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January 31, 2023

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

Attention: Cheryl Blundon  
Director of Corporate Services and Board Secretary

**Re: Quarterly Report on Performance of Generating Units for the Twelve Months Ended December 31, 2022**

Please find enclosed Newfoundland and Labrador Hydro's Quarterly Report on Performance of Generating Units for the Twelve Months Ended December 31, 2022.

Should you have any questions, please contact the undersigned.

Yours truly,

**NEWFOUNDLAND AND LABRADOR HYDRO**

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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 December 31, 2022

January 31, 2023

A report to the Board of Commissioners of Public Utilities



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1 **1.0 Introduction**

2 In this report, Newfoundland and Labrador Hydro (“Hydro”) provides data on forced outage rates of its  
3 generating facilities. The data provided pertains to historical forced outage rates and assumptions Hydro  
4 uses in its assessments of resource adequacy. This report covers the performance of Hydro’s generating  
5 units for the 12 months ended December 31, 2022.

6 This report contains forced outage rates for the current 12-month reporting period of January 1, 2022 to  
7 December 31, 2022 for individual generating units at hydraulic facilities, the Holyrood Thermal  
8 Generating Station (“Holyrood TGS”), and Hydro’s gas turbines. This report also provides, for  
9 comparison purposes, the individual generating unit data on forced outage rates for the period of  
10 January 1, 2020 to December 31, 2021. Further, total asset class data is presented based on the calendar  
11 year for the years 2006 to 2020.

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

16 DAFOR is a metric that measures the percentage of time that a unit or group of units is unable to  
17 generate at its maximum continuous rating due to forced outages or unit deratings. The DAFOR for each  
18 unit is weighted to reflect differences in generating unit sizes to provide a company total and reflect the  
19 relative impact a unit’s performance has on overall generating performance. This measure is applied to  
20 hydraulic and thermal units; however, it is not applicable to gas turbines because of their operation as  
21 standby units and their relatively low operating hours.

22 UFOP and DAUFOP are measures used for gas turbines. UFOP measures the percentage of time that a  
23 unit or group of units will encounter a forced outage and not be available when required. DAUFOP is a  
24 metric that measures the percentage of time that a unit or group of units will encounter a forced outage  
25 and not be available when required. This metric includes the impact of unit deratings.

26 The forced outage rates include outages that remove a unit from service completely, as well as instances  
27 when units are derated. If a unit’s output is reduced by more than 2%, the unit is considered derated

1 under Electricity Canada<sup>1</sup> guidelines. These guidelines require that derated levels of a generating unit  
 2 are calculated by converting the operating time at the derated 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 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 these assumptions form the basis of Hydro’s current planning processes, this report  
 14 also includes the historical assumptions and style to maintain similarity to previous reports.

## 15 **2.0 Overview for Period Ending December 31, 2022**

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

<b>Class of Units</b>	<b>1-Jan-2021 to 31-Dec-2021</b>	<b>1-Jan-2022 to 31-Dec-2022</b>	<b>Base Planning Assumption</b>	<b>Near-Term Planning Assumption<sup>2</sup></b>
Hydraulic (DAFOR)	3.09	2.01	0.90	2.60
Thermal (DAFOR)	33.72	7.09	9.64	14.00
Combined Gas Turbine (UFOP)	0.55	5.50	10.62	20.00
Holyrood Gas Turbine (UFOP)	0.00	0.00	5.00	5.00
Hardwoods/Stephenville Gas Turbine (DAUFOP)	1.73	6.88	-	30.00
Happy Valley Gas Turbine (DAUFOP)	2.13	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 improved for the current 12-month  
 17 period ending December 31, 2022 compared to the 12 months ending December 31, 2021. The UFOP

<sup>1</sup> Formerly Canadian Electricity Association.

<sup>2</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 combined gas turbines has declined over the previous period, while the UFOP  
2 performance for the Holyrood Gas Turbine remains unchanged. The DAUFOP<sup>3</sup> performance for  
3 Hardwoods and Stephenville has declined, the DAUFOP performance for Happy Valley Gas Turbine has  
4 improved, and the DAUFOP performance for the Holyrood Gas Turbine remains unchanged in the  
5 current period compared to the 12 months ending December 31, 2021.

### 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 the revised assumptions on reporting of generation unit performance  
10 are discussed in Section 9.0 of this report. While the revised assumptions form the basis of Hydro's  
11 current planning processes, this report also 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 the energy supply for the Island  
15 Interconnected System. This is part of Hydro's analysis of energy supply up to the Muskrat Falls  
16 interconnection. The May 2018 "Near-Term Generation Adequacy Report,"<sup>4</sup> contains an analysis based  
17 on the near-term DAFOR and DAUFOP and the resulting implications for meeting reliability criteria until  
18 the interconnection with the North American Grid. The near-term analysis has been updated since that  
19 time to reflect changes in assumptions with respect to the in-service of the Labrador-Island Link. The  
20 results of this analysis were presented to the Board of Commissioners of Public Utilities as part of the  
21 "Labrador-Island Link In-Service Update."<sup>5</sup>

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 newer and can be expected to have better availability than the older units.<sup>6</sup>

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<sup>3</sup> Hydro began reporting DAUFOP performance in January 2018 for its gas turbines.

<sup>4</sup> "Near-Term Generation Adequacy Report," Newfoundland and Labrador Hydro, rev. May 30, 2018 (originally filed May 22, 2018).

<sup>5</sup> "Labrador-Island Link In-Service Update," Newfoundland and Labrador Hydro, October 1, 2018.

<sup>6</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 System* proceeding.

**Table 2: 2017<sup>7</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 Near-Term Generation Adequacy Assumption	DAUFOP 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 months ending December 31, 2022 and the 12 months ending
- 5 December 31, 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>7</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 Dec 2021 (%)	12 Months Ending Dec 2022 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
<b>All Hydraulic Units – Weighted</b>	954.4	3.09	2.01	0.90	2.60
<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	0.00	0.06	0.90	3.90
Bay d'Espoir 4	76.5	0.21	0.22	0.90	3.90
Bay d'Espoir 5	76.5	0.00	27.87	0.90	3.90
Bay d'Espoir 6	76.5	0.16	0.61	0.90	3.90
Bay d'Espoir 7	154.4	0.00	0.00	0.90	3.90
Cat Arm 1	67	1.30	0.14	0.90	0.70
Cat Arm 2	67	1.06	0.05	0.90	0.70
Hinds Lake	75	0.46	0.35	0.90	0.70
Upper Salmon	84	22.69	0.00	0.90	0.70
Granite Canal	40	1.88	3.10	0.90	0.70
Paradise River	8	1.45	0.00	0.90	0.70

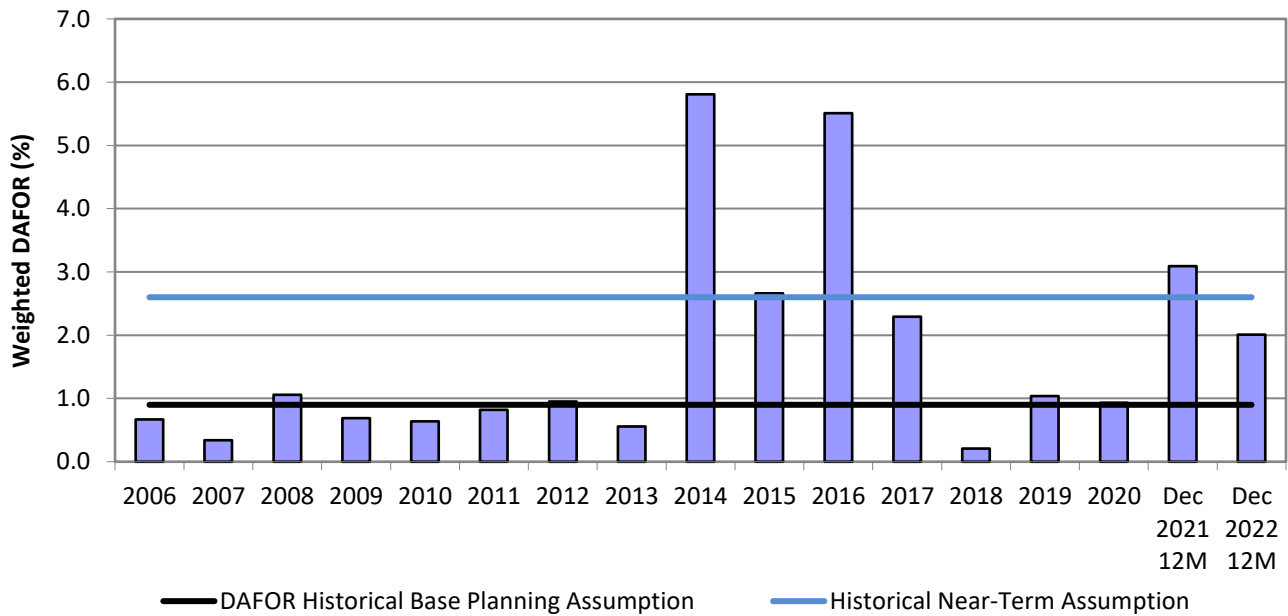


Chart 1: Hydraulic Weighted DAFOR



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

2 Considering individual hydraulic unit performance, the Bay d’Espoir Unit 5 DAFOR of 27.87% 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 well as an additional outage experienced in July 2022 as  
6 previously reported. The first, on March 13, 2022, was caused by the failure of a governor pump motor.  
7 Maintenance crews replaced the failed motor with an inventory spare and the unit was returned to  
8 service. The second outage, on March 30, 2022, was required to address a hot connection on Phase-A of  
9 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 Thirdly, Bay d’Espoir Unit 5 experienced a forced outage on July 3, 2022 as a result of the failure of  
15 transformer, BDE T5. This transformer was removed, a suitable spare transformer was installed in its  
16 place and the unit successfully synchronized to the system on September 1, 2022 for testing and  
17 released for normal service on September 4, 2022. The investigation into the cause of the transformer  
18 failure is ongoing.

19 **4.1.2 Granite Canal Hydroelectric Generating Station**

20 The Granite Canal Unit DAFOR of 3.10% for the current period did not meet either the historical near-  
21 term planning assumption of 0.7% or the historical base planning assumption of 0.9%. This increase in  
22 DAFOR was the result of seven forced outages as previously reported. From April 13, 2022 to  
23 April 17, 2022, the Granite Canal unit forced outage was the result of a leaking generator bearing oil  
24 cooler. The leaking cooler was replaced with a spare and the unit returned to service. On May 3, 2022,  
25 following a distribution line trip, the Granite Canal essential service breaker tripped resulting in a  
26 subsequent trip of the generating unit. Following the investigation, it was determined that the trip  
27 settings on the essential service breaker were not suitable for the operation and the breaker was  
28 replaced with one equipped with appropriate trip settings. On May 6, 2022, while attempting to return  
29 the unit to service, a generator surface air cooler developed a leak and required replacement. This work  
30 was completed and the Granite Canal Unit was returned to service on May 7, 2022.

1 In addition, the Granite Canal unit experienced two outages caused by vibration trips, which occurred on  
 2 July 22, 2022 and July 31, 2022. The cause of the vibration in both events was determined to be  
 3 excessive operation in the unit’s rough zone. Both outages were short in duration and resulted in no  
 4 damage to the unit. It is not unexpected to see increased vibration levels when the unit is operated in its  
 5 defined rough zone, therefore care must be taken to avoid prolonged operation in its rough zone. To  
 6 mitigate the likelihood of future occurrences, changes were made to automatic generation control  
 7 parameters to maintain operation above the rough zone where possible. The sixth outage occurred on  
 8 August 26, 2022 and appeared to be caused by high turbine bearing temperatures; however, upon  
 9 further investigation it was determined that the device setting was too low, thus false alarming. This  
 10 setting was adjusted to the correct value and the unit returned to service the same day. The final outage  
 11 impacting the DAFOR for the current period occurred on September 8, 2022. This outage resulted from  
 12 loss of signal to the unit’s governor controller. Investigation at site revealed no obvious concerns,  
 13 communication to the controller was re-established and the unit returned to service the same day.  
 14 Further investigation into the cause of this outage did not yield conclusive results; however, it has been  
 15 four months since the event and the governor controller has performed normally since being returned  
 16 to service.

17 **5.0 Thermal Unit DAFOR Performance**

18 Detailed results for the 12 months ending December 31, 2022 and the 12 months ending  
 19 December 31, 2021 are presented in Table 5 and Chart 2. These results are compared to Hydro’s short-  
 20 term generation adequacy assumptions, as used in the May 2018 “Near-Term Generation Adequacy  
 21 Report,” and Hydro’s long-term generation planning assumptions for the forced outage rate.

**Table 5: Thermal DAFOR**

<b>Generating Unit</b>	<b>Maximum Continuous Unit Rating (MW)</b>	<b>12 Months Ending Dec 2021 (%)</b>	<b>12 Months Ending Dec 2022 (%)</b>	<b>Historical Base Planning Assumption (%)</b>	<b>Historical Near-Term Planning Assumption (%)</b>
<b>All Thermal Units – Weighted</b>	<b>490</b>	<b>33.72</b>	<b>7.09</b>	<b>9.64</b>	<b>14.00</b>
<b>Thermal Units</b>					
Holyrood 1	170	34.50	9.27	9.64	15.00
Holyrood 2	170	26.19	5.86	9.64	10.00
Holyrood 3	150	42.12	6.10	9.64	18.00

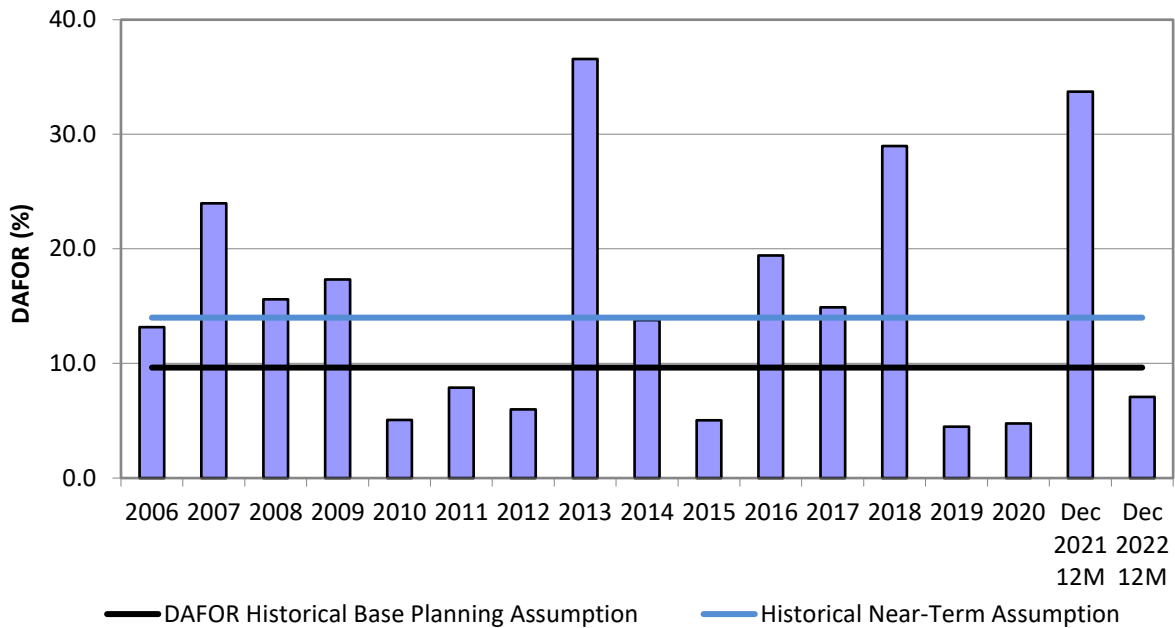


Chart 2: Thermal DAFOR

1 For the 12 months ending December 31, 2022, the weighted DAFOR for all thermal units of 7.09% is  
 2 below the historical base planning assumption DAFOR value of 9.64% and the historical near-term  
 3 planning assumption of 14.00%. All individual unit DAFOR outcomes for the current period are below  
 4 their respective historical base and near-term planning assumptions.

5 The current period DAFOR performance for all three Holyrood units has improved over the 12 months  
 6 ending December 31, 2021.

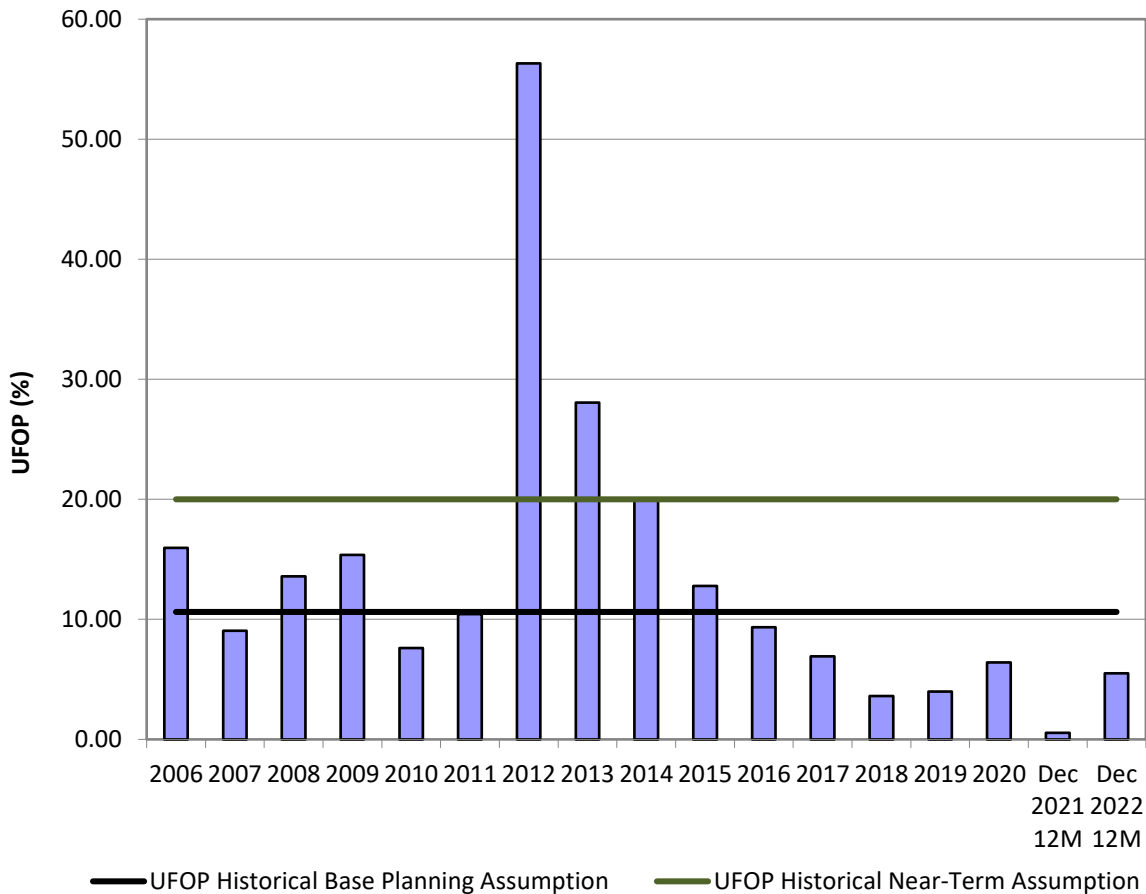
## 7 6.0 Gas Turbine UFOP Performance

8 The combined UFOP for the Hardwoods, Happy Valley, and Stephenville Gas Turbines was 5.50% for the  
 9 12 months ending December 31, 2022 (Table 6 and Chart 3). This performance is better than the base  
 10 planning assumption of 10.62% and the near-term assumption of 20.00% but has declined in  
 11 comparison to performance during the 12 months ending December 31, 2021. The Stephenville Gas  
 12 Turbine UFOP for the current period is 10.89%, as compared to the historical base planning assumption  
 13 of 10.62%. The Hardwoods Gas Turbine UFOP for the current period is 1.29%, as compared to the  
 14 historical base planning assumption of 10.62%. The Happy Valley Gas Turbine UFOP is 0.00% for the  
 15 current period, as compared to the base planning assumption of 10.62%. On an individual unit basis, gas

- 1 turbine UFOP performance for the current period has declined for the Hardwoods and Stephenville units,
- 2 and improved for the Happy Valley unit over the 12 months ending December 31, 2021.

**Table 6: Gas Turbine UFOP**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending Dec 2021 (%)	12 months ending Dec 2022 (%)	Historical Base Planning Assumption (%)	Historical Near-Term Planning Assumption (%)
<b>Combined Gas Turbines</b>	<b>125</b>	<b>0.55</b>	<b>5.50</b>	<b>10.62</b>	<b>20.00</b>
Stephenville	50	0.38	10.89	10.62	20.00
Hardwoods	50	0.12	1.29	10.62	20.00
Happy Valley	25	2.13	0.00	10.62	20.00

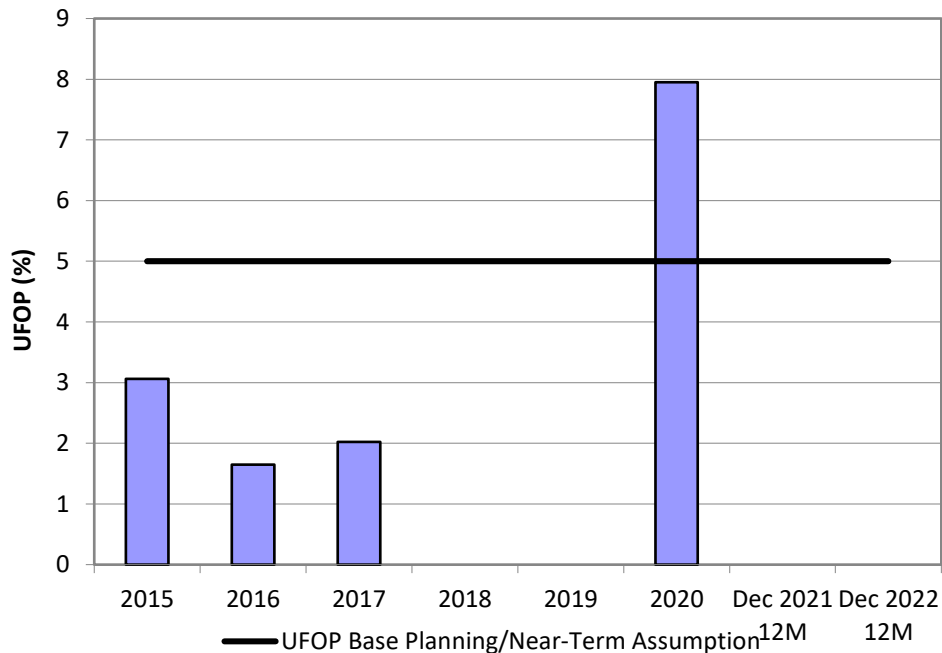


**Chart 3: Gas Turbine UFOP: Hardwoods/Happy Valley/Stephenville Units**

- 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 December 31, 2021.

**Table 7: Holyrood Gas Turbine UFOP**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending Dec 2021 (%)	12 months ending Dec 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**

**4 6.1.1 Stephenville Gas Turbine**

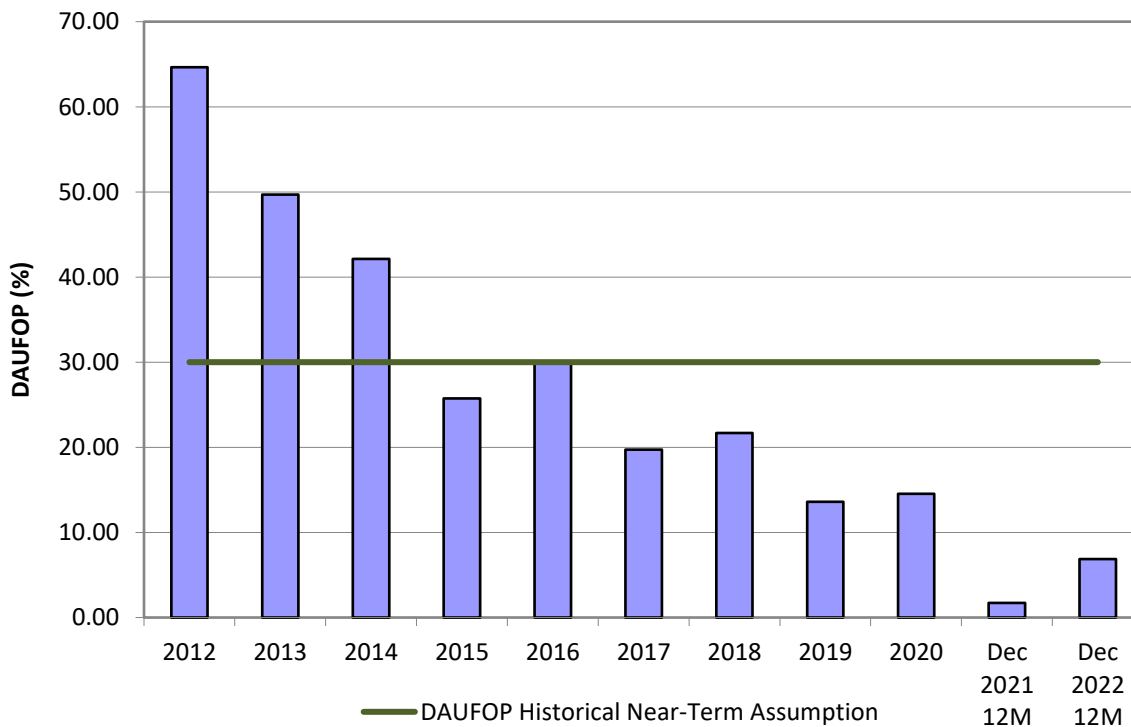
- 5 The Stephenville Gas Turbine UFOP of 10.89% for the current period did not meet the historical base
- 6 panning assumption of 10.62%, but was better than the historical near-term planning assumption of
- 7 20%. This increase in UFOP was the result of a glycol system leak which occurred on
- 8 September 27, 2022. This leak was repaired, necessary clean-up completed, and the unit returned to
- 9 service on October 16, 2022.

## 7.0 Gas Turbine DAUFOP Performance

The combined DAUFOP for the Hardwoods and Stephenville Gas Turbines was 6.88 % for the 12 months ending December 31, 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 10.89 %, which is below the near-term planning assumption of 30.00%. The Hardwoods Gas Turbine DAUFOP for the current period is 1.29%, 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 December 31, 2021 for both units.

**Table 8: Hardwoods/Stephenville Gas Turbine DAUFOP**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending Dec 2021 (%)	12 months ending Dec 2022 (%)	Historical Near-Term Planning Assumption (%)
<b>Gas Turbines (HWD/SVL)</b>	<b>100</b>	<b>1.73</b>	<b>6.88</b>	<b>30.00</b>
Stephenville	50	1.11	10.89	30.00
Hardwoods	50	1.91	1.29	30.00

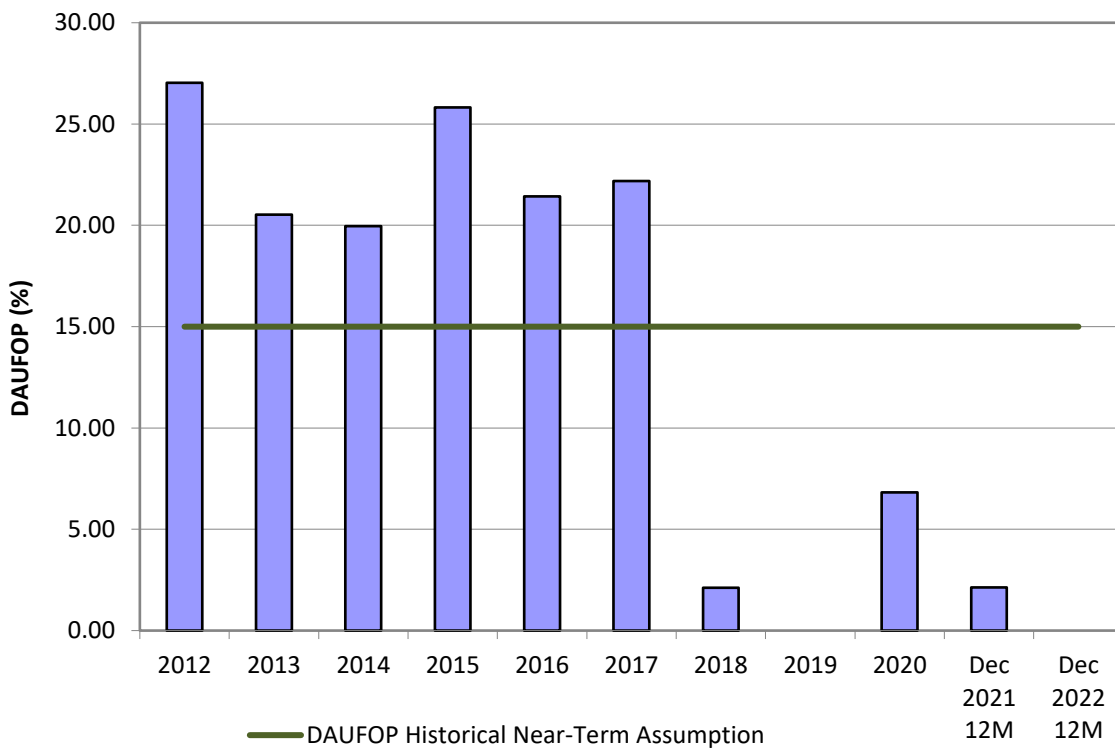


**Chart 5: Gas Turbine DAUFOP: Hardwoods/Stephenville Units**

- 1 The DAUFOP for the Happy Valley Gas Turbine was 0.00% for the 12 months ending December 31, 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 December 31, 2021.

**Table 9: Happy Valley Gas Turbine DAUFOP**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending Dec 2021 (%)	12 months ending Dec 2022 (%)	Historical Near-Term Planning Assumption (%)
Happy Valley	25	2.13	0.00	15.00

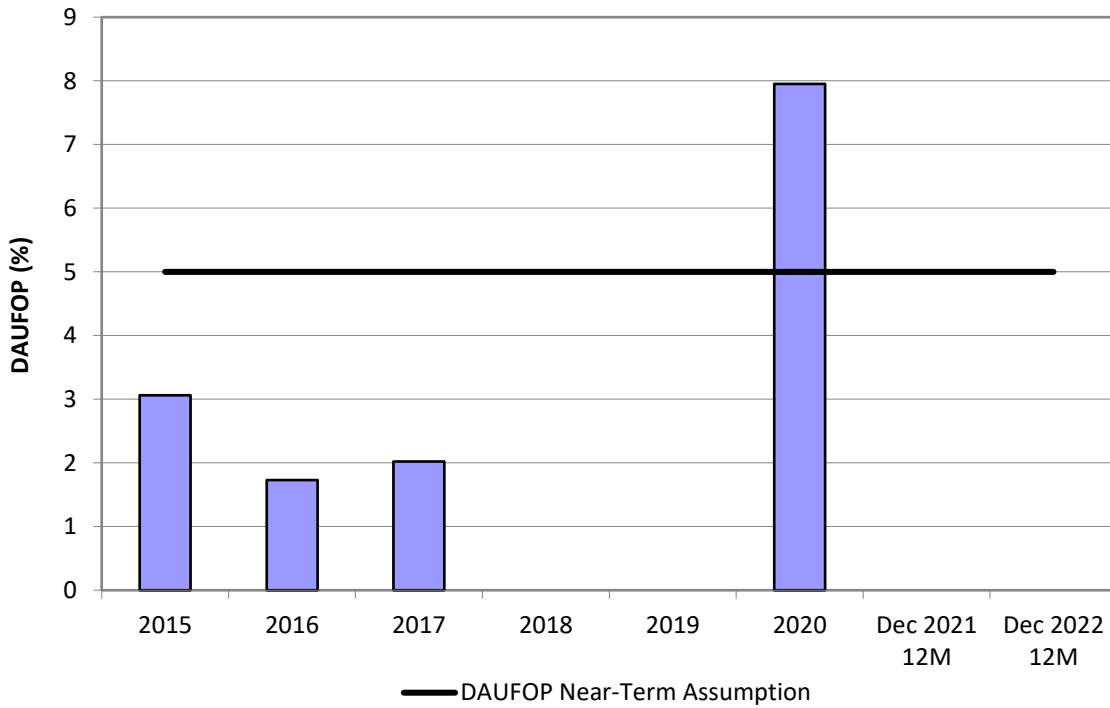


**Chart 6: Gas Turbine DAUFOP: Happy Valley Unit**

- 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 December 31, 2021.

**Table 10: Holyrood Gas Turbine DAUFOP**

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



**Chart 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.<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	2.3	2.3
Thermal	DAUFOP	20.0 <sup>9</sup>	20.0
Gas Turbines	-	-	-
Happy Valley	DAUFOP	6.7	7.6
Hardwoods and Stephenville	DAUFOP	30.0	N/A
Holyrood	DAUFOP	4.9	4.9

A five-year, capacity-weighted average was applied to the hydraulic 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%,<sup>10</sup> while a ten-year, capacity-weighted average was applied for use in the resource planning model, resulting in a DAFOR of 2.3%. The DAFOR value was based on historical data reflective of Hydro’s maintenance program over the long term.

Historically, forced outage rates for the three units at the Holyrood TGS have been reported using the DAFOR metric, predominately used for units that operate in a continuous (base-load) capacity. As presented in Hydro’s Reliability and Resource Adequacy Study – 2022 Update,<sup>11</sup> there are reliability concerns associated with the operation of the units at the Holyrood TGS in a standby capacity. When considering standby or peaking operations of units at the Holyrood TGS, DAFOR is no longer the most

<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 – November Report,” Newfoundland and Labrador Hydro, November 15, 2022.

<sup>9</sup> Holyrood TGS Base assumption is 20.0%. The Sensitivity Assumption is 34%.

<sup>10</sup> In the 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.

<sup>11</sup> “Reliability and Resource Adequacy Study Review – Reliability and Resource Adequacy Study – 2022 Update,” Newfoundland and Labrador Hydro, October 3, 2022.

1 appropriate measure of forced outage rates, and UFOP and DAUFOP should be considered instead.  
2 Given the frequency of deratings historically experienced by these units, DAUFOP is a more appropriate  
3 measure.

4 Analyses performed for a range of Holyrood TGS DAUFOP assumptions indicate the sensitivity of supply  
5 adequacy to changes in Holyrood TGS availability. From this analysis, a DAUFOP of 20% was  
6 recommended in the near-term, with a sensitivity value of 34%. Hydro will continue to analyze the  
7 operational data to ensure that forced outage rate assumptions for the Holyrood TGS are appropriate.

8 As the gas turbines in the existing fleet are in varied conditions, each was considered on an individual  
9 basis rather than applying a weighted average across all units. For the Happy Valley Gas Turbine, a  
10 three-year, capacity-weighted average was applied to the unit for the near-term analysis, resulting in a  
11 DAUFOP of 6.7%, while a ten-year, capacity-weighted average was applied for use in the resource  
12 planning model resulting in a DAUFOP of 7.6%. The DAUFOP values were based on historical data  
13 founded upon the unit's past reliable performance. For the Holyrood Gas Turbine, a scenario-based  
14 approach was used to estimate an appropriate value for the near-term analysis, resulting in a DAUFOP  
15 of 4.9%. For the Hardwoods and Stephenville Gas Turbines, a DAUFOP of 30% was used for the near-  
16 term analysis, consistent with the metrics that were considered in Hydro's May 2018 "Near-Term  
17 Generation Adequacy Report." As the Stephenville Gas Turbine is proposed for retirement in 2024 and  
18 the Hardwoods Gas Turbine in 2030, these units were not included in the long-term analysis; therefore,  
19 there is no resource planning analysis value listed for these facilities and the near-term assumption will  
20 remain for the remaining life of each facility.

## 21 **9.0 Comparison of Planning Assumptions and Analysis Values**

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

25 Hydro notes that the Reliability and Resource Adequacy Study did not utilize UFOP in its analysis. The  
26 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	2.3	2.3
Thermal	DAFOR	9.64	14.0	N/A	N/A
Thermal	DAUFOP	N/A	N/A	20.0	N/A
Gas Turbines					
Happy Valley	DAUFOP	-	15.0	6.7	7.6
Hardwoods and Stephenville	DAUFOP	-	30.0	30.0	N/A
Holyrood	DAUFOP	-	5.0	4.9	4.9

- 1 The generating unit performance presented earlier in this report is again presented in Table 13 to Table
- 2 17, with comparisons to the previous assumptions, as well as the recently revised values. Hydro notes
- 3 that on an asset class basis, the 12-month rolling performance of its generating units has not violated
- 4 Hydro’s current planning assumptions pertaining to asset availability for all assets.

Table 13: Hydraulic Weighted DAFOR Performance Comparison

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending Dec 2021 (%)	12 months ending Dec 2022 (%)	May 2018		November 2022	
				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	3.09	2.01	0.90	2.60	2.30	2.30
<b>Hydraulic Units</b>							
Bay d'Espoir 1	76.5	3.31	0.00	0.90	3.90	2.30	2.30
Bay d'Espoir 2	76.5	0.00	0.00	0.90	3.90	2.30	2.30
Bay d'Espoir 3	76.5	0.00	0.06	0.90	3.90	2.30	2.30
Bay d'Espoir 4	76.5	0.21	0.22	0.90	3.90	2.30	2.30
Bay d'Espoir 5	76.5	0.00	27.87	0.90	3.90	2.30	2.30
Bay d'Espoir 6	76.5	0.16	0.61	0.90	3.90	2.30	2.30
Bay d'Espoir 7	154.4	0.00	0.00	0.90	3.90	2.30	2.30
Cat Arm 1	67	1.30	0.14	0.90	0.70	2.30	2.30
Cat Arm 2	67	1.06	0.05	0.90	0.70	2.30	2.30
Hinds Lake	75	0.46	0.35	0.90	0.70	2.30	2.30
Upper Salmon	84	22.69	0.00	0.90	0.70	2.30	2.30
Granite Canal	40	1.88	3.10	0.90	0.70	2.30	2.30
Paradise River	8	1.45	0.00	0.90	0.70	2.30	2.30

**Table 14: Thermal DAFOR<sup>12</sup> Performance Comparison**

Generating Unit	Maximum Continuous Unit Rating (MW)	12 Months Ending Dec 2021 (%)	12 months ending Dec 2022 (%)	May 2018		November 2022	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
<i>All Thermal Units - weighted</i>	490	33.72	7.09	9.64	14.00	N/A	N/A
<b>Thermal Units</b>							
Holyrood 1	170	34.50	9.27	9.64	15.00	N/A	-
Holyrood 2	170	26.19	5.86	9.64	10.00	N/A	-
Holyrood 3	150	42.12	6.10	9.64	18.00	N/A	-

**Table 15: Hardwoods/Stephenville Gas Turbine DAUFOP Performance Comparison**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending Dec 2021 (%)	12 months ending Dec 2022 (%)	May 2018		November 2022	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
<i>Gas Turbines (HWD/SVL)</i>	100	1.73	6.88	N/A	30.00	30.00	N/A
Stephenville	50	1.11	10.89	N/A	30.00	30.00	N/A
Hardwoods	50	1.91	1.29	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 Dec 2021 (%)	12 months ending Dec 2022 (%)	May 2018		November 2022	
				Historic Base Planning Assumption (%)	Historic Near-Term Planning Assumption (%)	Near-Term Planning Analysis Value (%)	Resource Planning Analysis Value (%)
Happy Valley	25	2.13	0.00	N/A	15.00	6.70	7.60

**Table 17: Holyrood Gas Turbine DAUFOP Performance Comparison**

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 Months Ending Dec 2021 (%)	12 months ending Dec 2022 (%)	May 2018		November 2022	
				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	4.90

<sup>12</sup> DAFOR is no longer used for Near-Term and Resource Planning analysis for Thermal Generation; however, calculation of DAFOR performance will continue.