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April 30, 2018

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

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Newfoundland and Labrador Hydro - The Board's Investigation and Hearing into Supply Issues and Power Outages on the Island Interconnected System – Rolling 12 Month Performance of Hydro's Generating Units

In accordance with item 2.8 of the Liberty Report Recommendations dated December 17, 2014, please find attached one (1) original plus twelve (12) copies of the quarterly *Rolling 12 Month Performance of Hydro's Generating Units report* (the "Report").

We trust the foregoing is satisfactory. If you have any questions or comments, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Michael Ladha
Legal Counsel & Assistant Corporate Secretary
MSL/skc

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey
Danny Dumaresque
Dennis Browne, Q.C. – Browne, Fitzgerald, Morgan & Avis
Dean Porter – Poole Althouse

ecc: Dennis Fleming – Cox & Palmer
Roberta Frampton Benefiel – Grand Riverkeeper Labrador
Larry Bartlett – Teck Resources Limited

Quarterly Report on Performance of Generating Units

For the Quarter ended March 31, 2018

April 30, 2018

A Report to the Board of Commissioners of Public Utilities

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Table of Contents

1.0 Introduction

In this report, Newfoundland and Labrador Hydro (Hydro) provides data on forced outage rates of its generating facilities. This data is provided in relation to historical forced outage rates and in relation to assumptions used for system planning purposes.

The forced outage rates are provided for individual generating units at hydraulic facilities; the three units at the Holyrood Thermal Generating Station; and Hydro's gas turbines for the current 12-month reporting period of April 1, 2017 to March 31, 2018. The report also provides, for comparison purposes, the individual generating unit data on forced outage rates for the previous period April 1, 2016 to March 31, 2017. Further, total asset class data is presented on an annual basis for the years 2006-2016. This report provides data on outage rates for forced outages, not planned outages.

The forced outage rates of Hydro's generating units are presented using three measures: (i) Derated Adjusted Forced Outage Rate (DAFOR) for the hydraulic and thermal units; (ii) Utilization Forced Outage Probability (UFOP) for the gas turbines; and (iii) Derated Adjusted Utilization Forced Outage Probability (DAUFOP)[1] for the gas turbines.

Derated Adjusted Forced Outage Rate (DAFOR) is a metric that measures the percentage of the time that a unit or group of units is unable to generate at its maximum continuous rating due to forced outages. The DAFOR for each unit is weighted to reflect differences in generating unit sizes in order 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, this measure is not applicable to gas turbines because of their operation as standby units, and relatively low operating hours.

[1] First report in which DAUFOP is reported.

Utilization Forced Outage Probability (UFOP) 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 is used for the gas turbines.

Derated Adjusted Utilization Forced Outage Probability (DAUFOP) is also 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, but also includes impact of unit deratings. This metric is used for the gas turbines.

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 by Canadian Electricity Association (CEA) guidelines. Per CEA guidelines, to take into account the derated levels of a generating unit, the operating time at the derated level is converted into an equivalent outage time.

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

2.0 Period Ending March 31, 2018 Overview

Table 1: DAFOR, UFOP, and DAUFOP Overview

Class of Units	April 1, 2016 to March 31, 2017 (%)	**April 1, 2017 to March 31, 2018 (%)**	Base Planning Assumption[2] (%)	Near-term Planning Assumption[3] (%)
Hydraulic (DAFOR)	5.55	**2.13**	0.90	2.60
Thermal (DAFOR)	13.96	**24.10**	9.64	14.00
Gas Turbine (Combined) (UFOP)	12.32	**7.26**	10.62	20.00
Gas Turbine (Holyrood) (UFOP)	2.24	**0.07**	5.00	5.00
Gas Turbine (Combined) (DAUFOP)	33.37	**20.93**	-	30.00
Gas Turbine Holyrood) (DAUFOP)	2.24	**0.07**	-	5.00

There was an improvement in hydraulic DAFOR and a decline in thermal DAFOR performance for the current 12-month period ending March 2018, compared to the previous 12-month period ending March 2017 (see Table 1). The combined[4] gas turbine UFOP and DAUFOP performance shows an improvement in performance for the current period compared to the previous period.

In the 10-year period prior to 2015, the hydraulic units showed a somewhat consistent DAFOR. The DAFOR of the current 12-month period, compared to the previous 10 years, is higher primarily due to penstock issues experienced on Units 1 and 2 at Bay d'Espoir in 2016 and 2017. For the Holyrood thermal units, the forced outage rate of the current period ending March 2018 is 24.10%, which is above the base planning assumption of 9.64%, the sensitivity of

[2] Hydro is reviewing all base planning assumptions as part of its reliability criteria and supply adequacy assessment, to be submitted to the Board in November 2018.

[3] Near-term Generation Adequacy Report, November 15, 2017, see Section 5.0 for further details.

[4] Combined Gas Turbines include the Hardwoods, Happy Valley, and Stephenville units. The performance of the Holyrood GT was not included in the combined base planning or sensitivity numbers as these numbers were set prior to the Holyrood GT's in service date.

11.64%, and above the near-term planning assumption of 14.00%.[5] This is primarily caused by an airflow derating on Unit 1 and Unit 2 that continued in 2017 and an extended forced outage on Unit 1 in February 2018.

Hydro's combined gas turbines' UFOP in the 10-year period prior to 2015 was generally consistent at approximately 10% until the year 2012 when the rate exceeded 50%. Since 2012, the UFOP has been improving each year. For the current 12-month period ending March 31, 2018, performance was affected by forced outages to the Hardwoods, Happy Valley, and Stephenville units.

Note that the data for 2006 to 2016 in Figures 1, 2, and 3 are annual numbers (January 1 to December 31), while the data for 2017 and 2018 are 12-month rolling numbers (April 1 to March 31 for each year).

3.0 Generation Planning Assumptions

The DAFOR and UFOP indicators used in Hydro's generation planning model are representative of a historic average of the actual performance of these units. These numbers are noted in Table 2 under the column "Base Planning Assumption." This is a long term outlook.

Hydro also provides a sensitivity number for DAFOR and UFOP as part of its generation planning analysis. This number takes into account a higher level of unavailability, should it occur, to assess the impact of higher unavailability of these units on overall generation requirements. During the 12-month period ending March 31, 2018, the gas turbine units performed well within this sensitivity range for UFOP, while both the hydraulic and thermal classes performed outside of the sensitivity range for DAFOR.

[5] While the near-term planning assumption for thermal was materially exceeded in the preceding 12-month period, there were no supply issues experienced. Improved performance at the other assets contributed to this outcome. Further, the near-term planning assumption is a probabilistic view of system performance under various criteria.

The new gas turbine (Holyrood GT) has a lower expected rate of unavailability than the original gas turbines (5% compared to 10.62%) due to the fact that the unit is new and can be expected to have better availability than the older units.[6]

Hydro's generation long term planning assumptions for DAFOR and UFOP for the year 2018 are noted in Table 2.

Table 2: 2017 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	20.62
Gas Turbines - New			5.0	10.0

As part of Hydro's analysis of energy supply up to Muskrat Falls interconnection, Hydro completes comprehensive reviews of, and produces reports on, energy supply for the Island Interconnected System. The Near-Term Generation Adequacy Report, filed on November 15, 2017, contains analysis based on the near-term DAFOR and DAUFOP and the resulting implication for meeting reliability criteria until the interconnection with the North American grid. In the November report, Hydro used the DAUFOP metric as the measure of gas turbine unit reliability into the near term. In 2018, Hydro will be measuring and reporting using DAUFOP and UFOP for the gas turbines.

The DAFOR and DAUFOP assumptions used in developing Hydro's November 2017 Near-term Generation Adequacy Report are noted in Table 3.

[6] Hydro selected a 5% UFOP for the new Holyrood GT following commentary on forced outage rates contained in the *Independent Supply Decision Review – Navigant (September 14, 2011).*

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 Plant	14.0	
Holyrood Unit 1	15.0	
Holyrood Unit 2	10.0	
Holyrood Unit 3	18.0	
Hardwoods & Stephenville Gas Turbines		30.0
Holyrood Gas Turbine		5.0

4.0 Hydraulic Unit Forced Outage Rate Performance

The hydraulic unit-forced outage rates are measured using the CEA metric, DAFOR. Detailed results for the 12-month period ending March 31, 2018, are presented in Table 4, as well as the data for the 12-month period ending March 31, 2017. These are compared to Hydro's short-term generation adequacy assumptions, as used in the Near-term Generation Adequacy Report, and Hydro's long-term generation planning assumptions for the forced outage rate.

Table 4: Hydraulic Weighted DAFOR

Generating Unit	Maximum Continuous Unit Rating (MW)	12 months ending March 2017 (%)	12 months ending March 2018 (%)	Hydro Generation Base Planning Assumption (%)	Near-Term Planning Assumption (%)
All Hydraulic Units - weighted	954.4	5.55	2.13	0.90	2.60
Hydraulic Units					
Bay D'Espoir 1	76.5	30.54	8.86	0.90	3.90
Bay D'Espoir 2	76.5	31.30	13.79	0.90	3.90
Bay D'Espoir 3	76.5	0.02	0.01	0.90	3.90
Bay D'Espoir 4	76.5	0.69	0.29	0.90	3.90
Bay D'Espoir 5	76.5	0.48	0.00	0.90	3.90
Bay D'Espoir 6	76.5	1.31	0.00	0.90	3.90
Bay D'Espoir 7	154.4	0.00	1.80	0.90	3.90
Cat Arm 1	67	1.02	0.22	0.90	0.70
Cat Arm 2	67	0.00	0.09	0.90	0.70
Hinds Lake	75	0.25	0.87	0.90	0.70
Upper Salmon	84	0.91	0.05	0.90	0.70
Granite Canal	40	1.16	0.11	0.90	0.70
Paradise River	8	6.94	1.45	0.90	0.70

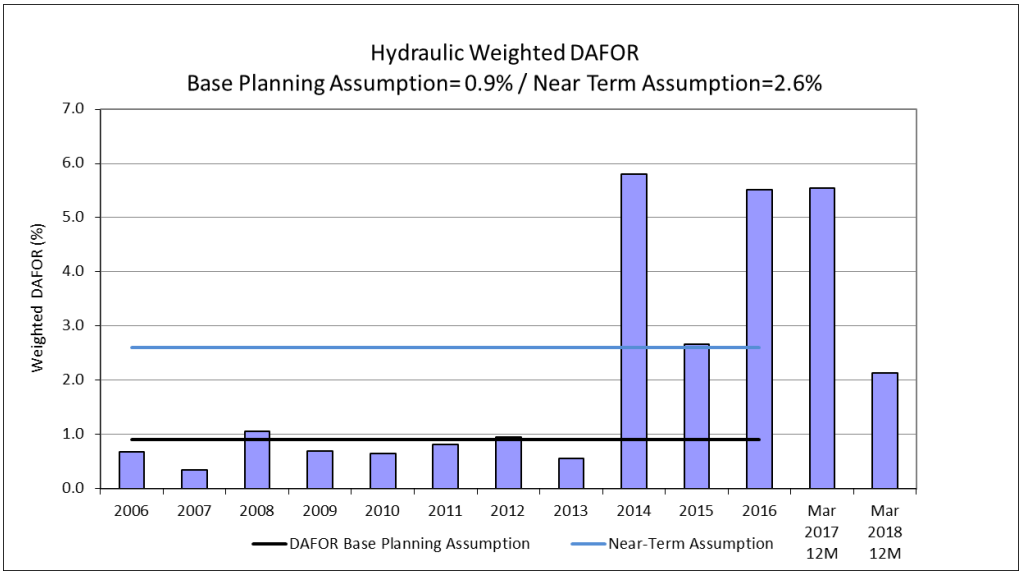

Figure 1: Hydraulic Weighted DAFOR

Considering the individual units' performance, the assumed Hydro generation base planning DAFOR was materially exceeded for Bay d'Espoir Unit 1 and Bay d'Espoir Unit 2. Also, there were exceedances compared to base planning assumption for Bay d'Espoir Unit 7, and Paradise River for the current period.

The Bay d'Espoir Unit 1 DAFOR of 8.86% and Unit 2 DAFOR of 13.79% exceeded the base planning assumption of 0.9% and the near-term assumption of 3.9% for an individual Bay d'Espoir unit. This was due to Units 1 and 2 being removed from service on November 4, 2017 as a result of a leak in Penstock 1, which provides water to both units. The leak occurred in the same area where similar leaks had occurred in 2016 which initiated further investigation and subsequent refurbishment. A consultant was engaged in the process to provide engineering analysis and recommendations to return the penstock to reliable service. Extensive inspection and testing was completed, which resulted in the damaged section being completely removed, and replaced with a new plate that was overlaid with a second plate; all additional suspect areas were also cleaned, re-welded, and overlaid with additional plates; and additional backfill was placed over a section of the ruptured area, as this had been part of the approved capital plan resulting from the 2016 leak. The draft report of findings and analysis has been received and is presently being reviewed. The penstock was returned to service on December 8, 2017.

The Bay d'Espoir Unit 7 DAFOR of 1.80% exceeded the base planning assumption of 0.9% and is less than the near-term assumption of 3.9% for an individual Bay d'Espoir unit, as a result of the unit being unavailable from July 3, 2017 to July 9, 2017 due to a failure in the collector assembly which caused the unit protection to operate and isolate the unit from the system. An investigation was completed, and it was determined that the there was a flash-over between the positive and negative slip rings which was caused by excessive brush wear. The investigation was completed and improvements to the preventative maintenance (PM) program have been implemented across the hydraulic generation fleet of assets. As a short-term measure, all brush gear assemblies had an additional inspection completed prior to December 1, 2017 and no issues were found.

The Paradise River Unit DAFOR of 1.45% exceeded the base planning assumption of 0.9% and the near-term assumption of 0.7%, primarily as a result of outages from May 23, 2017 to May 25, 2017. The Unit tripped off on May 23, 2017 shortly after being synchronized to the system and loaded to 8 MW. Several attempts to return the unit to service were unsuccessful, which

resulted in the unit being unavailable until the investigation was completed. The investigation determined the trip was a result of a high generator terminal voltage, attributed to TL 212 being out of service. The condition was rectified by adjusting the generator excitation voltage, and the Unit was returned to service on May 25, 2017. There have been no recurrence of events relating to this issue since that time, and this issue is now considered to be resolved.

5.0 Thermal Unit Forced Outage Rate Performance

The thermal unit forced outage rates are measured using the CEA metric, DAFOR. Detailed results for the 12-month period ending March 31, 2018, are presented in Table 5, as well as the data for the 12-month period ending March 31, 2017. These are compared to Hydro's short-term generation adequacy assumptions, as used in the Near-term Generation Adequacy Report, 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 March 2017 (%)	12 months ending March 2018 (%)	Hydro Generation Base Planning Assumption (%)	Near-Term Planning Assumption (%)
All Thermal Units - weighted	490	13.96	24.10	9.64	14.00
Thermal Units					
Holyrood 1	170	20.49	31.66	9.64	15.00
Holyrood 2	170	14.92	25.36	9.64	10.00
Holyrood 3	150	3.06	14.03	9.64	18.00

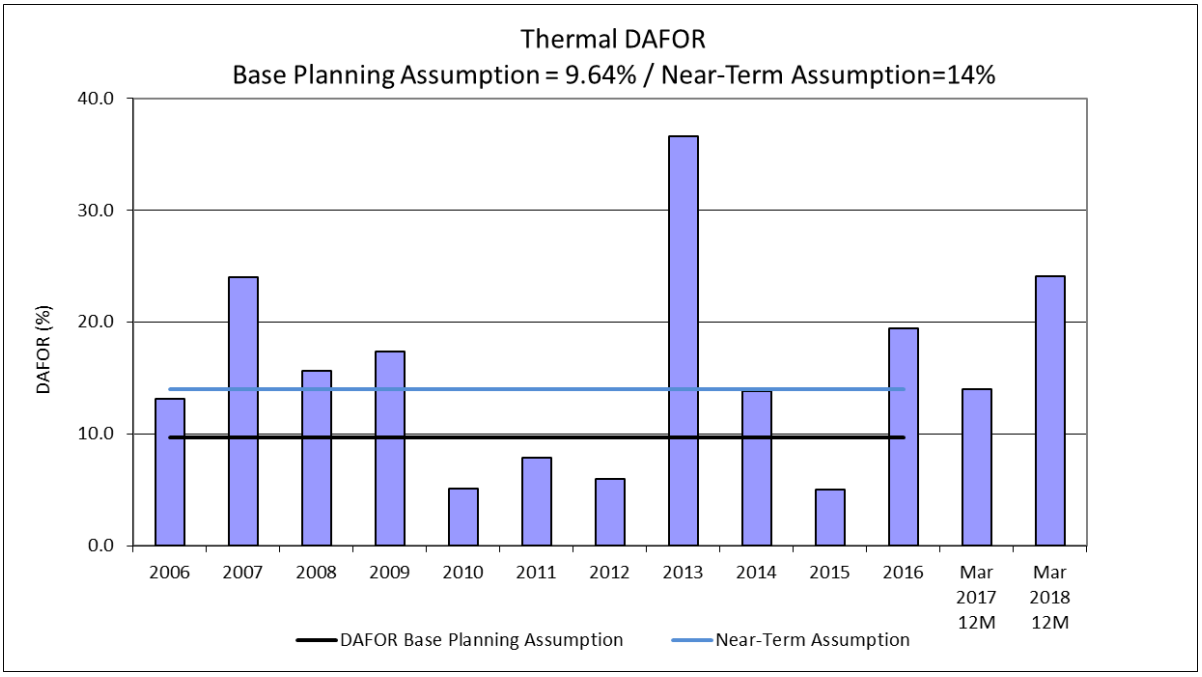

Figure 2: Thermal DAFOR

For the 12-month period ending March 31, 2018, the weighted DAFOR for all thermal units of 24.90% is above the assumed Hydro generation base planning DAFOR value of 9.64% and the near-term assumption of 14.00%[7]. Unit 1 DAFOR was 31.66% and Unit 2 DAFOR was 25.36%.The performance for both Units 1 and 2 was above the base planning assumption of 9.64% and the near-term assumption of 15% (Unit 1) and 10% (Unit 2). Unit 3 DAFOR was 14.03%, which is above the base planning assumption of 9.64% but below the near-term assumption of 18.0%.

The DAFOR performance for Holyrood Unit 1 (170 MW) was affected by the following events in the current 12 month to date period:

- The 2017 maintenance outage on Unit 1 was from July 5, 2017 until September 11, 2017. The Unit was put online on September 17, 2017 to allow for online commissioning of the new exciter controls system by the original equipment manufacturer, ABB. The Unit tripped at 70 MW on September 18, 2017 during

[7] See Hydro's Near-term Generation Adequacy Report, November 15, 2017, section 7.0 for results discussing Holyrood plant DAFOR at 15% compared to 14%. Plant DAFOR of 15% does result in minor differences only, and these differences result only in the extreme sensitivity cases, not the expected system operating cases.

commissioning of the new exciter controls on that unit. The Unit was derated to 50 MW (below UFLS) until September 21, 2017, when the cause of the trip was determined. This was to ensure that any further trips would not impact customers. Investigation determined that this trip, which happened when starting a boiler feed pump, was due to low unit board voltages. Starting the pump caused the already low voltage to drop below acceptable levels and this appropriately engaged under voltage protection and a unit trip. Voltages had been reduced intentionally as part of the exciter commissioning and were not returned to normal levels prior to starting the pump. This issue has been addressed with commissioning activities to ensure that it will not reoccur.

- Unit 1 tripped on October 5, 2017 and was derated to a precautionary load of 35 MW, while the reason for the trip was being investigated and corrected. It was determined that the trip was caused by frayed wires in one of the forced draft (FD) fan motors and, following repairs, the Unit was returned to full capability on October 10, 2017.
- From October 17, 2017 to October 22, 2017, the Unit was derated to 154 MW due to low steam pressure while waiting for safety valve testing to be completed. The safety valve testing was completed on October 24, 2017, but the Unit was further derated to 145 MW from October 22, 2017 to October 24, 2017 and to 135 MW until the end of the month due to overheating motor windings in the west FD fan. Plans were established to replace this motor after completion of Unit 2 exciter commissioning. The spare motor was brought to site and the winding temperature was monitored regularly for changes. The spare motor was installed during an outage from November 7, 2017 to November 11, 2017. The Unit was returned to service on November 12, 2017 but remained derated to 145 MW due to high furnace pressure.
- On November 14, 2017 the Unit was taken offline to repair a piping leak at the condenser flash tank. This was repaired and the Unit returned to service on

November 15, 2017. However another leak developed in the area and the Unit was removed from service on November 15, 2017 for 12 hours for repair.

- Unit 1 remained limited to 145 MW until it was taken offline on November 30, 2017 to perform an air heater wash and additional maintenance. The Unit was returned to service on December 4, 2017, after completion of a maintenance outage to perform an air heater wash and additional maintenance work to restore capacity. This included a pressure wash of the top air heater baskets. A load test completed on December 5, 2017, confirmed a capacity of 150 MW[8] with the Unit load limited by high furnace pressure.
- On January 3, 2018 the Unit capability was reduced from 150 to 135 MW as a result of oscillations in the turbine control valve hydraulic ram. An outage was taken from January 5, 2018 to January 6, 2016 to replace a loose control cable on the hydraulic ram and to complete an air heater wash. After this work, the load was restored to 145 MW, limited by high furnace pressure, and it was observed that the control valve oscillations had not been eliminated. On January 18, 2018 the oscillations had increased and the load was reduced to 140 MW as a result. On January 20, 2018 the Unit was taken offline to replace another control cable as recommended by GE to resolve the oscillation issue. While the Unit was offline for this work, the boiler stop valve failed, which resulted in an extension to the outage. The Unit remained offline until February 2, 2018 while stop valve refurbishment was ongoing. During this time, the hydraulic ram was removed from the turbine and sent off site for refurbishment to ensure that the oscillation problem had been resolved. Also a high pressure wash was completed on the air heater baskets to 12,500 psi.
- The outage due to the boiler stop valve failure extended from January 20, 2018 until February 21, 2017, following several solutions attempted to address the leak. On

[8] Hydro continues to work towards restoring full load on all three units. Hydro set up an engineering team to work with the boiler service provider and other industry experts. This team has recommended replacement of air heater baskets on all three units, correction of excessive air heater leakage on Unit 3, cleaning of economizers on Unit 1 and Unit 2, and use of fuel additive on all three units to prevent continued fouling. These recommendations address the issues of high furnace pressure in Unit 1 and Unit 2 and the issues of high air heater fouling and air flow limitations on Unit 3. They are currently being pursued with the intent to complete this work during the 2018 annual overhauls.

February 21, 2018, the stop valve work was complete and the Unit was returned to service.

- On February 22, 2018 the Unit had to be taken offline due to a turbine bearing issue. Lube oil had leaked, undetected, from the bearing during the stop valve outage. This led to a smoldering underneath the bearing when the components heated up. The contaminated insulation was replaced and close inspection of the bearing confirmed no active leak. The Unit was returned to service on February 25, 2018.
- On February 28, 2018 a load test was completed to 148 MW, with load limited by high furnace pressure due to boiler and air heater fouling. By the end of March this capability had reduced to 137 MW as a result of continued fouling in the boiler and air heaters.
- There were two unit trips related to forced draft fan variable frequency drive trips. These occurred on March 19, 2018 and March 26, 2018. In both instances the Unit was returned to service using replacement parts from inventory. During the outage related to the March 19, 2018 trip, a problem with the Mark V turbine governor system was also resolved. Hydro is continuing to work towards resolving the problems with variable frequency drive reliability.

The DAFOR performance for Holyrood Unit 2 (170 MW) was primarily affected by the following events:

- On April 22, 2017 there was a brief outage required to repair a section of flexible ductwork on the ignitor air system that had failed during start-up after the boiler cleaning outage.
- On May 1, 2017, the Unit experienced a forced outage when a section of flexible ductwork adjacent to the location that failed on April 22, 2017, also failed and allowed hot gas to escape from the boiler. This hot gas caused a cable tray fire adjacent to the north east corner of the boiler on the second floor. Refurbishment work was completed by May 28, 2017 and included asbestos abatement, as loose asbestos fibres were found in the cable tray. While the Unit was offline for repairs,

work protection permits were issued to allow other work that was planned for the annual outage, to proceed in parallel. Also, Unit 3 was recalled from its planned outage to provide generation to satisfy system requirements.

- In parallel to the refurbishment work noted above, the cause of the failure of the ignitor flex hoses was investigated. This was the first such incident on record at the plant. All of the Unit 2 flexible hoses on the ignitor system were upgraded as required. This included extending the rigid pipe in the corner that failed such that the gap could be spanned by one flexible hose length. Two lengths had been spliced together in the area of the failure and this was concluded to be part of the reason for the failure. On Unit 1, which was in operation at the time, additional clamps were installed to ensure the hoses were secure. During the annual 2017 outages, all hoses on Unit 1 and Unit 2 were positively secured to ensure this failure cannot reoccur. Unit 3 is not of the same design, does not have flexible ignitor air ducting, and thus is not susceptible to a similar failure.
- On June 3, 2017, Unit 2 tripped. The Unit was returned to service a few hours later but was limited to 50 MW until the reason for the trip could be confirmed and mitigated. A GE representative was brought to site to diagnose the problem and determined that, during the trip, the control valves closed while the governor was calling for them to remain open. This pointed to three possibilities; (i) loose wire; (ii) control card failure; or (iii) servo failure. A card failure was ruled out since all other functions of the card were working normally. The wires were tested with the Unit at 25 MW and no issues were found. An outage was then completed on June 8, 2017 to June 11, 2017 to replace the servo and change out the hydraulic fluid and filters. During this same outage, the turbine speed probe cables were replaced and probe clearance gaps were adjusted. This corrected a reliability issue that previously occurred on November 18, 2016 and was planned to be done during the annual outage.
- On June 16, 2017, there was an issue with one of the two approximately 50% duty boiler feed pumps. It appeared that some debris went through one of the bearings

of the west pump and caused a spike in temperature and vibration. The temperature and vibration returned to normal, but the pump was taken out of service to change the oil and clean out the lube oil tank. The Unit was derated to 70 MW while the pump was out of service. It was successfully tested and returned to service on June 17, 2017.

- On June 29, 2017, vibration and temperature excursions occurred on same the motor inboard bearing. At this point failure of the bearing was suspected. The pump was again taken out of service causing another derate to 70MW. Failure of the bearing was confirmed and the spare boiler feed pump motor was brought to site and installed in place of the motor with the failed bearing. This was the most expedient option to get the pump back in service. This work was completed on July 2, 2017 and the Unit returned to 165 MW capability. Additional checks have been added to pump rebuilds to check for the issues experienced on this pump.
- Unit 2 was removed from service at the end of July to accommodate the planned total plant outage and the unit annual maintenance outage. During the Unit outage, additional work was completed to address air flow issues. This included additional boiler cleaning and air heater upgrades.
- The Unit returned from the annual planned outage and was placed online for commissioning of new exciter controls on October 28, 2017 with a scheduled derating of 35 MW. Exciter commissioning was interrupted by two forced outages. From October 28, 2017 to October 30, 2017 the Unit was taken offline due to a combustion upset in the boiler. The Unit was returned to service with load restricted to 50 MW. It was determined that the upset was due incomplete setup of a new fuel flow transmitter. Setup of this transmitter was completed on November 2, 2017. Also, from October 30, 2017 to November 1, 2017 the Unit was removed from service to replace some oil-soaked turbine insulation that resulted from an oil leak at a turbine bearing.
- From November 3, 2017, until November 4, 2017 the Unit was derated to 70 MW and then to 110 MW while completing commissioning of the new exciter controls.

From November 4, 2017 to November 8, 2017 the Unit was derated to 150 MW while waiting for safety valve testing to be completed. From November 8, 2017 to November 20, 2017, the Unit was derated to 165 MW until a leaking safety valve could be restored. This work required an outage to complete. The Unit was taken offline on November 20, 2017, and returned to service on November 24, 2017. An air heater wash was also completed during this outage. A load test on November 28, 2017 revealed that the Unit was capable of 160 MW, limited by high furnace pressure.

- On December 19, 2017, the Unit experienced a 14 hour deration to 70 MW as a result of a trip of one forced draft fan on the Unit. The cause of the fan trip was corrected and the fan returned to service later that day in time for the evening peak, with the Unit again capable of 160 MW.
- The capability of the Unit continued to decline due to ongoing fouling during operation. On January 4, 2018 the capability had reduced to 154 MW. On January 25, 2018 the capability had reduced to 135 MW due to high furnace pressure as a result of boiler and air heater fouling. On February 14, 2018 the capability had reduced to 117 MW. At the end of February the capability had reduced to 100 MW. System requirements, given the issues with Unit 1, had precluded an air heater wash on this Unit during the month of February 2018. An air heater wash was completed from March 5, 2018 to March 6, 2018 however this was not successful in restoring any load. By the end of March 2018, the Unit capability had reduced to 90 MW as a result of continued boiler and air heater fouling during operation.
- On February 7, 2018 the Unit was taken offline for a short, planned outage to replace generator brushes. There was a forced extension to this outage when a unit board breaker tripped during restart of the Unit. Electricians were called in to reset the breaker.
- The Unit was further derated to 70 MW from March 1, 2018 to March 2, 2018 due to an issue with the west boiler feed pump. A water leak from a line nearby caused

contamination of the pump lube oil and the pump was taken offline until the repairs were completed.

- On March 22, 2018, one of the turbine reheat intercept valves became stuck during regular online testing and the Unit had to be taken offline for approximately eight hours to replace the valve servos. Hydraulic fluid contamination will be addressed during the annual outage to prevent recurrence.

The DAFOR performance for Holyrood Unit 3 (150 MW) was primarily affected by the following events:

- On December 13, 2017, Unit 3 was derated to 135 MW as a result of air flow issues. The Unit capability declined steadily to 105 MW until an air heater wash could be completed on December 31, 2017. The wash was successful in restoring the load to 131 MW. The available load continued to decline due to ongoing air heater fouling. On January 18, 2018 the available load was determined to be 120 MW and on February 10, 2018 this had further reduced to 100 MW. An air heater wash outage was completed from February 10, 2018 to February 11, 2018. System requirements, with Unit 1 already offline, had precluded an air heater wash on this Unit until that time. When the Unit was returned to service there was a derating to 70 MW for approximately 10 hours when the west boiler feed pump failed to start.
- This was resolved and the available load was determined to be 110 MW, still limited by air heater fouling. The Unit was capable of 100 MW at the beginning of March 2018. This capability had further reduced to 75 MW on March 20, 2018. An air heater wash outage was completed on March 28, 2018 and the predicted load after this wash was 110 MW. This Unit was not required for the system, and was left on standby until the planned unit outage in early April 2018.
- On January 11, 2018, a ¾" diameter domestic water pipe located above the Unit 3 exciter ruptured at a cap and the resulting water leak contacted the exciter causing a unit trip. There was no significant equipment damage resulting from this incident and once the exciter was safely dried, the Unit was returned to service on January

12, 2018. This event was investigated and the leak was repaired. A shut-off valve was relocated for improved access in the event of a further trip, regular inspections of the area were implemented, and a plan was formulated to replace this piping during the annual outages. On February 14, 2018 the Unit load was reduced to 50 MW for approximately eight hours as a precautionary measure due to another leak in a domestic water line in close proximity to the exciter. After this event, the piping was relocated so that further leaks would not impact the exciter.

6.0 Gas Turbine UFOP Performance

The combined UFOP for the Hardwoods (HWD), Happy Valley (HVY), and Stephenville (SVL) gas turbines was 7.26% for the 12-month period ending March 31, 2018 (see Table 6). This is below the base planning assumption of 10.62%, and the near-term assumption of 20.00%. The current period UFOP declined from the previous period UFOP of 12.32%. The Hardwoods UFOP for the current period is 1.09%, which is better than the base planning assumption of 10.62%. The Stephenville UFOP for the current period is 5.57%, which is better than the base planning assumption of 10.62%. Happy Valley's UFOP is 20.87% for the current period compared to 2.61% in the previous period.

Table 6: Gas Turbine UFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2017 (%)	12 months ending March 2018 (%)	Hydro Generation Base Planning Assumption (%)	Near-Term Planning Assumption (%)
Combined Gas Turbines	125	12.32	7.26	10.62	20.00
Stephenville	50	15.96	5.57	10.62	20.00
Hardwoods	50	15.97	1.09	10.62	20.00
Happy Valley	25	2.61	20.87	10.62	20.00

The Holyrood (HRD) GT UFOP of 0.07% for the current period is better than the base planning and near-term assumptions of 5.00% (see Table 7).

Table 7: Holyrood GT UFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2017 (%)	12 months ending March 2018 (%)	Hydro Generation Base Planning Assumption (%)	Near-Term Planning Assumption (%)
Holyrood GT	123.5	2.24	0.07	5.00	5.00

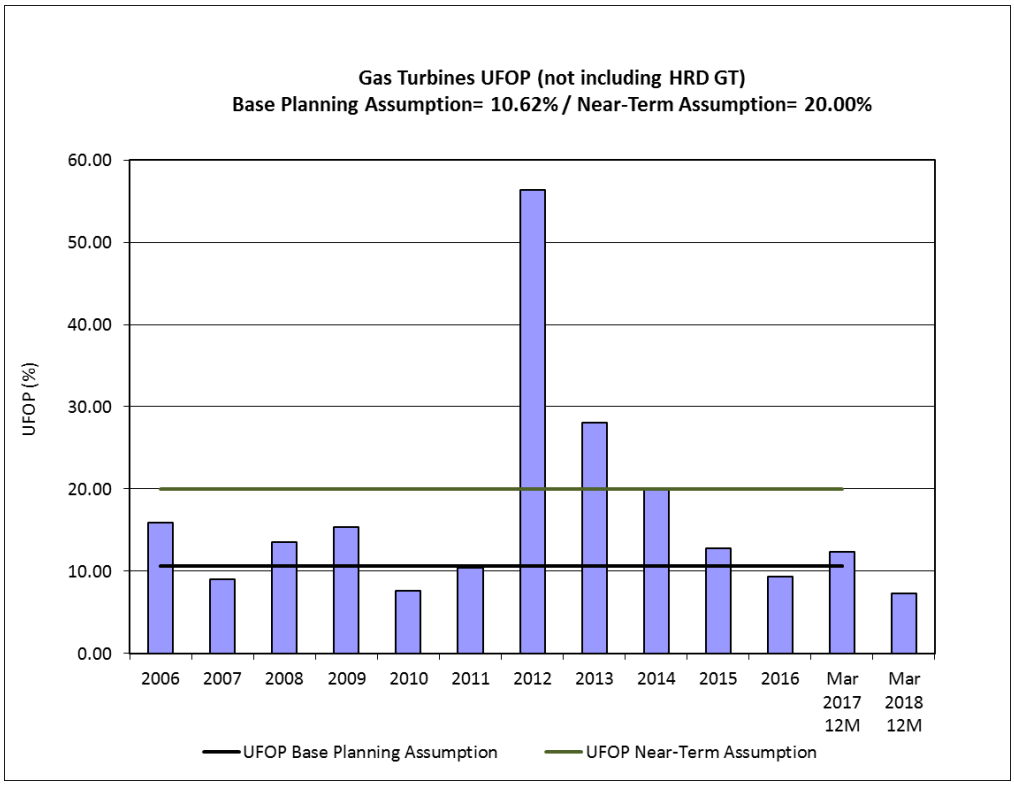

Figure 3: Gas Turbine UFOP – HWD/HVY/SVL Units

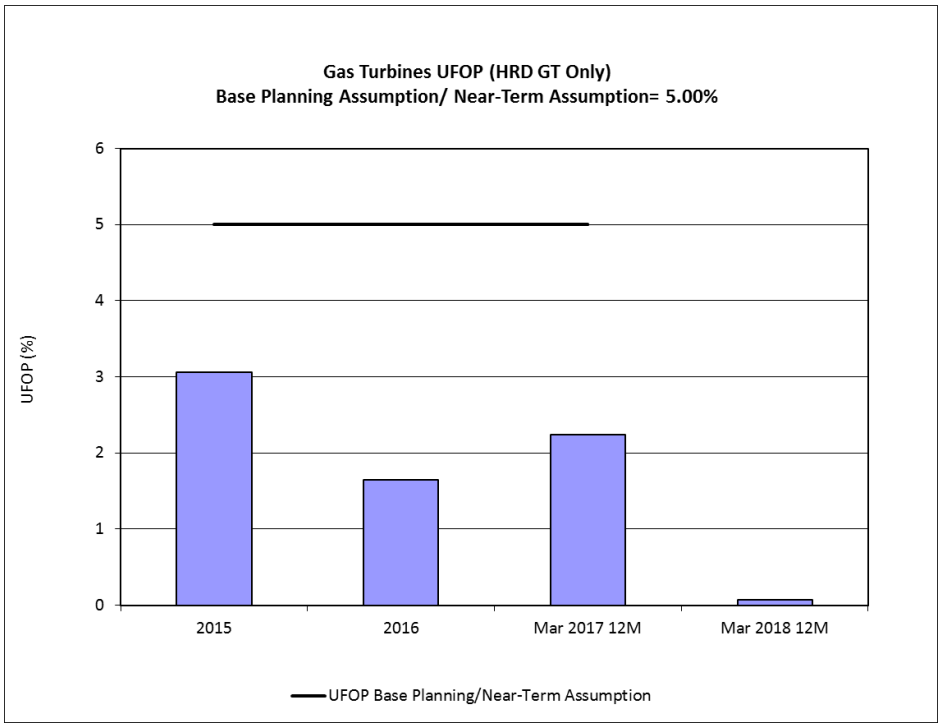

Figure 4: Gas Turbine UFOP – HRD Unit

On September 16, 2017 the Happy Valley Gas Turbine tripped when attempting a black start of the unit to support an unplanned outage in the Happy Valley area. Hydro's investigation found that the cause of the trip was related to the operation of a voltage protection relay in the terminal station. Upon review of the relevant procedures, drawings and settings it was determined that a setting change was required to the protection relay. The setting was changed and the Unit was returned to service on September 21, 2017. During the investigation, it was found that prior to the trip the power turbine had developed higher than normal vibration, though it was not the cause of the trip. Further investigation of the higher than normal vibration found the source to be a high temperature exhaust gas leak from the power turbine. Repairs were made and vibration levels returned to normal on October 7, 2017.

On October 15, 2017 the Happy Valley Gas Turbine experienced a trip while operating at near-full load. Hydro's investigation determined that the trip was the result of the failure of an emergency fuel shutoff valve solenoid. The failure of the solenoid caused the three-way valve to divert some fuel away from the engine as is its design. The reduced fuel flow to the engine

caused the engine to be unable to sustain the required load and this resulted in the unit shutting down. A replacement solenoid was sourced, and when received the valve was repaired and the engine was released for service on November 9, 2017.

7.0 Gas Turbine DAUFOP Performance

The combined DAUFOP for the Hardwoods, Happy Valley, and Stephenville gas turbines was 20.93% for the 12-month period ending March 31, 2018 (see Table 8). This is below the near-term assumption of 30.00%. The Hardwoods DAUFOP for the current period is 5.01%, which is significantly better than the near-term assumption of 30.00%. The Stephenville UFOP for the current period is 52.11%, which is above the near-term assumption of 30.00%. Happy Valley's DAUFOP is 20.87% which is below the near-term assumption of 30.00%.

Table 8: Gas Turbine DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2017 (%)	12 months ending March 2018 (%)	Near-Term Planning Assumption (%)
Combined Gas Turbines	125	33.37	20.93	30.00
Stephenville	50	46.46	52.11	30.00
Hardwoods	50	32.79	5.01	30.00
Happy Valley	25	2.61	20.87	30.00

The Holyrood (HRD) GT DAUFOP of 0.07% for the current period is better than the near-term assumptions of 5.00% (see Table 9).

Table 9: Holyrood GT DAUFOP

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2017 (%)	12 months ending March 2018 (%)	Near-Term Planning Assumption (%)
Holyrood GT	123.5	2.24	0.07	5.00

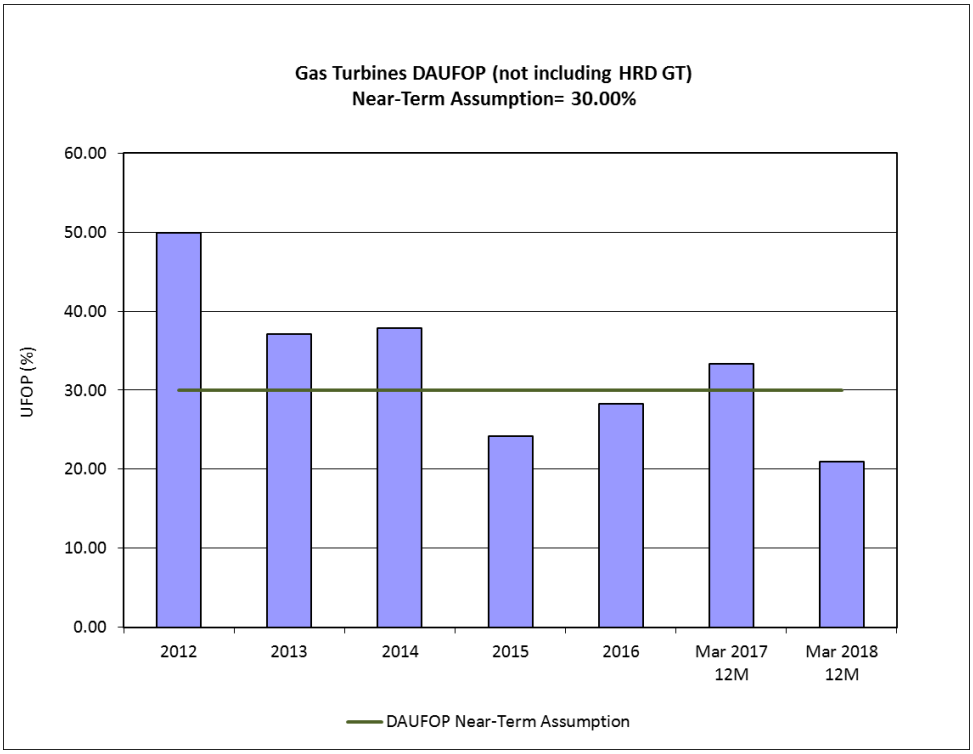

Figure 5: Gas Turbine DAUFOP – HWD/HVY/SVL Units

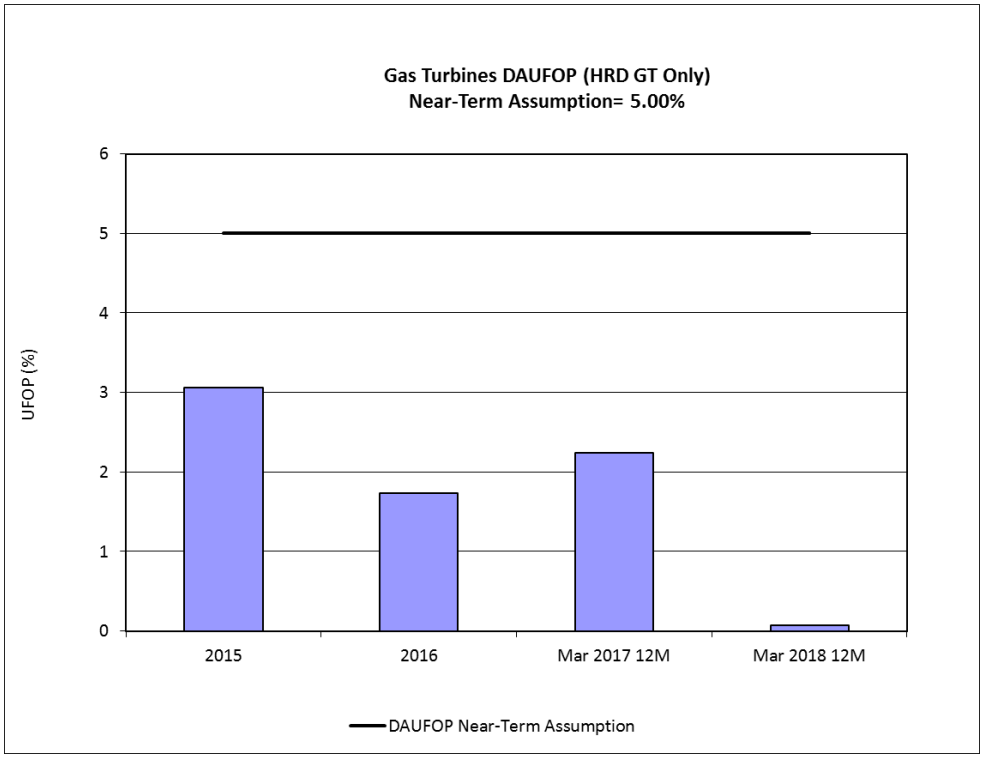

Figure 6: Gas Turbine DAUFOP – HRD Unit

The Stephenville Gas Turbine DAUFOP for the period is impacted by the unavailability of End A as a result of an exhaust bellows failure at Hardwoods Gas Turbine End A on December 28, 2017. End A was unavailable at this time due to issues with the power turbine rear bearing which requires the bearing to be replaced. Hydro decided to remove the bellows from End A at Stephenville and install it at Hardwoods End A to return that Unit to full capacity. It is currently expected that the Stephenville Gas Turbine will be returned to full capacity at the end of July 2018.