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October 31, 2022

Board of Commissioners of Public Utilities  
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St. John's, NL A1A 5B2

Attention: Cheryl Blundon  
Director of Corporate Services & Board Secretary

**Re: Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2022**

Please find enclosed Newfoundland and Labrador Hydro's Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2022.

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

Yours truly,

**NEWFOUNDLAND AND LABRADOR HYDRO**

Shirley A. Walsh  
Senior Legal Counsel, Regulatory  
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Encl.

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# **Quarterly Report on Performance of Generating Units for the Twelve Months Ended September 30, 2022**

**October 31, 2022**

**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, 2022.

This report contains forced outage rates for the current 12-month reporting period of October 1, 2021 to September 30, 2022 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, 2020 to September 30, 2021. 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 Electricity Canada (formerly Canadian Electricity Association) guidelines. These guidelines require

1 that derated levels of a generating unit are calculated by converting the operating time at the derated  
 2 level into an equivalent 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 8.0 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, 2022**

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

| <b>Class of Units</b>                       | <b>1-Oct-2020<br/>to<br/>30-Sep-2021</b> | <b>1-Oct-2021<br/>to<br/>30-Sep-2022</b> | <b>Base<br/>Planning<br/>Assumption</b> | <b>Near-Term<br/>Planning<br/>Assumption<sup>1</sup></b> |
|---|--|--|---|--|
| Hydraulic (DAFOR)                           | 2.03                                     | 3.11                                     | 0.90                                    | 2.60   |
| Thermal (DAFOR)                             | 12.28                                    | 30.28                                    | 9.64                                    | 14.00  |
| Combined Gas Turbine (UFOP)                 | 0.81                                     | 2.07                                     | 10.62                                   | 20.00  |
| Holyrood Gas Turbine (UFOP)                 | 0.00                                     | 0.00                                     | 5.00                                    | 5.00   |
| Hardwoods/Stephenville Gas Turbine (DAUFOP) | 1.04                                     | 3.77                                     | -                                       | 30.00  |
| Happy Valley Gas Turbine (DAUFOP)           | 3.18                                     | 0.00                                     | -                                       | 15.00  |
| Holyrood Gas Turbine (DAUFOP)               | 0.00                                     | 0.00                                     | -                                       | 5.00   |

16 As shown in Table 1, hydraulic and thermal DAFOR performance declined for the current 12-month  
 17 period ending September 30, 2022 compared to the 12 months ending September 30, 2021. The UFOP  
 18 performance for the combined gas turbines has declined over the previous period, while the UFOP

<sup>1</sup> Please refer to the “Near-Term Generation Adequacy Report,” Newfoundland and Labrador Hydro, November 15, 2017, s 5.0 for further details.

1 performance for the Holyrood gas turbine remains unchanged. The DAUFOP<sup>2</sup> performance for  
2 Hardwoods and Stephenville has declined, the DAUFOP performance for Happy Valley gas turbine has  
3 improved, and the DAUFOP performance for the Holyrood gas turbine remains unchanged in the current  
4 period compared to the 12 months ending September 30, 2021.

### 5 **3.0 Generation Planning Assumptions**

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

13 Hydro produces reports based on comprehensive reviews of the energy supply for the Island  
14 Interconnected System. This is part of Hydro's analysis of energy supply up to the Muskrat Falls  
15 interconnection. The May 2018 "Near-Term Generation Adequacy Report,"<sup>3</sup> contains an analysis based  
16 on the near-term DAFOR and DAUFOP and the resulting implications for meeting reliability criteria until  
17 the interconnection with the North American Grid. The near-term analysis has been updated since that  
18 time to reflect changes in assumptions with respect to the in-service of the Labrador-Island Link. The  
19 results of this analysis were presented to the Board of Commissioners of Public Utilities ("Board") as part  
20 of the "Labrador-Island Link In-Service Update."<sup>4</sup>

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

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<sup>2</sup> Hydro began reporting DAUFOP performance in January 2018 for its gas turbines.

<sup>3</sup> "Near-Term Generation Adequacy Report," Newfoundland and Labrador Hydro, rev. May 30, 2018 (originally filed May 22, 2018).

<sup>4</sup> "Labrador-Island Link In-Service Update," Newfoundland and Labrador Hydro, October 1, 2018.

<sup>5</sup> 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: 2017<sup>6</sup> 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<br>Near-Term<br>Generation Adequacy<br>Assumption | DAUFOP<br>Near-Term<br>Generation Adequacy<br>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 months ending September 30, 2022 and the 12 months ending
- 5 September 30, 2021 are presented in Table 4 and Chart 1. These are compared to Hydro’s short-term
- 6 generation adequacy assumptions, as used in the May 2018 “Near-Term Generation Adequacy Report,”
- 7 and Hydro’s long-term generation planning assumptions for the forced outage rate.

<sup>6</sup> Please refer to “Near-Term Generation Adequacy Report,” Newfoundland and Labrador Hydro, November 15, 2017, s 5.0 for further details.

Table 4: Hydraulic Weighted DAFOR

| Generating Unit                       | Maximum Continuous Unit Rating (MW) | 12 Months Ending Sept 2021 (%) | 12 Months Ending Sept 2022 (%) | Historical Base Planning Assumption (%) | Historical Near-Term Planning Assumption (%) |
|---------------------------------------|-------------------------------------|--------------------------------|--------------------------------|---|--|
| <b>All Hydraulic Units – Weighted</b> | <b>954.4</b>                        | <b>2.03</b>                    | <b>3.11</b>                    | <b>0.90</b>                             | <b>2.60</b>                                  |
| <b>Hydraulic Units</b>                |                                     |                                |                                |   |  |
| Bay d'Espoir 1                        | 76.5                                | 3.31                           | 0.00                           | 0.90                                    | 3.90   |
| Bay d'Espoir 2                        | 76.5                                | 0.00                           | 0.00                           | 0.90                                    | 3.90   |
| Bay d'Espoir 3                        | 76.5                                | 0.17                           | 0.06                           | 0.90                                    | 3.90   |
| Bay d'Espoir 4                        | 76.5                                | 0.24                           | 0.21                           | 0.90                                    | 3.90   |
| Bay d'Espoir 5                        | 76.5                                | 0.00                           | 33.24                          | 0.90                                    | 3.90   |
| Bay d'Espoir 6                        | 76.5                                | 0.00                           | 0.77                           | 0.90                                    | 3.90   |
| Bay d'Espoir 7                        | 154.4                               | 0.29                           | 0.00                           | 0.90                                    | 3.90   |
| Cat Arm 1                             | 67                                  | 0.51                           | 0.97                           | 0.90                                    | 0.70   |
| Cat Arm 2                             | 67                                  | 1.00                           | 0.10                           | 0.90                                    | 0.70   |
| Hinds Lake                            | 75                                  | 0.50                           | 0.30                           | 0.90                                    | 0.70   |
| Upper Salmon                          | 84                                  | 13.03                          | 10.45                          | 0.90                                    | 0.70   |
| Granite Canal                         | 40                                  | 1.73                           | 3.67                           | 0.90                                    | 0.70   |
| Paradise River                        | 8                                   | 0.00                           | 1.02                           | 0.90                                    | 0.70   |

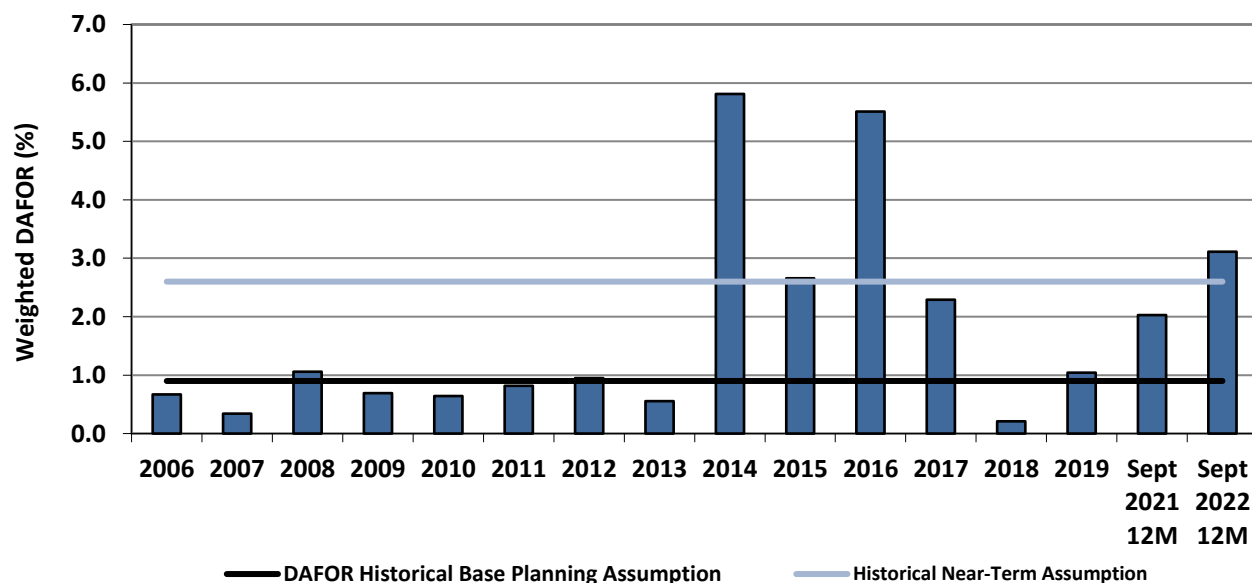


Chart 1: Hydraulic Weighted DAFOR



1 **4.1.1 Bay d’Espoir Hydroelectric Generating Facility**

2 Considering individual hydraulic unit performance, the Bay d’Espoir Unit 5 DAFOR of 33.24% did not  
3 meet the historical base planning assumption of 0.9% and is above the historical near-term planning  
4 assumption of 3.90% for an individual Bay d’Espoir unit. This increase in DAFOR was the result of two  
5 forced outages experienced in March 2022, as previously reported, as well as an additional outage  
6 experienced in July 2022. The first, on March 13, 2022, was caused by the failure of a governor pump  
7 motor. Maintenance crews replaced the failed motor with an inventory spare and the unit was returned  
8 to service. The second outage, on March 30, 2022, was required to address a hot connection on Phase-A  
9 of the unit manual disconnect switch, 29-5. On March 29, 2022, it was reported that the Phase-A  
10 connection was showing 40 degrees higher than Phases B and C. At that time, the unit was derated to  
11 20 MW until it could be removed from service to investigate and complete necessary corrective actions.  
12 The investigation revealed misalignment and poor surface contact on the affected phase. Components  
13 were replaced and the unit returned to service. Temperatures remain acceptable on the affected Phase.

14 Since the previous filing, Bay d’Espoir Unit 5 experienced a forced outage on July 3, 2022 as a result of  
15 the failure of transformer, BDE T5. This transformer was removed, a suitable spare transformer was  
16 installed in its place and the unit successfully synchronized to the system on September 1, 2022 for  
17 testing and released for normal service on September 4, 2022. The investigation into the cause of the  
18 transformer failure is ongoing.

19 **4.1.2 Cat Arm Hydroelectric Generating Station**

20 The Cat Arm Unit 1 DAFOR of 0.97% for the current period did not meet either the historical near-term  
21 planning assumption of 0.7% or the historical base planning assumption of 0.9%. This was the result of  
22 the previously reported deratings experienced in October 2021 that were the result of increased  
23 generator surface air cooler temperatures, as well as one forced outage, experienced on  
24 February 17, 2022, while operating in synchronous condenser mode, which was caused by a low  
25 auxiliary cooling water supply to the unit, experienced when one unit is offline and the other is  
26 operating in sync condense. A capital project was executed in September 2022 to upgrade the cooling  
27 water system in Cat Arm, which included the replacement of cooling water valves.

28 **4.1.3 Granite Canal Hydroelectric Generating Station**

29 The Granite Canal Unit DAFOR of 3.67% for the current period did not meet either the historical near-  
30 term planning assumption of 0.7% or the historical base planning assumption of 0.9%. This increase in

1 DAFOR was the result of three forced outages as previously reported, as well as four additional outages  
2 that occurred since the previous filing. As previously filed, from April 13 to 17, 2022, the Granite Canal  
3 unit was the result of a leaking generator bearing oil cooler. The leaking cooler was replaced with a  
4 spare and the unit returned to service. On May 3, 2022, following a distribution line trip, the Granite  
5 Canal essential service breaker tripped resulting in a subsequent trip of the generating unit. Following  
6 the investigation, it was determined that the trip settings on the essential service breaker were not  
7 suitable for the operation and the breaker was replaced with one equipped with appropriate trip  
8 settings. On May 6, 2022, while attempting to return the unit to service, a generator surface air cooler  
9 developed a leak and required replacement. This work was completed and the Granite Canal Unit was  
10 returned to service on May 7, 2022.

11 Since the previous filing, the Granite Canal unit has experienced four additional outages. The first two  
12 outages were vibration trips, which occurred on July 22 and 31, 2022. The cause of the vibration in both  
13 events was determined to be excessive operation in the unit's rough zone. Both outages were short in  
14 duration and resulted in no damage to the unit. It is not unexpected to see increased vibration levels  
15 when the unit is operated in its defined rough zone, therefore care must be taken to avoid prolonged  
16 operation in its rough zone. To mitigate the likelihood of future occurrences, changes were made to  
17 automatic generation control parameters to maintain operation above the rough zone where possible.  
18 The third outage occurred on August 26, 2022 and appeared to be caused by high turbine bearing  
19 temperatures; however, upon further investigation it was determined that the device setting was too  
20 low, thus false alarming. This setting was adjusted to the correct value and the unit returned to service  
21 the same day. The final outage impacting the DAFOR for the current period occurred on September 8,  
22 2022. This outage resulted from loss of signal to the unit's governor controller. Investigation at site  
23 revealed no obvious concerns, communication to the controller was re-established and the unit  
24 returned to service the same day. Further investigation into the cause of this final outage is ongoing.

#### 25 **4.1.4 Upper Salmon Hydroelectric Generating Station**

26 The Upper Salmon Unit DAFOR of 10.45% for the current period did not meet either the historical near-  
27 term planning assumption of 0.7% or the historical base planning assumption of 0.9%. As filed  
28 previously, during the 2021 planned annual preventative maintenance inspection in August 2021, a  
29 significant crack on rim guidance block #10 was discovered. Further inspection of all rim guidance blocks  
30 revealed that over 35% (6 of 16 total blocks) of the rim guidance blocks exhibited cracking. Metallurgy  
31 analysis determined the failure mode was due to fatigue cracking. The cracking was beyond repair and

1 the blocks were replaced. In addition, after consultation with the original equipment manufacturer  
2 (“OEM”), it was determined adjacent blocks to the cracked blocks were subjected to higher than normal  
3 forces due to the reduced strength of the cracked blocks and would likely suffer damage and failure. To  
4 ensure continued reliable operation of the Upper Salmon Unit, all 16 blocks were replaced. This work  
5 was not included in the scope of the planned outage, thus resulting in a forced extension to the outage  
6 that lasted from August 21 to October 21, 2021.

7 The OEM attributes the cause of this issue to be a combination of an out-of-round stator and a loose  
8 rotor rim. Addressing this life extension work was not possible prior to the 2021–2022 winter season;  
9 however, replacement of the blocks before the winter operating season is considered a suitable  
10 approach by the OEM to reduce the residual risk to an acceptable level. In addition to the block  
11 replacement, the OEM has recommended implementing a non-destructive testing (“NDT”) inspection  
12 program of the blocks at 12-week intervals until life extension work is completed. This inspection  
13 program is now included in Hydro’s work plan.

14 NDT inspections completed in November 2021, February 2022, May 2022, July 2022, and October 2022  
15 revealed no material concerns with newly installed blocks; however, cracks and fretting corrosion were  
16 found on rim keys similar to those previously seen. Following further consultation with the OEM, it was  
17 advised to increase the frequency of scheduled inspections from every 2,000 operating hours to every  
18 1,000 hours. This 1,000 hour frequency will continue through the winter operating period.

19 The planned life extension is expected to be carried out to address the out-of-round stator and loose  
20 rotor rim, as per the approved supplemental capital expenditure application.<sup>7</sup>

21 As previously reported, the Upper Salmon Unit experienced two additional forced outages that  
22 contributed to this increase in DAFOR. The first, on November 5, 2021, was the result of a failed low  
23 voltage jumper on the generator step-up transformer, USL T1. The investigation into the cause of the  
24 failure is ongoing and includes a review of the preventive maintenance program. The failed jumper was  
25 replaced and the unit returned to service on November 10, 2021. A short time after returning to service,  
26 on November 10, 2021, the unit experienced a field ground and was once again taken offline. An  
27 investigation discovered a ground on rotor pole #9, this pole was replaced with a spare and a thorough

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<sup>7</sup> Approved in *Public Utilities Act*, RSNL 1990, c P-47, Board Order No. P.U. 18(2022), Board of Commissioners of Public Utilities, May 20, 2022.

1 inspection and cleaning of the unit were completed. The unit was returned to service on  
 2 November 17, 2021.

3 **4.1.5 Paradise River Hydroelectric Generating Station**

4 The Paradise River Unit DAFOR of 1.02% did not meet either the historical near-term planning  
 5 assumption of 0.7% or the historical base planning assumption of 0.9%. As previously reported, the  
 6 Paradise River Unit was unavailable due to a forced outage from October 17 to 19, 2021. This outage  
 7 was the result of a failed servomotor seal. This seal was original and has been in service since the unit  
 8 was first commissioned. The seal was replaced and the unit returned to service.

9 **5.0 Thermal Unit DAFOR Performance**

10 Detailed results for the 12 months ending September 30, 2022 and the 12 months ending  
 11 September 30, 2021 are presented in Table 5 and Chart 2. These results are compared to Hydro’s short-  
 12 term generation adequacy assumptions, as used in the May 2018 “Near-Term Generation Adequacy  
 13 Report,” and Hydro’s long-term generation planning assumptions for the forced outage rate.

**Table 5: Thermal DAFOR**

| <b>Generating Unit</b>              | <b>Maximum<br/>Continuous<br/>Unit Rating<br/>(MW)</b> | <b>12 Months<br/>Ending<br/>Sept 2021<br/>(%)</b> | <b>12 Months<br/>Ending<br/>Sept 2022<br/>(%)</b> | <b>Historical Base<br/>Planning<br/>Assumption<br/>(%)</b> | <b>Historical Near-<br/>Term Planning<br/>Assumption<br/>(%)</b> |
|-------------------------------------|--|---|---|--|--|
| <b>All Thermal Units – Weighted</b> | <b>490</b>   | <b>12.28</b>                                      | <b>30.28</b>                                      | <b>9.64</b>  | <b>14.00</b>   |
| <b>Thermal Units</b>                |  |   |   |  |  |
| Holyrood 1                          | 170  | 13.67   | 30.42   | 9.64   | 15.00  |
| Holyrood 2                          | 170  | 5.48  | 30.50   | 9.64   | 10.00  |
| Holyrood 3                          | 150  | 20.74   | 29.79   | 9.64   | 18.00  |

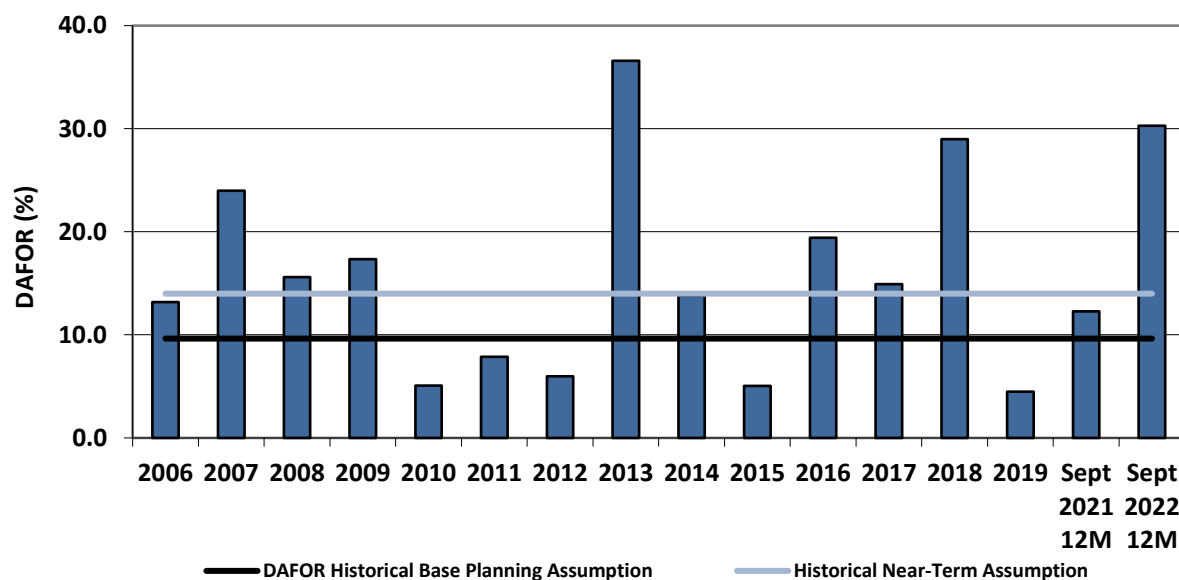


Chart 2: Thermal DAFOR

1 For the 12 months ending September 30, 2022, the weighted DAFOR for all thermal units of 30.28% is  
 2 above the historical base planning assumption DAFOR value of 9.64% and the historical near-term  
 3 planning assumption of 14.00%.

4 **5.1.1 Holyrood TGS Unit 1**

5 Unit 1 DAFOR was 30.42%, which is above both the historical base planning assumption of 9.64% and  
 6 the historical near-term planning assumption of 15.00%. The increase in Unit 1 DAFOR is a result of two  
 7 significant events as reported in the previous filing; a forced extension of the planned 2021 annual  
 8 maintenance outage and a water hammer event that caused damage to the cold reheat line between  
 9 the turbine and the boiler during start up of the unit upon completion of the 2021 annual outage.

10 The annual maintenance outage was planned for completion on September 10, 2021, but Unit 1  
 11 remained on maintenance outage until October 20, 2021. This forced extension was caused by a number  
 12 of significant findings during the execution of the planned major turbine overhaul. Most significant was  
 13 the additional time required to replace the high-temperature studs that connect the upper half of the  
 14 turbine to the lower half at the horizontal joint. Also significant was damage found on the rotor and  
 15 diaphragms, which had to be corrected on site by GE experts, as well as the alignment issues, which  
 16 required correction. The COVID-19 pandemic protocols associated with bringing experts to the site  
 17 further contributed to the schedule delay.

1 On October 25, 2021, Unit 1 experienced a water hammer event in the cold reheat pipe while restarting  
2 following successful completion of the overspeed testing required to verify turbine operation after  
3 completion of the overhaul work. The unit was offline until December 1, 2021 to allow an investigation  
4 of the cause of the event, assessment of the damage, and completion of all remedial work. The  
5 investigating team determined that water had been leaking into the cold reheat pipe through a spray  
6 station designed to control reheat steam temperature when online. The presence of this water during  
7 start up led to a water hammer event, which caused damage to the piping and supports. As  
8 recommended from the investigation, spray station valves were refurbished or replaced as appropriate  
9 during the 2022 annual outage season.

### 10 **5.1.2 Holyrood TGS Unit 2**

11 Unit 2 DAFOR was 30.50 %, which is above the historical base planning assumption of 9.64% and the  
12 historical near-term assumption of 10.00%. This increase in DAFOR is the result of a failure of power  
13 transformer T2, which was discussed in the previous filing. The failure occurred on November 12, 2021,  
14 and the unit was returned to service utilizing a spare transformer on January 13, 2022. With the spare  
15 transformer installed, Unit 2 has been proven to have an output capacity of 150 MW, which was the  
16 capacity of the unit through the remainder of the 2021–2022 winter operating season. With the recent  
17 replacement of a cooling pump on transformer T2, it is anticipated that Unit 2 will be increased to a  
18 170 MW rating for the coming winter season. The actual capacity will be confirmed through testing  
19 when the unit is returned to service and the system is able to accept high loads from the unit. An  
20 investigation into the cause of the T2 power transformer failure is ongoing, Hydro has engaged outside  
21 technical support through both Hitachi Energy (ABB) and Doble Engineering to assist with this  
22 investigation.

### 23 **5.1.3 Holyrood TGS Unit 3**

24 Unit 3 DAFOR was 29.79%, 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 was discussed in the  
27 previous filing. The leak occurred on September 11, 2021, during the return to service after the  
28 completion of the planned annual outage. Unit 3 remained on forced outage until November 19, 2021,  
29 to allow for a complete investigation of the failure, an assessment of the condition of the remaining  
30 boiler tubes, and replacement of all damaged tubes.

1 The current period DAFOR performance for all three Holyrood units has declined over the 12 months  
 2 ending September 30, 2021.

### 3 **6.0 Gas Turbine UFOP Performance**

4 The combined UFOP for the Hardwoods, Happy Valley, and Stephenville Gas Turbines was 2.07% for the  
 5 12 months ending September 30, 2022 (Table 6 and Chart 3). This performance is better than the base  
 6 planning assumption of 10.62% and the near-term assumption of 20.00% but is declined over  
 7 performance during the 12 months ending September 30, 2021. The Stephenville Gas Turbine UFOP for  
 8 the current period is 5.83%, as compared to the historical base planning assumption of 10.62%. The  
 9 Hardwoods Gas Turbine UFOP for the current period is 0.21%, as compared to the base planning  
 10 assumption of 10.62%. The Happy Valley Gas Turbine UFOP is 0.00% for the current period, as compared  
 11 to the base planning assumption of 10.62%. On an individual unit basis, gas turbine UFOP performance  
 12 for the current period has declined for the Hardwoods and Stephenville units, and improved for the  
 13 Happy Valley unit over the 12 months ending September 30, 2021.

**Table 6: Gas Turbine UFOP**

| <b>Gas Turbine Units</b>     | <b>Maximum Continuous Unit Rating (MW)</b> | <b>12 months ending Sept 2021 (%)</b> | <b>12 months ending Sept 2022 (%)</b> | <b>Historical Base Planning Assumption (%)</b> | <b>Historical Near-Term Planning Assumption (%)</b> |
|------------------------------|--|---------------------------------------|---------------------------------------|--|---|
| <b>Combined Gas Turbines</b> | <b>125</b>                                 | <b>0.81</b>                           | <b>2.07</b>                           | <b>10.62</b>                                   | <b>20.00</b>  |
| Stephenville                 | 50   | 0.00                                  | 5.83                                  | 10.62  | 20.00   |
| Hardwoods                    | 50   | 0.20                                  | 0.21                                  | 10.62  | 20.00   |
| Happy Valley                 | 25   | 3.18                                  | 0.00                                  | 10.62  | 20.00   |

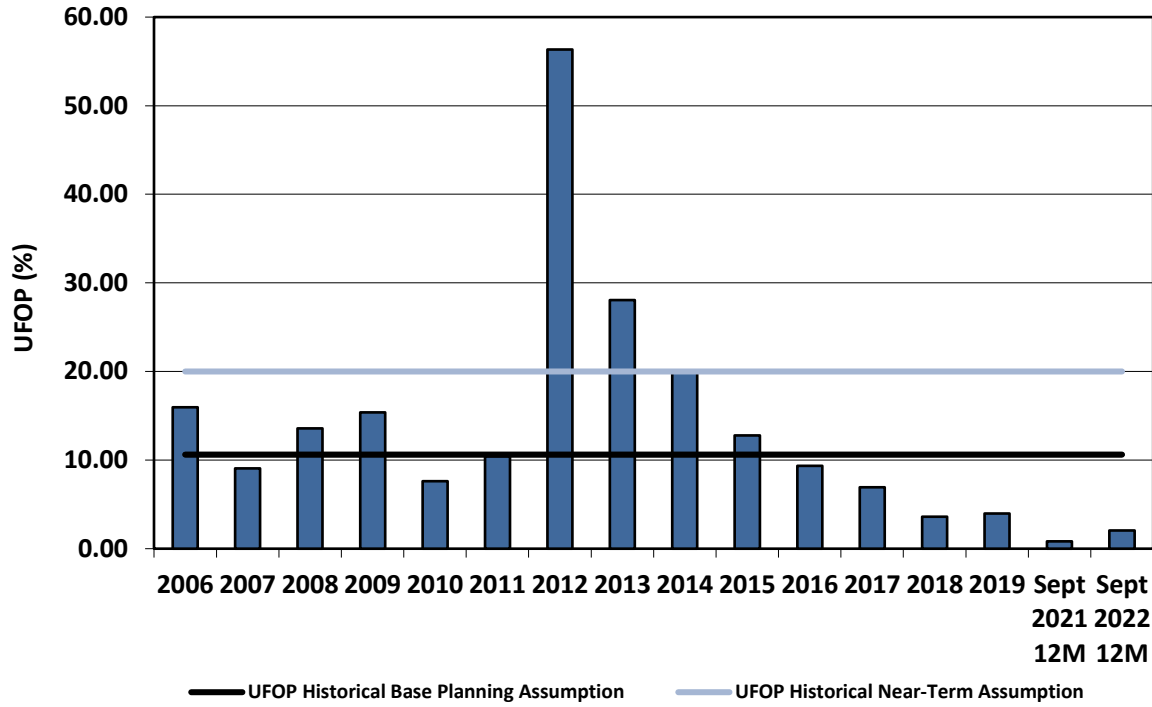


Chart 3: Gas Turbine UFOP: Hardwoods/Happy Valley/Stephenville Units

- 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 Chart 4) and is consistent over the 12 months
- 3 ending September 30, 2021.

Table 7: Holyrood Gas Turbine UFOP

| Gas Turbine Units | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | Historical Base Planning Assumption (%) | Historical Near-Term Planning Assumption (%) |
|-------------------|-------------------------------------|--------------------------------|--------------------------------|---|--|
| Holyrood          | 123.5                               | 0.00                           | 0.00                           | 5.00                                    | 5.00   |



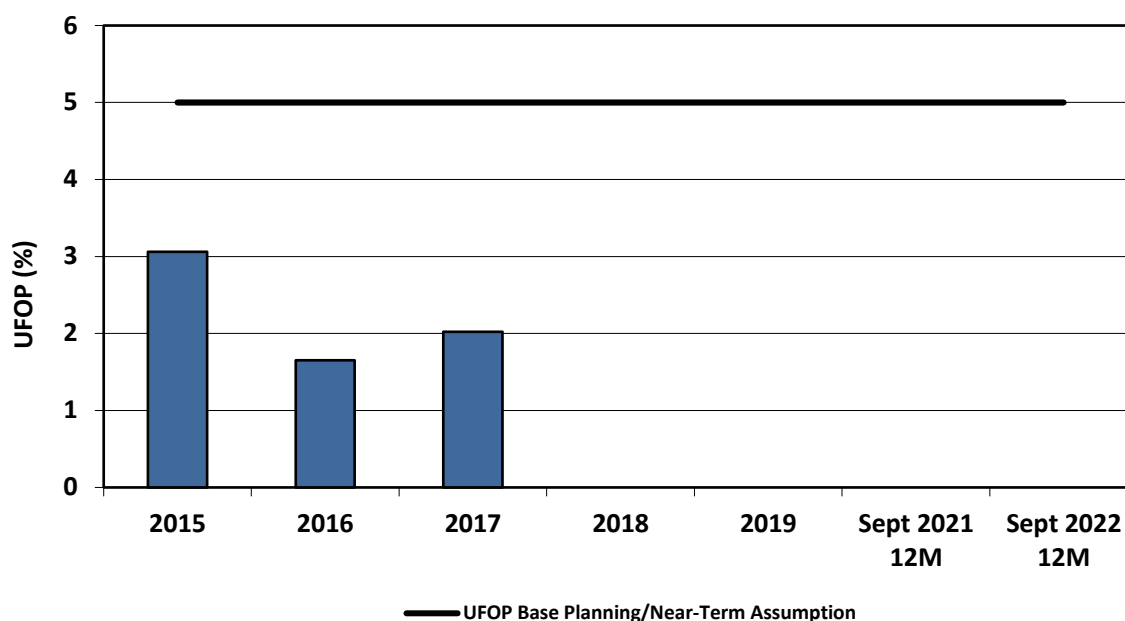


Chart 4: Gas Turbine UFOP: Holyrood Unit

## 7.0 Gas Turbine DAUFOP Performance

The combined DAUFOP for the Hardwoods and Stephenville Gas Turbines was 3.77% for the 12 months ending September 30, 2022 (Table 8 and Chart 5). This is below the near-term planning assumption of 30.00%. The Stephenville Gas Turbine DAUFOP for the current period is 6.44%, which is below the near-term planning assumption of 30.00%. The Hardwoods Gas Turbine DAUFOP for the current period is 1.92%, which is below the near-term planning assumption of 30.00%. On a per unit basis, this indicates a decline in performance over the 12 months ending September 30, 2021 for both units.

Table 8: Hardwoods/Stephenville Gas Turbine DAUFOP

| Gas Turbine Units             | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | Historical Near-Term Planning Assumption (%) |
|-------------------------------|-------------------------------------|--------------------------------|--------------------------------|--|
| <b>Gas Turbines (HWD/SVL)</b> | <b>100</b>                          | 1.04                           | 3.77                           | 30.00  |
| Stephenville                  | 50                                  | 0.00                           | 6.44                           | 30.00  |
| Hardwoods                     | 50                                  | 1.26                           | 1.92                           | 30.00  |

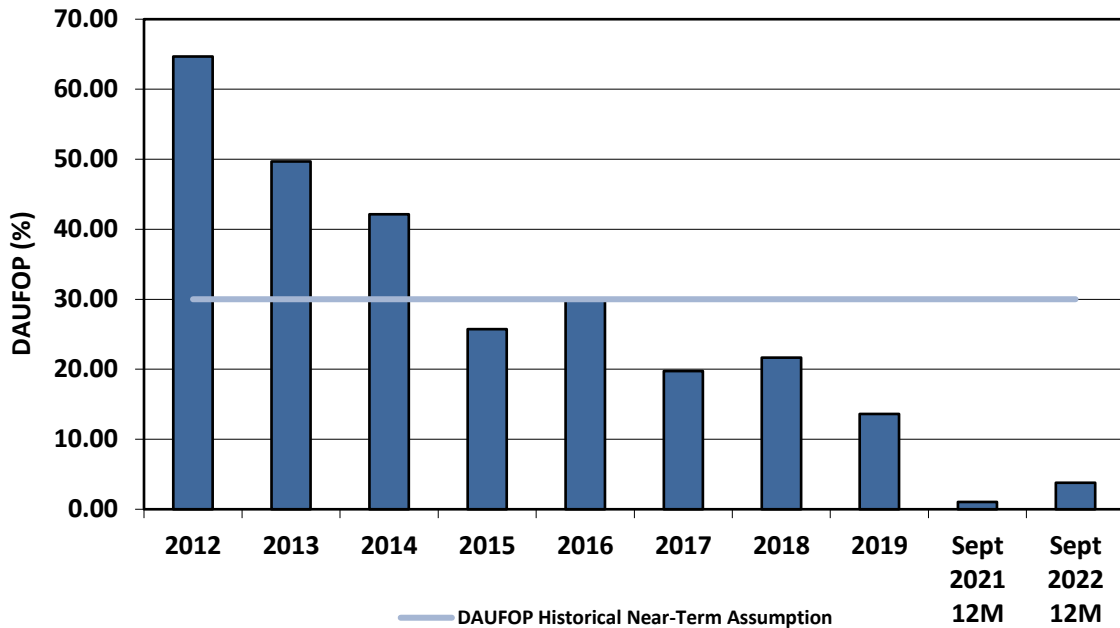


Chart 5: Gas Turbine DAUFOP: Hardwoods/Stephenville Units

- 1 The DAUFOP for the Happy Valley Gas Turbine was 0.00% for the 12 months ending September 30, 2022
- 2 (Table 9 and Chart 6). This is below the near-term planning assumption of 15.00% and shows an
- 3 improvement in performance over the 12 months ending September 30, 2021.

Table 9: Happy Valley Gas Turbine DAUFOP

| Gas Turbine Units | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | Historical Near-Term Planning Assumption (%) |
|-------------------|-------------------------------------|--------------------------------|--------------------------------|--|
| Happy Valley      | 25                                  | 3.18                           | 0.00                           | 15.00  |

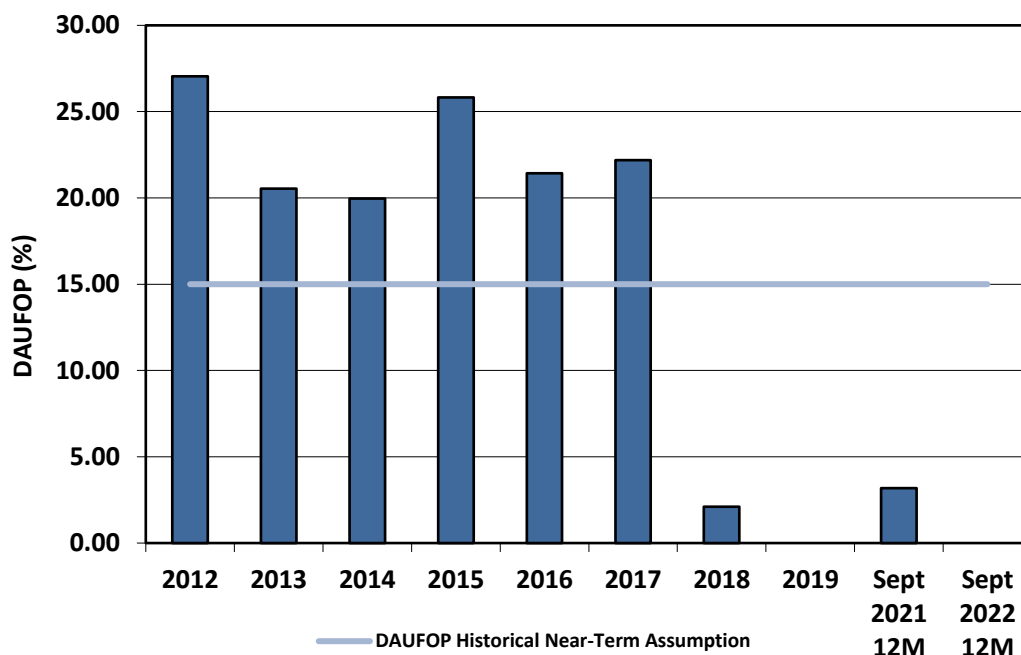


Chart 6: Gas Turbine DAUFOP: Happy Valley Unit

- 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 Chart 7), and is consistent when compared to the 12 months ending
- 3 September 30, 2021.

Table 10: Holyrood Gas Turbine DAUFOP

| Gas Turbine Units | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | Historical Near-Term Planning Assumption (%) |
|-------------------|-------------------------------------|--------------------------------|--------------------------------|--|
| Holyrood          | 123.5                               | 0.00                           | 0.00                           | 5.00   |

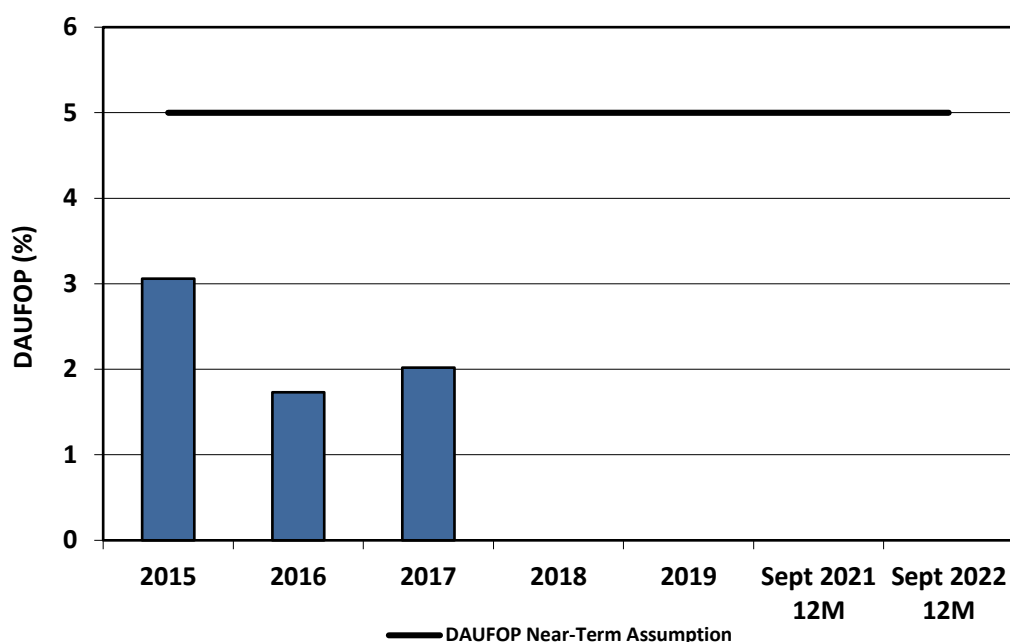


Chart 7: Gas Turbine DAUFOP: Holyrood Unit

## 1 8.0 Updated Planning Assumptions/Analysis Values

2 As part of the Reliability and Resource Adequacy Study, Hydro detailed the process undertaken for  
 3 determining the forced outage rates most appropriate for use in its near-term reliability assessments  
 4 and long-term resource adequacy analysis. Table 11 summarizes the most recent forced outage rate  
 5 assumptions as calculated using the forced outage rate methodology.<sup>8</sup>

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                                  |

<sup>8</sup> Values indicated for Hydro’s near-term analysis reflect those used in the “Reliability and Resource Adequacy Study 2022 Update: Volume II: Near-Term Reliability Report – May Report,” Newfoundland and Labrador Hydro, May 16, 2022.

1 A five-year, capacity-weighted average was applied to the hydraulic units (Bay d’Espoir, Cat Arm, Hinds  
2 Lake, Granite Canal, Upper Salmon, and Paradise River) for the near-term analysis, resulting in a DAFOR  
3 of 2.6%,<sup>9</sup> while a ten-year, capacity-weighted average was applied for use in the resource planning  
4 model, resulting in a DAFOR of 2.1%. The DAFOR value was based on historical data reflective of Hydro’s  
5 maintenance program over the long term.

6 DAFORs of 15%, 20%, and 34% were applied to each of the units at the Holyrood TGS to determine the  
7 sensitivity of the system to Holyrood TGS availability in the near term. This is a deviation from the  
8 May 2018 “Near-Term Generation Adequacy Report,” which previously used values of 15%, 18%, and  
9 20%. At the time of the May 2018 filing, the the Holyrood TGS units were planned to be retired from  
10 generation mode in the near term. With that fact in mind, the units were not included in the long-term  
11 analysis; therefore, there is no resource planning analysis value listed for these units. For the total plant,  
12 an all units weighted value of 15% is used for the near term.

13 As the gas turbines in the existing fleet are in varied conditions, each was considered on an individual  
14 basis rather than applying a weighted average across all units. For the Happy Valley Gas Turbine, a  
15 three-year, capacity-weighted average was applied to the unit for the near-term analysis, resulting in a  
16 DAUFOP of 12%, while a ten-year, capacity-weighted average was applied for use in the resource  
17 planning model resulting in a DAUFOP of 9.7%. The DAUFOP values were based on historical data  
18 founded upon the unit’s past reliable performance. For the Holyrood Gas Turbine, a scenario-based  
19 approach was used to estimate an appropriate value for the near-term analysis, resulting in a DAUFOP  
20 of 4.9%. For the Hardwoods and Stephenville Gas Turbines, a DAUFOP of 30% was used for the near-  
21 term analysis, consistent with the metrics that were considered in Hydro’s May 2018 “Near-Term  
22 Generation Adequacy Report.” As the Hardwoods and Stephenville Gas Turbines are being considered  
23 for retirement in the near term, these units were not included in the long-term analysis; therefore, there  
24 is no resource planning analysis value listed for these facilities.

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<sup>9</sup> In its most recent Near-term Reliability Report, filed May 16, 2022, Hydro deviated from the forced outage rate methodology as described when selecting forced outage rates for its hydraulic units as the result of the prescribed methodology did not accurately represent the risk of unit outage. For the hydraulic units, Hydro maintained the capacity-weight average DAFOR from its Near-Term Reliability Report filed in November 2021, which is higher than the five-year DAFOR, increasing the forced outage rates to more appropriately represent the risk of failure in the near term.

## 9.0 Comparison of Planning Assumptions and Analysis Values

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

Hydro notes that the Reliability and Resource Adequacy Study did not utilize UFOP in its analysis. The 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                              |

The generating unit performance presented earlier in this report is again presented in Table 13 to Table 17, with comparisons to the previous assumptions, as well as the recently revised values. Hydro notes that on an asset class basis, the 12-month rolling performance of its generating units has violated Hydro’s current planning assumptions pertaining to asset availability for both hydraulic and thermal units. Details of what contributed to these violations are included in Sections 4.0 and 5.0 of this report.

Table 13: Hydraulic Weighted DAFOR Performance Comparison

| Generating Unit                       | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | May 2018                              |  | November 2020                         |                                      |
|---------------------------------------|-------------------------------------|--------------------------------|--------------------------------|---------------------------------------|--|---------------------------------------|--------------------------------------|
|                                       |                                     |                                |                                | Historic Base Planning Assumption (%) | Historic Near-Term Planning Assumption (%) | Near-Term Planning Analysis Value (%) | Resource Planning Analysis Value (%) |
| <b>All Hydraulic Units - weighted</b> | 954.4                               | 2.03                           | 3.11                           | 0.90                                  | 2.60                                       | 2.60                                  | 2.10                                 |
| <b>Hydraulic Units</b>                |                                     |                                |                                |                                       |  |                                       |                                      |
| Bay D'Espoir 1                        | 76.5                                | 3.31                           | 0.00                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 2                        | 76.5                                | 0.00                           | 0.00                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 3                        | 76.5                                | 0.17                           | 0.06                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 4                        | 76.5                                | 0.24                           | 0.21                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 5                        | 76.5                                | 0.00                           | 33.24                          | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 6                        | 76.5                                | 0.00                           | 0.77                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Bay D'Espoir 7                        | 154.4                               | 0.29                           | 0.00                           | 0.90                                  | 3.90                                       | 2.60                                  | 2.10                                 |
| Cat Arm 1                             | 67                                  | 0.51                           | 0.97                           | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |
| Cat Arm 2                             | 67                                  | 1.00                           | 0.10                           | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |
| Hinds Lake                            | 75                                  | 0.50                           | 0.30                           | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |
| Upper Salmon                          | 84                                  | 13.03                          | 10.45                          | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |
| Granite Canal                         | 40                                  | 1.73                           | 3.67                           | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |
| Paradise River                        | 8                                   | 0.00                           | 1.02                           | 0.90                                  | 0.70                                       | 2.60                                  | 2.10                                 |

Table 14: Thermal DAFOR Performance Comparison

| Generating Unit                     | Maximum Continuous Unit Rating (MW) | 12 months ending Sept 2021 (%) | 12 months ending Sept 2022 (%) | May 2018                              |  | November 2020                         |                                      |
|-------------------------------------|-------------------------------------|--------------------------------|--------------------------------|---------------------------------------|--|---------------------------------------|--------------------------------------|
|                                     |                                     |                                |                                | Historic Base Planning Assumption (%) | Historic Near-Term Planning Assumption (%) | Near-Term Planning Analysis Value (%) | Resource Planning Analysis Value (%) |
| <b>All Thermal Units - weighted</b> | 490                                 | 12.28                          | 30.28                          | 9.64                                  | 14.00                                      | 15.00                                 | N/A                                  |
| <b>Thermal Units</b>                |                                     |                                |                                |                                       |  |                                       |                                      |
| Holyrood 1                          | 170                                 | 13.67                          | 30.42                          | 9.64                                  | 15.00                                      | 15.00                                 | -                                    |
| Holyrood 2                          | 170                                 | 5.48                           | 30.50                          | 9.64                                  | 10.00                                      | 15.00                                 | -                                    |
| Holyrood 3                          | 150                                 | 20.74                          | 29.79                          | 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 Sept 2021 (%) | 12 months ending Sept 2022 (%) | May 2018                              |  | November 2020                         |                                      |
|-------------------------------|-------------------------------------|--------------------------------|--------------------------------|---------------------------------------|--|---------------------------------------|--------------------------------------|
|                               |                                     |                                |                                | Historic Base Planning Assumption (%) | Historic Near-Term Planning Assumption (%) | Near-Term Planning Analysis Value (%) | Resource Planning Analysis Value (%) |
| <b>Gas Turbines (HWD/SVL)</b> | 100                                 | 1.04                           | 1.16                           | N/A                                   | 30.00                                      | 30.00                                 | N/A                                  |
| Stephenville                  | 50                                  | 0.00                           | 0.99                           | N/A                                   | 30.00                                      | 30.00                                 | N/A                                  |
| Hardwoods                     | 50                                  | 1.26                           | 1.21                           | 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 Sept 2021 (%) | 12 months ending Sept 2022 (%) | 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                                  | 3.18                           | 0.00                           | 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 Sept 2021 (%) | 12 months ending Sept 2022 (%) | May 2018                              |  | November 2020                         |                                      |
|-------------------|-------------------------------------|--------------------------------|--------------------------------|---------------------------------------|--|---------------------------------------|--------------------------------------|
|                   |                                     |                                |                                | Historic Base Planning Assumption (%) | Historic Near-Term Planning Assumption (%) | Near-Term Planning Analysis Value (%) | Resource Planning Analysis Value (%) |
| Holyrood GT       | 123.5                               | 0.00                           | 0.00                           | N/A                                   | 5.00                                       | 4.90                                  | 1.70                                 |