2025 Winter Readiness Report, new equipment was successfully installed to mitigate cable switching transients at the LIL Transition Compounds in mid-October 2024. Subsequent testing confirmed that the modifications have addressed the transients; as such, this issue no longer restricts LIL dispatch levels or the completion of the 900 MW test.

Replacement of Direct Current Current Transformers ("DCCT")

In 2023, the OEM and Hydro determined that very low air temperatures at Muskrat Falls Converter Station were influencing the measurement accuracy of DCCTs, resulting in false protection trips and power control issues on the LIL. The OEM identified the root cause of the issue to be a manufacturing defect with the Delay Coil Fiber Optical Cable located within the DCCTs; this issue occurred with a select batch of fiber optic cables, affecting six DCCTs at the Muskrat Falls HVdc Converter Station, which have since been replaced.[2]

[2] One of these DCCTs has an operation rating to -40°C, and will be replaced with a DCCT rated to -50°C as soon as is practical.

As noted in Hydro's final 2024–2025 Winter Readiness Report, the OEM discovered additional DCCTs that require replacement due to cold temperature issues.[3] Three DCCTs were identified to be replaced as a precaution based on site measurements; with two replaced during December 2024. The remaining DCCT identified to be replaced is targeted for replacement as soon as possible, depending on outage availability. Four additional DCCTs were identified as low risk for this issue, and are being targeted for replacement during maintenance outages in 2025, with dates to be confirmed.

Conductor Testing

Following a bipole trip on March 30, 2024, line patrol determined that the electrode conductor was broken and damaged during an ice storm at several locations in Southern Labrador. As a result, conductor testing was completed and determined no material issues with the conductor, and found that the failure was due to overload, which is consistent with past findings. There is evidence that cyclic loading due to ice and wind on the conductor may be causing fatigue and could contribute to the failure. This was consistent with previous testing results. There will be additional conductor testing completed in 2025.

Capital Projects

Replace Turnbuckles and Install Airflow Spoilers Program

With regard to the Turnbuckles Replacement and Airflow Spoiler Installation Program, Hydro continues to actively address the recommendations resulting from the localized failures experienced on the LIL over the past three winters. Hydro's capital programs to replace turnbuckles and install airflow spoilers intend to reduce galloping are ongoing, prioritizing the high-priority areas of the LIL first.

At the end of 2024, Hydro had completed 100% of the planned replacements of turnbuckles for that year. To date, 74% of air spoilers have been installed, with the remaining to be completed in 2025.[4]

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[3] While none of these additional DCCTs have experienced issues associated with cold temperatures, there are indicators the issue could present itself; therefore, as a precaution, they have been identified for replacement.

[4] Based on the outcome of its galloping study, Hydro is installing airflow spoilers on priority areas of the LIL to control galloping and mitigate further damage to the line. Hydro has mitigated the risk of prolonged customer outage as a result of fatigue failures due to galloping by prioritizing the most remote locations where galloping has been observed.

Optimizing Clamp Designs

Hydro has identified, through its preventative maintenance program and component failure investigations, multiple opportunities for clamp and conductor inspection, with refurbishment or replacement of parts made according to findings. As a result, Hydro is optimizing clamp designs for the electrode conductor and optical ground wires ("OPGW").

Three alternative suspension clamp designs have been installed on the electrode conductor at ten structures and will be inspected for performance on an annual basis. The contract has been awarded to a consultant for the electrode suspension assembly analysis, and the assessment will be completed in the first quarter of 2025. Hydro completed additional electrode conductor testing as a result of an incident in March 2024, with further recommendations expected from that investigation report, once complete.

An alternate OPGW clamp assembly with improved slip strength has been selected and ordered and is expected to arrive in January 2025. As the OPGW relates to communications functionality, Hydro does not anticipate that further occurrences of similar damage would result in a prolonged power interruption or customer outage.

Top Plate Design

In December 2022 there were two incidents impacting two adjacent structures of the LIL where the connection of the top plate of the OPGW suspension detached from the tower, falling onto the cross arm. As a result Hydro is implementing a reinforcement of the top plate that secures the OPGW to A3 type towers. As of the end of 2024, all sixty-one A3 tower top plates have been reinforced as planned.

Analysis of potential modifications to this plate for other tower types is underway.

Ice Monitoring

In response to icing experienced on the LIL, Hydro is undertaking capital projects in 2025 for the installation of a real-time weather station, as well as the installation of on-line ice and galloping monitoring equipment. Installation of the weather station is planned for 2025, and the contract for monitoring equipment was awarded in 2024, to be installed in 2025.

High-Power Testing

As reported in its final 2024–2025 Winter Readiness Report, Hydro postponed the 900 MW test until later in the winter.[5] The LIL is available for reliable operation up to 700 MW, as the previously reported 450 MW restriction was lifted on November 8, 2024.

Planning for the 900 MW test is underway. As previously reported, the following are prerequisite conditions for the test to occur:

- Satisfactory system conditions are present, including both those in Newfoundland and Labrador, where a high system load can be reasonably expected to occur, and neighbouring jurisdictions;
- Successful coordination with all relevant neighbouring system operators is attained; and
- Identification of risks and implementation of all necessary risk mitigation actions are in place.

Software

New LIL software was commissioned in mid-October. This software, as with the previous version, allows for full operation of the LIL up to 900 MW. Through dynamic commissioning, non-critical software-related issues were identified. The software to address these non-critical issues successfully passed Factory Acceptance Testing in November and is anticipated to be installed in spring 2025 once system conditions allow.

Engineering Studies and Reports

Since its commissioning in April 2023, Hydro has gained valuable insight into LIL operations. Using Hydro's operating experience and recommendations from its investigations, supplemented by the recommendations made by Haldar and Associates Inc., Hydro has identified three potential reinforcements to LIL assets to sustain reliability, address common failure modes, and mitigate risks to the Island Interconnected System. While these potential reinforcements have been identified, further engineering assessment is required to determine the benefits, costs, schedule, and feasibility of these modifications. These include:

[5] "Reliability and Resource Adequacy Study Review – 2024–2025 Winter Readiness Planning Report – Final Report," Newfoundland and Labrador Hydro, December 10, 2024, p. i.

- Review of unbalanced ice loads for the entire line length to determine appropriate design unbalanced ice loading, followed by design and cost estimates for tower design modifications to meet unbalanced design loads;
- Feasibility assessment and cost estimates for installation of mid-span structures to reduce tower loading in critical areas; and
- Engineering design and cost estimates to relocate electrode conductors from towers to wood poles in some sections, to reduce tower loading, improve access and logistics, and minimize outages to address electrode line issues in critical areas.

These assessments are planned for completion in the first quarter of 2025, at which point Hydro will be in a position to evaluate these projects based on their anticipated reliability benefits and their estimated cost. A detailed update on each of these assessments is provided below:

Ice Loading Analysis

The ice loading assessment has been completed. The unbalanced ice loads causing failures have been determined and provided to a consultant for the design of tower modifications, and feasibility of mid span structures.

Tower Design

Analysis is ongoing to determine the requirement for modifications to the tower or transmission line design to further reduce the risk of incidents. Specifically, this includes design for strengthening electrode cross arm; electrode suspension assembly assessment and design; and design for OPGW tower peak strengthening. These studies are being undertaken by a consultant, and are scheduled to be complete in the first quarter of 2025.

Line Modifications

Hydro is undertaking engineering assessments on the potential installation of mid-span structures to reduce load on towers and to remove the electrode line from the towers (in specific sections) to reduce load on towers. Work is ongoing, and initial cost estimates were completed in Q4 2024 and are being reviewed internally. The feasibility of mid-span structures is being assessed through the consultant contract for tower design, and the assessment on the electrode removal is being completed internally, scheduled to be complete in the first quarter of 2025.

Ongoing Investigations

Investigations have been completed for two incidents that occurred in 2024, and the results are currently under review by management. Hydro will communicate the findings of these investigations to the Board upon completion. These incidents and their associated investigations are described below.

OPGW Tower Peaks – Central Newfoundland

There was damage to the LIL during an icing event on February 9, 2024. The issues which were similar in nature, and occurred on eight structures in three groups. In each occurrence, the top peak of the tower where the OPGW is connected sustained damage; however, the OPGW wire itself did not physically fail. This issue occurred on 8 of 3,223 tower peaks. While damage to the OPGW tower peaks will not cause extended power outages, for safety reasons, outages were taken to complete the repair work. These structures are all located in central Newfoundland.

Electrode Cross Arm, Conductor and OPGW Tower Peak – Southern Labrador

Following a bipole trip on March 30, 2024, line patrol determined that the electrode conductor was broken and damaged during an ice storm at several locations. In some locations, the electrode conductor was touching or close to the pole conductor, which would explain the line trip. There was also damage to the steel lattice towers at the electrode cross arm and OPGW tower peaks. There was damage on a total of 12 structures of 3,223 towers. There was no customer impact as a result of the incident; however, an outage was required to clear the damaged conductor from the line while repairs were being completed. These structures are all located in southern Labrador.

Restoration Plans and Operational Strategy

In addition to engineering studies to inform potential reinforcements to mitigate the risk of component failures and outages, Hydro is currently in the process of contracting a consultant to review Hydro's restoration plans, including review and development of specific restoration plans for a variety of potential and previously experienced scenarios. It is expected that this review will include the identification of alternative restoration approaches that can be selected based on the situation for the most efficient and effective execution of the work. Restoration plans will consider geographic and weather challenges. Restoration plan reviews will include estimates of the time to effect the repairs as well as time challenges and opportunities for restoration duration and provide cost and benefit information to identify incremental investment in restoration time improvement and quantify the associated benefits.

5.0 Conclusion

Hydro recognizes the criticality of the Muskrat Falls Assets to the supply of the Island Interconnected System, which helps to limit the thermal generation required from the Holyrood TGS and impacts the overall reliability of the grid will continue to monitor the performance of these assets address early life incidents such as those due to manufacturing issues or defective components.