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October 29, 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: Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2021

Please find enclosed Newfoundland and Labrador Hydro's "Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2021."

If you have any questions or comments, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

A handwritten signature in blue ink, appearing to read "Shirley A. Walsh", written over a horizontal line.

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

Encl.

ecc: **Board of Commissioners of Public Utilities**
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Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2021

October 29, 2021

A report to the Board of Commissioners of Public Utilities



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1.0 Introduction

In this report, Newfoundland and Labrador Hydro (“Hydro”) provides data on forced outage rates of its generating facilities. The data provided pertains to historical forced outage rates and assumptions Hydro uses in its assessments of resource adequacy. This report covers the performance of Hydro’s generating units for the 12 months ended September 30, 2021.

This report contains forced outage rates for the current 12-month reporting period of October 1, 2020 to September 30, 2021 for individual generating units at hydraulic facilities, the Holyrood Thermal Generating Station (“Holyrood TGS”), and Hydro’s gas turbines. This report also provides, for comparison purposes, the individual generating unit data on forced outage rates for the period of October 1, 2019 to September 30, 2020. Further, total asset class data is presented based on the calendar year for the years 2006 to 2020.

The forced outage rates of Hydro’s generating units are calculated using three measures: 1) Derated Adjusted Forced Outage Rate (“DAFOR”) for the hydraulic and thermal units, 2) Utilization Forced Outage Probability (“UFOP”), and 3) Derated Adjusted Utilization Forced Outage Probability (“DAUFOP”) for the gas turbines.

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 company total and reflect the relative impact a unit’s performance has on overall generating performance. This measure is applied to hydraulic and thermal units; however, it is not applicable to gas turbines because of their operation as standby units and their relatively low operating hours.

UFOP and DAUFOP are measures used for gas turbines. UFOP 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 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. 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 Canadian Electricity Association (“CEA”) guidelines. CEA guidelines require that derated levels of a

1 generating unit are calculated by converting the operating time at the derated level into an equivalent
 2 outage time.

3 In addition to forced outage rates, this report provides details for those outages that contributed
 4 materially to forced outage rates exceeding those used in Hydro’s generation planning analysis for both
 5 the near and long term.

6 The assumptions referred to throughout this report are the same as those reported in the 2018
 7 quarterly reports except for the new assumptions identified in Table 12. As part of its Reliability and
 8 Resource Adequacy Study, Hydro detailed the process undertaken to determine the forced outage rates
 9 most appropriate for use in its near-term reliability assessments and long-term resource adequacy
 10 analysis. The values have been updated to reflect the most current outage data and the revised forced
 11 outage rates that resulted from this process are included in Sections 0 and 9.0 of this report. The
 12 potential impacts of these revised forced outage rates on future performance reporting are also
 13 discussed. While the new assumptions form the basis of Hydro’s current planning processes, this report
 14 includes the historical assumptions and style to maintain similarity to previous reports.

15 **2.0 Overview for Period Ending September 30, 2021**

Table 1: DAFOR, UFOP, and DAUFOP Overview (%)

Class of Units	1-Oct-2019 to 30-Sep-2020	1-Oct-2020 to 30-Sep-2021	Base Planning Assumption	Near-Term Planning Assumption¹
Hydraulic (DAFOR)	1.25	2.03	0.90	2.60
Thermal (DAFOR)	2.08	12.28	9.64	14.00
Combined Gas Turbine (UFOP)	8.31	0.81	10.62	20.00
Holyrood Gas Turbine (UFOP)	7.59	0.00	5.00	5.00
Hardwoods/Stephenville Gas Turbine (DAUFOP)	17.83	1.04	-	30.00
Happy Valley Gas Turbine (DAUFOP)	6.70	3.18	-	15.00
Holyrood Gas Turbine (DAUFOP)	7.59	0.00	-	5.00

¹ Refer to “Near-Term Generation Adequacy Report,” Newfoundland and Labrador Hydro, November 15, 2017, sec. 5.0 for further details.

1 As shown in Table 1, hydraulic and thermal DAFOR performance declined for the current 12-month
2 period ending September 30, 2021 compared to the 12-month period ending September 30, 2020. The
3 UFOP and DAUFOP performance for all gas turbines improved in the current period compared to the 12-
4 month period ending September 30, 2020.

5 Hydro began reporting DAUFOP performance in January 2018 for its gas turbines.

6 **3.0 Generation Planning Assumptions**

7 The Reliability and Resource Adequacy Study introduced new generation planning assumptions;
8 however, the assumptions used throughout this report are the same as reported in previous quarterly
9 reports. The potential impacts of these revised assumptions on reporting of generation unit
10 performance are discussed in Section 9.0 of this report. While the new assumptions form the basis of
11 Hydro's current planning processes, this report includes the historical assumptions and style to maintain
12 similarity to previous reports while the regulatory process surrounding the *Reliability and Resource*
13 *Adequacy Study Review* proceeding remains underway.

14 Hydro produces reports based on comprehensive reviews of energy supply for the Island Interconnected
15 System. This is part of Hydro's analysis of energy supply up to the Muskrat Falls interconnection. The
16 May 2018 "Near-Term Generation Adequacy Report,"² contains an analysis based on the near-term
17 DAFOR and DAUFOP and the resulting implications for meeting reliability criteria until the
18 interconnection with the North American Grid. The near-term analysis has been updated since that time
19 to reflect changes in assumptions with respect to the in-service of the Labrador-Island Link. The results
20 of this analysis were presented to the Board of Commissioners of Public Utilities ("Board") as part of the
21 "Labrador-Island Link In-Service Update."³

22 Hydro's DAFOR and UFOP planning assumptions are provided in Table 2. The Holyrood Gas Turbine has a
23 lower expected rate of unavailability than the older gas turbines (5% compared to 10.62%) as the unit is
24 new and can be expected to have better availability than the older units.⁴

² "Near-Term Generation Adequacy Report," Newfoundland and Labrador Hydro, rev. May 30, 2018 (originally filed May 22, 2018).

³ Labrador-Island Link In-Service Update," Newfoundland and Labrador Hydro, October 1, 2018.

⁴ Hydro selected a 5% UFOP for the new Holyrood Gas Turbine following commentary on forced outage rates contained in the "Independent Supply Decision Review," Navigant Consulting Ltd., September 14, 2011, filed as Attachment 1 to Hydro's response to PUB-NLH-010 from the *Investigation and Hearing into Supply Issues and Power Outages on the Island Interconnected* proceeding.

Table 2: 2017⁵ DAFOR and UFOP Long-Term Planning Assumptions (%)

	DAFOR		UFOP	
	Base Planning Assumption	Sensitivity	Base Planning Assumption	Sensitivity
Hydraulic Units	0.90	0.90		
Thermal Units	9.64	11.64		
Gas Turbines: Existing			10.62	20.00
Gas Turbines: New			5.0	10.0

- 1 The DAFOR and DAUFOP assumptions used in developing the May 2018 “Near-Term Generation
- 2 Adequacy Report” are noted in Table 3.

Table 3: DAFOR and DAUFOP Near-Term Generation Adequacy Analysis Assumptions (%)

	DAFOR	DAUFOP
	Near-Term Generation Adequacy Assumption	Near-Term Generation Adequacy Assumption
All Hydraulic Units	2.6	
Bay d’Espoir Hydraulic Units	3.9	
Other Hydraulic Units	0.7	
Holyrood TGS	14.0	
Hardwoods and Stephenville Gas Turbines		30.0
Happy Valley Gas Turbine		15.0
Holyrood Gas Turbine		5.0

3 **4.0 Hydraulic Unit DAFOR Performance**

- 4 Detailed results for the 12-month period ending September 30, 2021 are presented in Table 4, as well as
- 5 the data for the 12-month period ending September 30, 2020. These are compared to Hydro’s short-
- 6 term generation adequacy assumptions, as used in the May 2018 “Near-Term Generation Adequacy
- 7 Report,” and Hydro’s long-term generation planning assumptions for the forced outage rate.

⁵ Refer to “Near-Term Generation Adequacy Report,” Newfoundland and Labrador Hydro, November 15, 2017, sec. 5.0 for further details.

Table 4: Hydraulic Weighted DAFOR

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
All Hydraulic Units - Weighted	954.4	1.25	2.03	0.90	2.60
Hydraulic Units					
Bay d'Espoir 1	76.5	3.18	3.31	0.90	3.90
Bay d'Espoir 2	76.5	1.63	0.00	0.90	3.90
Bay d'Espoir 3	76.5	3.72	0.17	0.90	3.90
Bay d'Espoir 4	76.5	4.96	0.24	0.90	3.90
Bay d'Espoir 5	76.5	1.13	0.00	0.90	3.90
Bay d'Espoir 6	76.5	0.67	0.00	0.90	3.90
Bay d'Espoir 7	154.4	0.17	0.29	0.90	3.90
Cat Arm 1	67	0.22	0.51	0.90	0.70
Cat Arm 2	67	0.27	1.00	0.90	0.70
Hinds Lake	75	1.95	0.50	0.90	0.70
Upper Salmon	84	0.09	13.03	0.90	0.70
Granite Canal	40	0.70	1.73	0.90	0.70
Paradise River	8	2.72	0.00	0.90	0.70

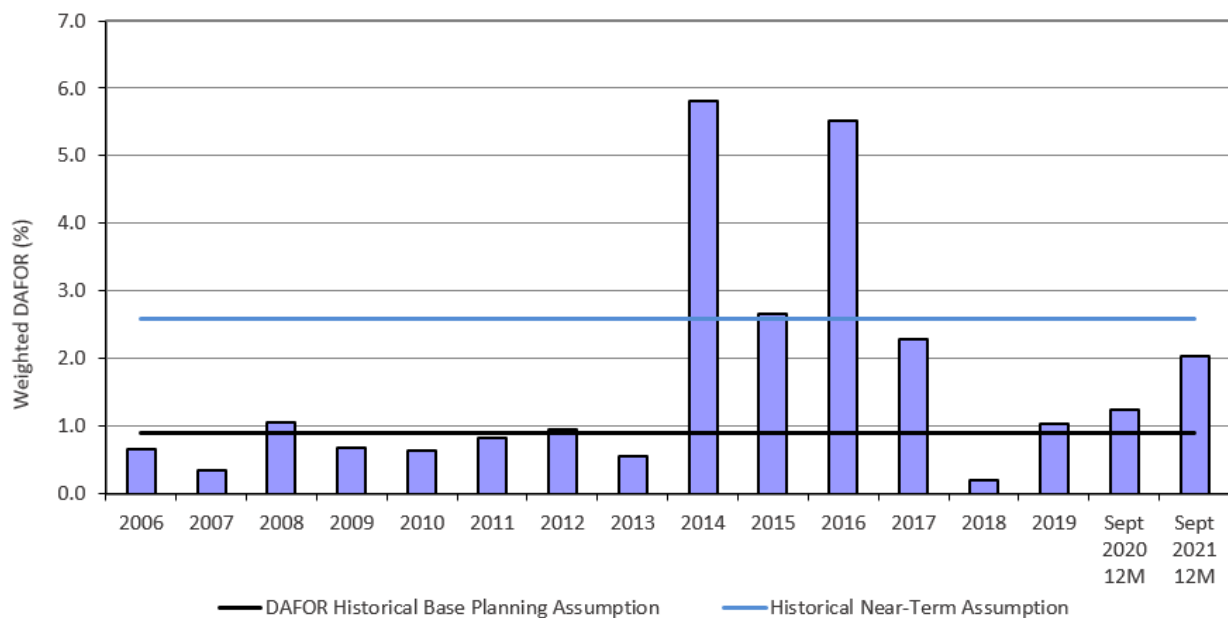


Figure 1: Hydraulic Weighted DAFOR

1 Considering individual hydraulic unit performance, the Bay d’Espoir Unit 1 DAFOR of 3.31% did not meet
2 the historical base planning assumption of 0.9% but is below the historical near-term planning
3 assumption of 3.90% for an individual Bay d’Espoir unit.

4 As previously reported, Bay d’Espoir Unit 1 has experienced two forced outages which impacted the
5 DAFOR performance for the current period. The first, from May 14 to 20, 2021, was a forced extension
6 of the planned outage, as a result of findings in the scheduled inspection of Penstock 1. During the
7 inspection, 16 distinct indications were identified over an approximately 200 foot span of the penstock
8 with indications ranging in length from 2 inches to 8 feet. The indications were similar in condition to
9 those discovered in recent years and were shallow in depth. Weld refurbishment and final inspection
10 were completed and the penstock was returned to service. This discovery was not unexpected given the
11 known condition of the Bay d’Espoir penstocks. Hydro will use the information obtained through the
12 inspection and refurbishment process to inform its long-term plan for the penstocks; the details of
13 Hydro’s long-term plan are expected to be filed with the Board in early 2022. The final outage that
14 impacted Bay d’Espoir Unit 1 DAFOR performance occurred May 29 to June 3, 2021 when the unit was
15 removed from service to investigate elevated governor oil temperatures. The investigation discovered
16 misalignment of the permanent magnet generator (“PMG”) coupling which caused excessive strain and
17 subsequent shearing of the drive pins which then contributed to the failure of a piston seal ring in the
18 servomotor. The necessary repairs were completed and the unit returned to service. Work orders were
19 entered to inspect other units with similar PMG couplings during the next planned outage and
20 preventative maintenance programs were updated to include the verification of alignment of the PMG
21 coupling. To date, inspections have been completed in Bay d’Espoir Unit 4 and Bay d’Espoir Unit 6 with
22 no findings of concern. Remaining inspections will be completed during the outstanding 2021 and 2022
23 annual outages.

24 The Upper Salmon unit DAFOR of 13.03% for the current period did not meet either the historical near-
25 term planning assumption of 0.7% or the historical base planning assumption of 0.9%. During the 2021
26 planned annual preventative maintenance inspection in August 2021, a significant crack on rim guidance
27 block #10 was discovered. Further inspection of all rim guidance blocks revealed that over 35% (6 of 16
28 total blocks) of the rim guidance blocks exhibited cracking. Metallurgy analysis determined the failure
29 mode was due to fatigue cracking. The cracking was beyond repair and the blocks were replaced. In
30 addition, after consultation with the original equipment manufacturer (“OEM”), it was determined that
31 adjacent blocks to the cracked blocks were subjected to higher than normal forces due to the reduced

1 strength of the cracked blocks and would likely also suffer damage and failure. To ensure continued
2 reliable operation of the Upper Salmon unit, all 16 blocks were replaced. This work was not included in
3 the scope of the planned outage, thus resulted in a forced extension to the outage which lasted from
4 August 21 to October 21, 2021.

5 The Cat Arm Unit 2 DAFOR of 1.00% for the current period did not meet either the historical near-term
6 planning assumption of 0.7% or the historical base planning assumption of 0.9%. This was the result of
7 three forced outages experienced in the current period. The first (May 25, 2021) and second (July 24,
8 2021) both were the result of failed solenoid coils on the shutdown valve assembly. The failed
9 components were replaced and the entire valve assembly is to be replaced at the next opportunity. The
10 final outage (August 28, 2021) was caused by a leaking governor sump cooler. A replacement cooler was
11 installed on the unit and then the unit was returned to service.

12 The Granite Canal unit DAFOR of 1.73% did not meet either the historical near-term planning
13 assumption of 0.7% or the historical base planning assumption of 0.9%. As previously reported, a leak in
14 the governor oil manifold resulted in a forced outage on October 1, 2020. Additionally, the Granite Canal
15 unit was unavailable due to a forced outage from February 25 to 26, 2021 and another from February 28
16 to March 3, 2021. These two outages were the result of governor pressure issues caused by the
17 accumulator system. These issues have been resolved and preventative maintenance procedures have
18 been updated to prevent future occurrence of similar issues. Additionally, since the previous filing, one
19 other forced outage occurred on the Granite Canal unit. This outage occurred on September 13, 2021
20 and was the result of faulty bearing temperature probe. The faulty equipment was replaced and suitable
21 spare components procured.

22 **5.0 Thermal Unit DAFOR Performance**

23 Detailed results for the 12-month period ending September 30, 2021 and the 12-month period ending
24 September 30, 2020 are presented in Table 5. These results are compared to Hydro's short-term
25 generation adequacy assumptions, as used in the May 2018 "Near-Term Generation Adequacy Report,"
26 and Hydro's long-term generation planning assumptions for the forced outage rate.

Table 5: Thermal DAFOR

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
All Thermal Units - Weighted	490	2.08	12.28	9.64	14.00
Thermal Units					
Holyrood 1	170	0.38	13.67	9.64	15.00
Holyrood 2	170	4.59	5.48	9.64	10.00
Holyrood 3	150	0.31	20.74	9.64	18.00

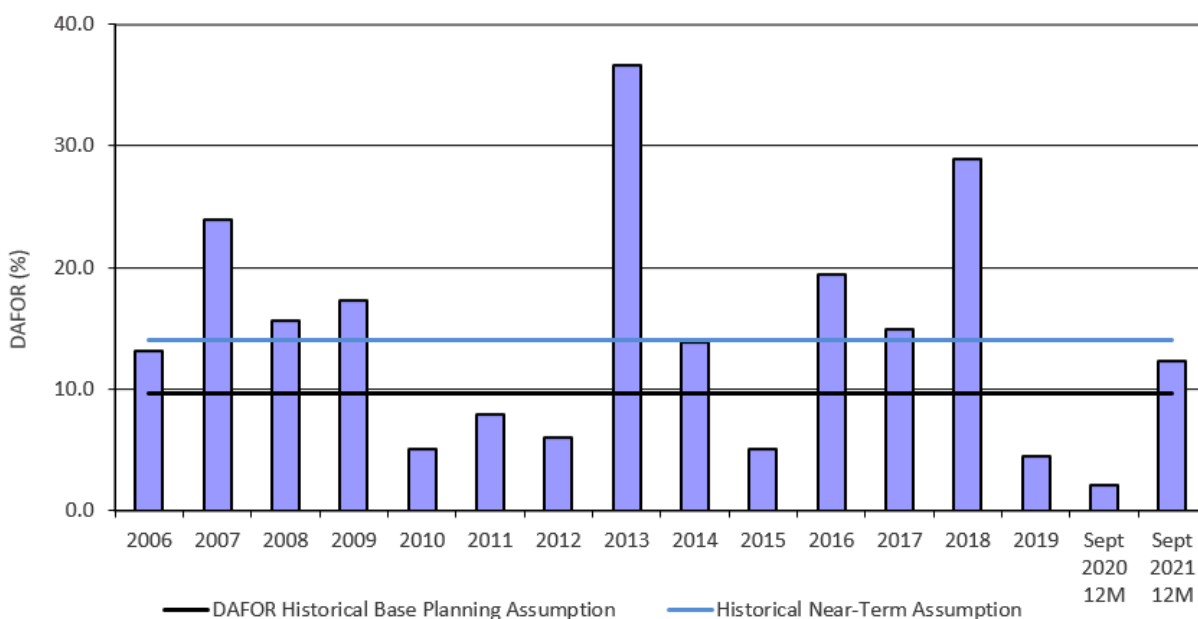


Figure 2: Thermal DAFOR

- 1 For the 12-month period ending September 30, 2021, the weighted DAFOR for all thermal units of
- 2 12.28% is above the historical base planning assumption DAFOR value of 9.64%, but is below the
- 3 historical near-term planning assumption of 14.00%.

- 4 Unit 1 DAFOR was 13.67%, which is above the historical base planning assumption of 9.64%, but is
- 5 below the historical near-term planning assumption of 15.00%. The increase in Unit 1 DAFOR is a result
- 6 of a forced extension of the planned annual maintenance outage. The outage was planned to be
- 7 completed on September 10, 2021 but the unit remained on maintenance outage though the end of

1 September 2021. It is anticipated that the unit will resume operation during the last week of October
2 2021, but may not be released to the Newfoundland and Labrador System Operator for service until
3 November 7, 2021 if balancing of the turbine is determined to be required when the unit is initially put
4 back on line.

5 The forced extension of the Unit 1 outage was caused by a number of significant findings during the
6 execution of the planned major turbine overhaul. Most significant was the additional time required to
7 replace the high temperature studs that connect the upper half of the turbine to the lower half at the
8 horizontal joint. These studs, ranging in size up to 4.5 inches in diameter, were beyond their service life
9 and required replacement as recommended by the turbine OEM, General Electric (“GE”), following an
10 inspection completed during the outage. Failure to replace them could have resulted in the inability to
11 seal the horizontal joint during turbine reassembly, or subsequent high pressure steam leaks from the
12 horizontal joint as a result of excessive stretch of the studs. While Hydro had planned for replacement of
13 the studs, removal of the original studs required materially more time than had originally been allocated
14 for this aspect of the project; 29 of the 116 studs had to be drilled out using specialized equipment and
15 machinists that had to travel to site and self-isolate for two weeks due to COVID-19 restrictions.

16 In addition to the above issue, alignment checks demonstrated the need to adjust the position of the
17 turbine bearings and the position of the generator relative to the turbine shaft. Also, a defect was found
18 on the turbine rotor which required weld repair. Correction of these issues was necessary to ensure a
19 reliable unit going forward, but there is a possibility that the turbine rotor may require balancing as a
20 result. This will not be known until the unit is run up to speed and vibration levels are confirmed. The
21 November 7, 2021 expected return-to-service date assumes that some balancing will be required.

22 Unit 2 DAFOR was 5.48%, which is below the historical base planning assumption of 9.64% and the
23 historical near-term assumption of 10.00%.

24 Unit 3 DAFOR was 20.74%, which is above the historical base planning assumption of 9.64% and the
25 historical near-term planning assumption of 18.00%. This increase in DAFOR is the result of a forced
26 outage caused by a cold-side tube leak on the east side of the Unit 3 boiler, which occurred on
27 September 11, 2021 during return to service after completion of the planned annual outage. The unit
28 remained on forced outage through the end of September 2021 to allow for a complete investigation of
29 the failure and an assessment of the condition of the remaining boiler tubes. Return to service is
30 expected in mid-November 2021 once the necessary assessments and tube replacements are complete.

1 Hydro is following the recommendations from the boiler OEM (B&W), the boiler service provider (GE)
2 and an independent metallurgical engineering company. Hydro has also engaged a specialized boiler
3 tube inspection company (TesTex) to complete the tube inspections.

4 The failure has been determined to be related to large structural attachments to tubes that are found in
5 eight locations on this particular boiler. Work remains ongoing on site to thoroughly inspect tubes.
6 Inspection must be done from the inside of the tubes using specialized probes designed to detect
7 damage in the tube and, as such, a section of each tube that spans the areas of concern must be cut out
8 to provide access for the specialized probes to pass through the tube. Any tubes that are found to have
9 surface indications of depth beyond the fit for service criteria established by the experts in accordance
10 with applicable codes are being replaced. The areas of concern are being expanded until there are at
11 minimum three consecutive tubes that do not show any sign of defect.

12 To date, 65 tubes have been cut into for testing and inspection. Approximately 75% of the scanning is
13 complete and there have been 6 sections of tube in 3 locations that have been identified for
14 replacement. Once inspection is completed and the defects are removed, new tube sections must be fit
15 and welded to replace the sections that were cut out. Before return to service, the insulation that was
16 removed to gain access to the tubes will have to be restored.

17 The current period DAFOR for all three Holyrood units has declined over the 12-month period ending
18 September 30, 2020.

19 **6.0 Gas Turbine UFOP Performance**

20 The combined UFOP for the Hardwoods, Happy Valley, and Stephenville Gas Turbines was 0.81% for the
21 12-month period ending September 30, 2021 (Table 6 and Figure 3). This performance is better than the
22 base planning assumption of 10.62% and the near-term assumption of 20.00% and is improved over
23 performance during the 12-month period ending September 30, 2020. The Stephenville Gas Turbine
24 UFOP for the current period is 0.00%, as compared to the historical base planning assumption of
25 10.62%. The Hardwoods Gas Turbine UFOP for the current period is 0.20%, as compared to the base
26 planning assumption of 10.62%. The Happy Valley Gas Turbine UFOP is 3.18% for the current period, as
27 compared to the base planning assumption of 10.62%. On an individual unit basis, gas turbine UFOP
28 performance for the current period has improved for the Hardwoods, Stephenville, and Happy Valley
29 units over the 12-month period ending September 30, 2020.

Table 6: Gas Turbine UFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
Combined Gas Turbines	125	8.31	0.81	10.62	20.00
Stephenville	50	10.97	0.00	10.62	20.00
Hardwoods	50	6.03	0.20	10.62	20.00
Happy Valley	25	6.70	3.18	10.62	20.00

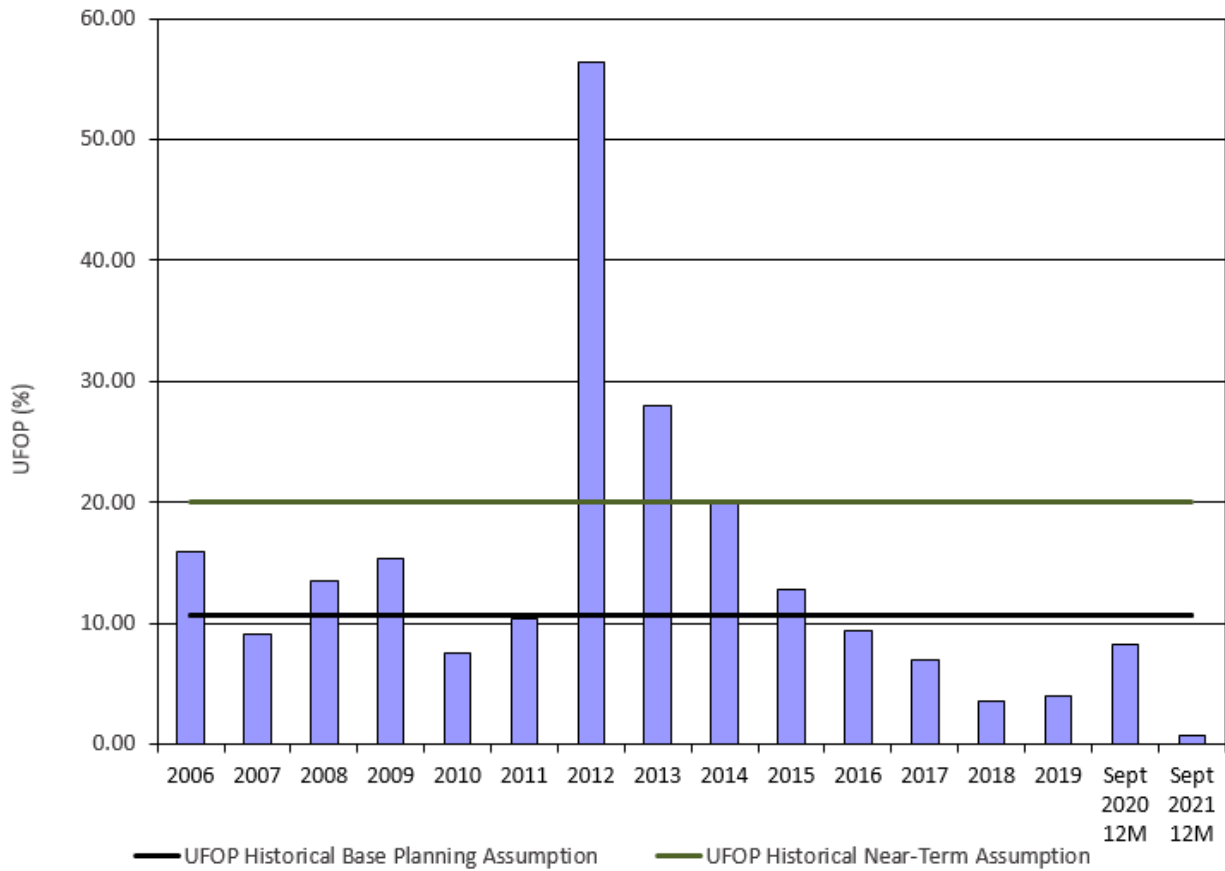


Figure 3: Gas Turbine UFOP: Hardwoods/Happy Valley/Stephenville Units

- 1 The Holyrood Gas Turbine UFOP for the current period is 0.00%, which is below the historical base and
- 2 near-term planning assumptions of 5.00% (Table 7 and Figure 4) and has improved when compared to
- 3 the 12-month period ending September 30, 2020.

Table 7: Holyrood Gas Turbine UFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
Holyrood	123.5	7.59	0.00	5.00	5.00

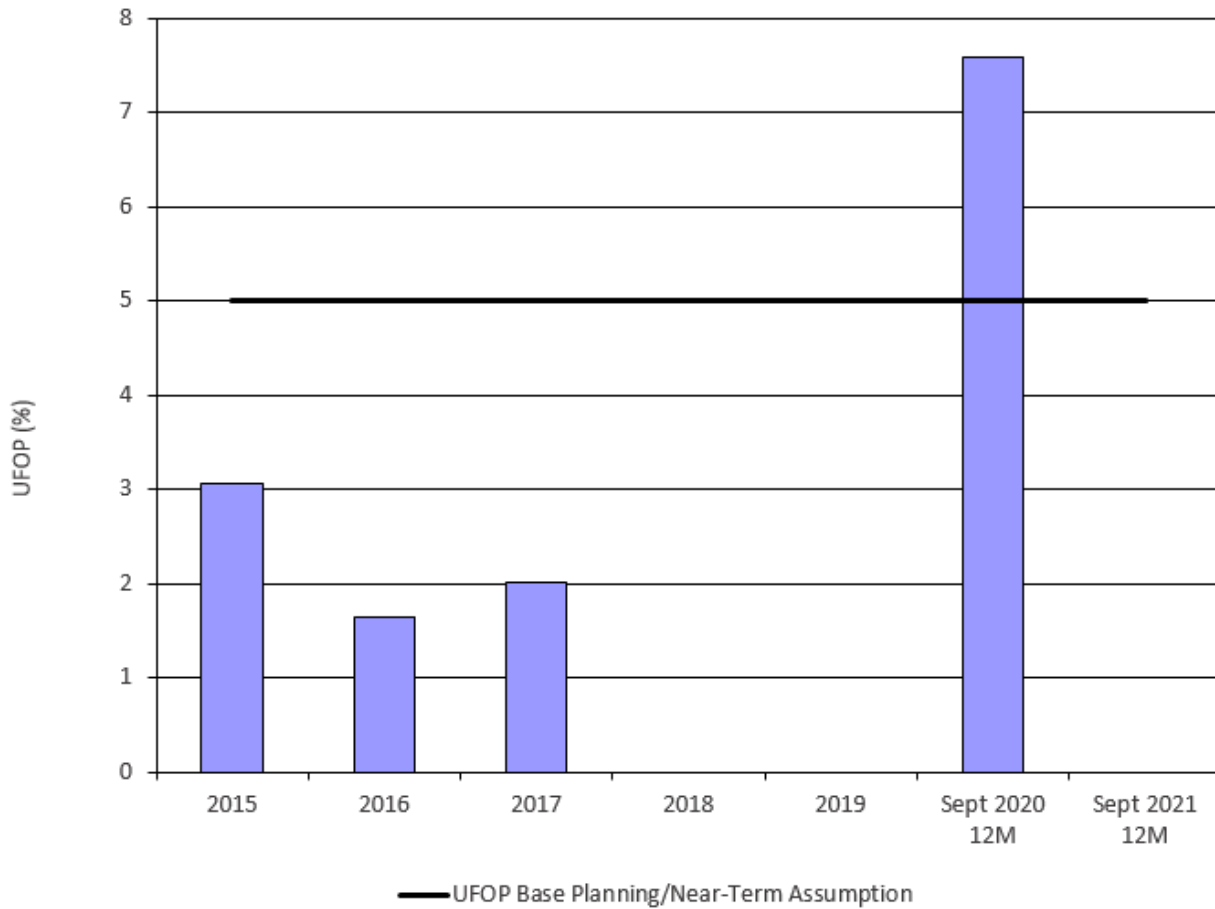


Figure 4: Gas Turbine UFOP: Holyrood Unit

1 7.0 Gas Turbine DAUFOP Performance

2 The combined DAUFOP for the Hardwoods and Stephenville Gas Turbines was 1.04% for the 12-month
 3 period ending September 30, 2021 (Table 8 and Figure 5). This is below the near-term planning
 4 assumption of 30.00%. The Stephenville Gas Turbine DAUFOP for the current period is 0.00%, which is
 5 below the near-term planning assumption of 30.00%. The Hardwoods Gas Turbine DAUFOP for the
 6 current period is 1.26%, which is below the near-term planning assumption of 30.00%. On a per unit
 7 basis, this indicates an improvement in performance over the 12-month period ending September 30,
 8 2020 for both units.

Table 8: Hardwoods/Stephenville Gas Turbine DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Near-Term Planning Assumption (%)
Gas Turbines (HWD/SVL)	100	17.83	1.04	30.00
Stephenville	50	11.89	0.00	30.00
Hardwoods	50	19.87	1.26	30.00

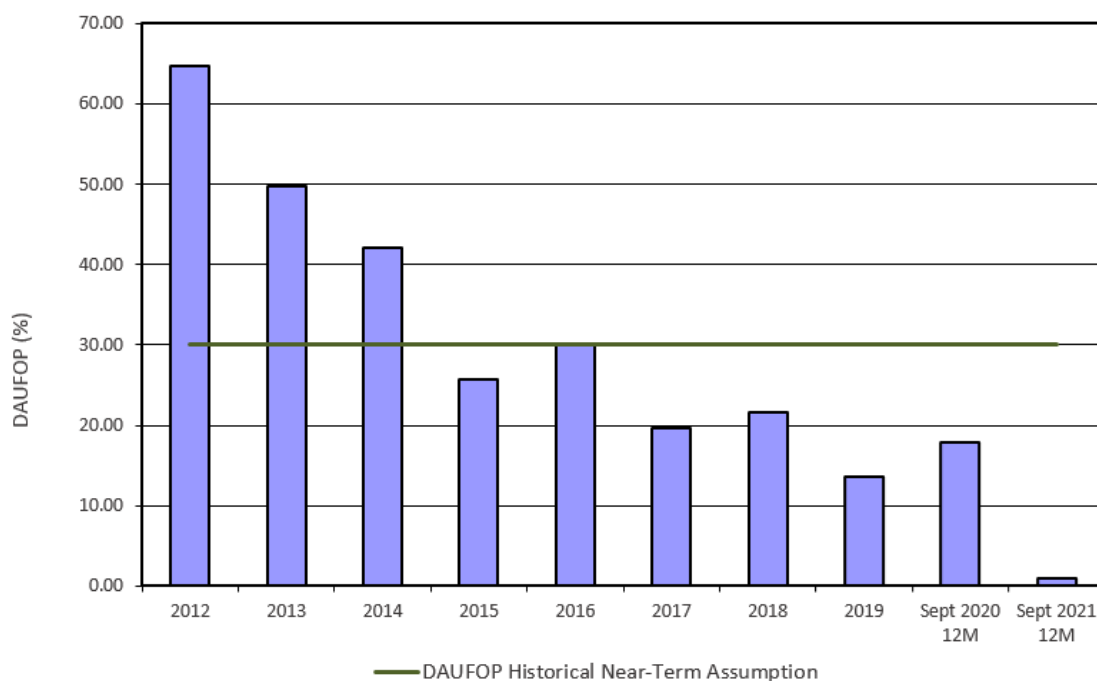


Figure 5: Gas Turbine DAUFOP: Hardwoods/Stephenville Units

- 1 The DAUFOP for the Happy Valley Gas Turbine was 3.18% for the 12-month period ending September
- 2 30, 2021 (Table 9 and Figure 6). This is below the near-term planning assumption of 15.00%, and shows
- 3 an improvement in performance over the 12-month period ending September 30, 2020.

Table 9: Happy Valley Gas Turbine DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Near-Term Planning Assumption (%)
Happy Valley	25	6.70	3.18	15.00

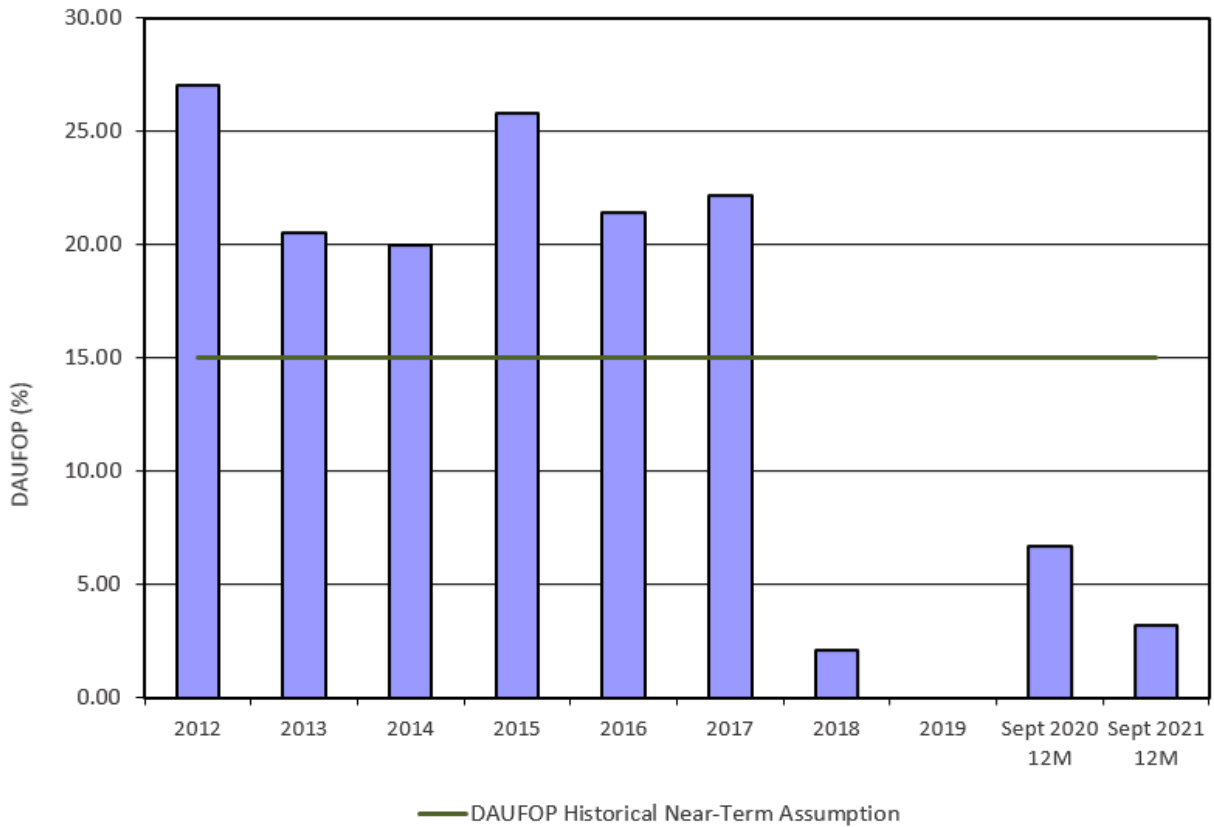


Figure 6: Gas Turbine DAUFOP: Happy Valley Unit

- 1 The Holyrood Gas Turbine DAUFOP of 0.00% for the current period is below the near-term planning
- 2 assumption of 5.00% (Table 10 and Figure 7) and has improved from the 12-month period ending
- 3 September 30, 2020.

Table 10: Holyrood Gas Turbine DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	Historical Near-Term Planning Assumption (%)
Holyrood	123.5	7.59	0.00	5.00

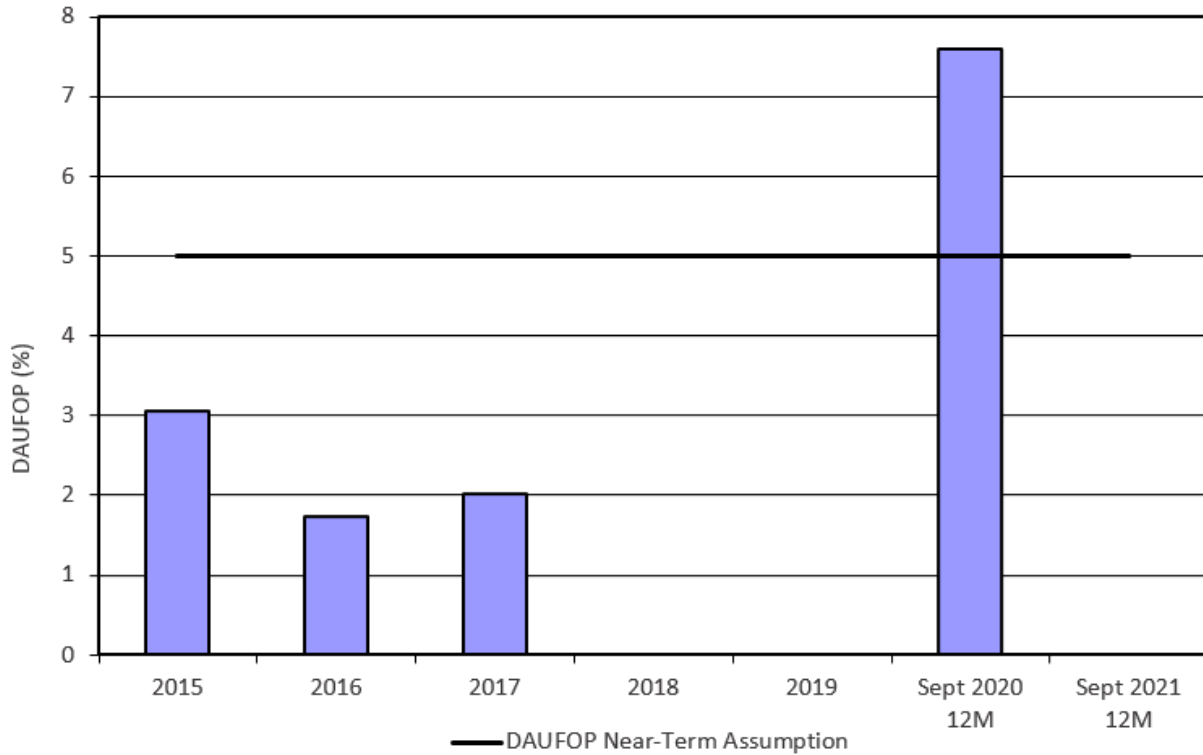


Figure 7: Gas Turbine DAUFOP: Holyrood Unit

8.0 Updated Planning Assumptions/Analysis Values

As part of the Reliability and Resource Adequacy Study, 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 11 summarizes the most recent forced outage rate assumptions as calculated using the forced outage rate methodology.⁶

Table 11: Hydro’s Reliability and Resource Adequacy Study Analysis Values

Unit Type	Measure	Near-Term Analysis Value (%)	Resource Planning Analysis Value (%)
Hydraulic	DAFOR	2.6	2.1
Thermal	DAFOR	15.0	N/A
Gas Turbines			
Happy Valley	DAUFOP	12.0	9.7
Hardwoods and Stephenville	DAUFOP	30.0	N/A
Holyrood	DAUFOP	4.9	1.7

A five-year, capacity-weighted average was applied to the hydroelectric units (Bay d’Espoir, Cat Arm, Hinds Lake, Granite Canal, Upper Salmon, and Paradise River) for the near-term analysis, resulting in a DAFOR of 2.6%, while a ten-year, capacity-weighted average was applied for use in the resource planning model, resulting in a DAFOR of 2.1%. The DAFOR value was based on historical data reflective of Hydro’s maintenance program over the long-term.

DAFORs of 15%, 18%, and 20% were applied to each of the units at the Holyrood TGS to determine the sensitivity of the system to Holyrood TGS availability in the near term. This is consistent with the May 2018 “Near-Term Generation Adequacy Report.” As the Holyrood TGS units are being retired from generation mode in the near term, the units were not included in the long-term analysis; therefore, there is no resource planning analysis value listed for these units. For the total plant, an all units weighted value of 15% is used for the near term.

As the gas turbines in the existing fleet are in varied condition, each was considered on an individual basis rather than applying a weighted average across all units. For the Happy Valley Gas Turbine, a

⁶ Values indicated for Hydro’s near-term analysis reflect those used in the “Reliability and Resource Adequacy Study 2020 Update: Volume II: Near-Term Reliability Report,” Newfoundland and Labrador Hydro, November 18, 2020.

1 three-year, capacity-weighted average was applied to the unit for the near-term analysis, resulting in a
 2 DAUFOP of 12%, while a ten-year, capacity-weighted average was applied for use in the resource
 3 planning model resulting in a DAUFOP of 9.7%. The DAUFOP values were based on historical data
 4 founded upon the unit’s past reliable performance. For the Holyrood Gas Turbine, a scenario-based
 5 approach was used to estimate an appropriate value for the near-term analysis, resulting in a DAUFOP
 6 of 4.9%. For the Hardwoods and Stephenville Gas Turbines, a DAUFOP of 30% was used for the near-
 7 term analysis, consistent with the metrics that were considered in Hydro’s May 2018 “Near-Term
 8 Generation Adequacy Report.” As the Hardwoods and Stephenville Gas Turbines are being considered
 9 for retirement in the near term, these units were not included in the long-term analysis; therefore, there
 10 is no resource planning analysis value listed for these facilities.

11 **9.0 Comparison of Planning Assumptions and Analysis Values**

12 As Hydro’s reliability and adequacy planning assumptions have historically been used in reporting on the
 13 performance of Hydro’s generating units, a comparison of the historical values to those used in the most
 14 recent analysis is provided in Table 12 for clarity.

15 Hydro notes that the Reliability and Resource Adequacy Study did not utilize UFOP in its analysis. The
 16 analysis instead utilized the DAUFOP measure with changes as shown in Table 12.

Table 12: Comparison of Hydro’s Planning Assumptions (%)

Generating Unit Type	Measure	Historical Planning Assumptions		Reliability and Resource Planning Assumptions	
		Historical Base Planning Assumption	Historical Near-Term Planning Assumption	Near-Term Analysis Value	Resource Planning Analysis Value
Hydraulic	DAFOR	0.9	2.6	2.6	2.1
Thermal	DAFOR	9.64	14.0	15.0	N/A
Gas Turbines					
Happy Valley	DAUFOP	-	15.0	12.0	9.7
Hardwoods and Stephenville	DAUFOP	-	30.0	30.0	N/A
Holyrood	DAUFOP	-	5.0	4.9	1.7

- 1 The generating unit performance presented earlier in this report is again presented in Tables 13 to 17
- 2 with comparison to the previous assumptions, as well as the recently revised values. Hydro notes that
- 3 on an asset class basis, the 12-month rolling performance of its generating units has no violations of
- 4 Hydro's current planning assumptions pertaining to asset availability.

Table 13: Hydraulic Weighted DAFOR Performance Comparison

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	May 2018		November 2020	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
All Hydraulic Units - Weighted	954.4	1.25	2.03	0.90	2.60	2.60	2.10
Hydraulic Units							
Bay D'Espoir 1	76.5	3.18	3.31	0.90	3.90	2.60	2.10
Bay D'Espoir 2	76.5	1.63	0.00	0.90	3.90	2.60	2.10
Bay D'Espoir 3	76.5	3.72	0.17	0.90	3.90	2.60	2.10
Bay D'Espoir 4	76.5	4.96	0.24	0.90	3.90	2.60	2.10
Bay D'Espoir 5	76.5	1.13	0.00	0.90	3.90	2.60	2.10
Bay D'Espoir 6	76.5	0.67	0.00	0.90	3.90	2.60	2.10
Bay D'Espoir 7	154.4	0.17	0.29	0.90	3.90	2.60	2.10
Cat Arm 1	67	0.22	0.51	0.90	0.70	2.60	2.10
Cat Arm 2	67	0.27	1.00	0.90	0.70	2.60	2.10
Hinds Lake	75	1.95	0.50	0.90	0.70	2.60	2.10
Upper Salmon	84	0.09	13.03	0.90	0.70	2.60	2.10
Granite Canal	40	0.70	1.73	0.90	0.70	2.60	2.10
Paradise River	8	2.72	0.00	0.90	0.70	2.60	2.10

Table 14: Thermal DAFOR Performance Comparison

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	May 2018		November 2020	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
All Thermal Units - Weighted	490	2.08	12.28	9.64	14.00	15.00	N/A
Thermal Units							
Holyrood 1	170	0.38	13.67	9.64	15.00	15.00	-
Holyrood 2	170	4.59	5.48	9.64	10.00	15.00	-
Holyrood 3	150	0.31	20.74	9.64	18.00	15.00	-

Table 15: Hardwoods/Stephenville Gas Turbine DAUFOP Performance Comparison

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	May 2018		November 2020	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
Gas Turbines (HWD/SVL)	100	17.83	1.04	N/A	30.00	30.00	N/A
Stephenville	50	11.89	0.00	N/A	30.00	30.00	N/A
Hardwoods	50	19.87	1.26	N/A	30.00	30.00	N/A

Table 16: Happy Valley Gas Turbine DAUFOP Performance Comparison

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	May 2018		November 2020	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
Happy Valley	25	6.70	3.18	N/A	15.00	12.00	9.70

Table 17: Holyrood Gas Turbine DAUFOP Performance Comparison

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending September 2020 (%)	12 Months Ending September 2021 (%)	May 2018		November 2020	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
Holyrood	123.5	7.59	0.00	N/A	5.00	4.90	1.70