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April 14, 2016

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

Attention: Ms. Cheryl Blundon
Director 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 the original plus 12 copies of the quarterly report *Rolling 12 Month Performance of Hydro's Generating Units*.

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

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Tracey Pennell
Legal Counsel

TLP/bs

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Sheryl Nisenbaum – Praxair Canada Inc.
ecc: Roberta Frampton Benefiel – Grand Riverkeeper Labrador
Thomas Johnson – Consumer Advocate
Thomas O' Reilly – Cox & Palmer
Danny Dumaresque

A REPORT TO
THE BOARD OF COMMISSIONERS OF PUBLIC UTILITIES

QUARTERLY REPORT
ON
PERFORMANCE OF GENERATING UNITS
FOR THE QUARTER ENDED MARCH 31, 2016

NEWFOUNDLAND AND LABRADOR HYDRO

APRIL 14, 2016

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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 as well as in relation to assumptions used in Loss of Load Hours (LOLH) calculations 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 (HTGS) and Hydro's gas turbines for the current 12-month reporting period of April 1, 2015 to March 31, 2016. The report also provides, for comparison purposes, the individual generating unit data on forced outage rates for the previous period April 1, 2014 to March 31, 2015. Further, total asset class data is presented on an annual basis for years the 2005-2014. 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 two measures: Derated Adjusted Forced Outage Rate (DAFOR) for the hydraulic and thermal units and Utilization Forced Outage Probability (UFOP) 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 (MCR) 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 nature as a standby unit and relatively low operating hours.

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.

Included in the forced outage rates are outages that remove the unit from service completely, as well as instances when units are de-rated. If a unit's output is reduced by more than 2%, the unit is considered de-rated by Canadian Electricity Association (CEA) guidelines. Per CEA guidelines, to take into account the de-rated levels of a generating unit, the operating time at the de-rated 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.

2.0 Period Ending March 31, 2016 Overview

Class of Units	April 1, 2014 to March 31, 2015 (%)	April 1, 2015 to March 31, 2016 (%)	Base Planning Assumption (%)
Hydraulic (DAFOR)	4.45	2.76	0.90
Thermal (DAFOR)	10.99	13.54	9.64
Gas Turbine (Combined) (UFOP)	18.36	8.29	10.62
Gas Turbine (Holyrood) (UFOP)	0.70[1]	2.81	5.00

The hydraulic DAFOR and the combined[2] gas turbine UFOP performance (in table above) all show improvement for the current period, the 12-month period ending March 2016 compared to the previous period, the 12-month period ending March 2015. There was a decline in Thermal DAFOR performance for the current period compared to the previous period.

In the 10 year period prior to 2014, the hydraulic units show a somewhat consistent DAFOR. The DAFOR of the current 12-month period compared to the previous 10 years is higher, primarily due to vibration problems experienced at Unit 1 at Bay d'Espoir.

The thermal units, in the 10 year period prior to 2014, exhibit more variability in DAFOR than the hydraulic units, but in many years were close to a consistent rate of approximately 10%. The forced outage rate of the current period ending March 2016 is 13.54% which is above the base planning assumption of 9.64%, and the sensitivity of 11.64%. This is primarily caused by an airflow derating on Unit 1 and boiler tube failures on Units 1 and 2.

Hydro's combined gas turbines' UFOP in the 10 year period prior to 2014 was generally consistent at approximately 10% until the year 2012 when the rate exceeded 50%. Since

[1] Only includes data from March 1, 2015 to March 31, 2015

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

2012, the UFOP has been improving each year. For the current 12-month period ending March 31, 2016, performance was mainly affected by the forced outages to both the Stephenville and Happy Valley units. The decline in performance for the Holyrood CT is related to the data collection period. Performance data for the Holyrood CT for the 12-month period ending March 2015 includes one month of data where the 12-month period ending March 2016 includes a full year of data.

Note that the data in the charts for 2004 to 2014 are annual numbers (January 1 to December 31), while the data for March 2015 and March 2016 are 12-month rolling (April 1 to March 31 for each period).

3.0 Generation Planning Assumptions

The DAFOR and UFOP indicators used in Hydro's generation planning model is representative of a historic average of the actual performance of these units. These numbers are noted in the table below under the column "Base Planning Assumption"[3].

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, 2016, the gas turbine units performed within this sensitivity range for UFOP, while both the hydraulic and thermal classes performed outside of the for DAFOR. Hydro notes that as part of the ongoing risk review considering energy supply up to Lower Churchill interconnection, Hydro is considering several years of data of DAFOR and UFOP and the resulting implication for meeting reliability criteria.

The new gas turbine (Holyrood CT) has a lower expected rate of unavailability than the original gas turbines, of 5% compared to 10.62% respectively, due to the fact that the unit is new and can be expected to have better availability than the older units.[4]

[3] Hydro is currently completing a risk assessment on thermal generation supply for the period up to interconnection with Labrador and Nova Scotia. As part of this risk assessment, Hydro is reviewing the recent availability results. The outcome of this review may reflect a new base planning assumption for various generation sources.

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

Hydro's current generation planning assumptions for DAFOR and UFOP are:

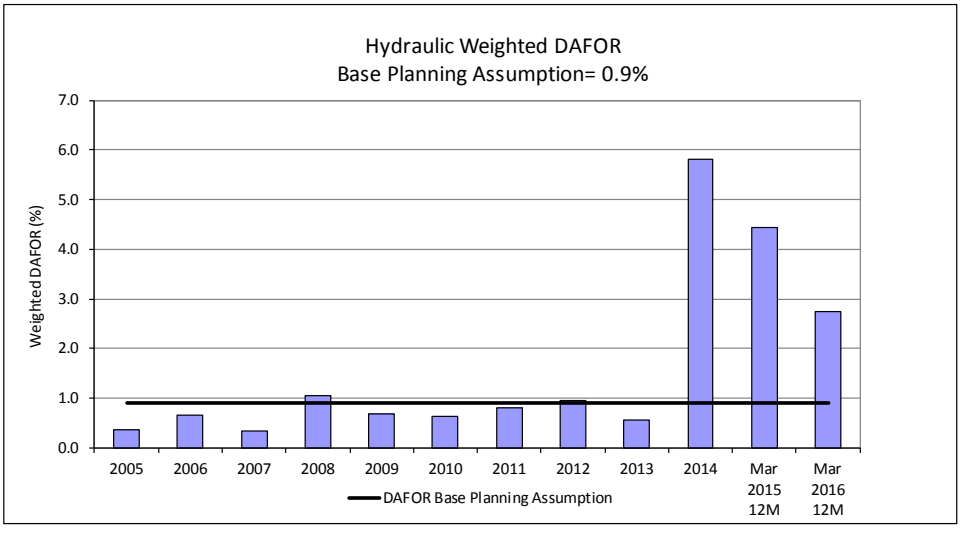
	DAFOR (%)		UFOP (%)	
	Base Planning Assumption	**Sensitivity**	**Base Planning Assumption**	**Sensitivity**
Hydraulic Units	0.90	0.90		
Thermal Units	9.64	11.64		
Gas Turbines - Existing			10.62	20.62
Gas Turbines - New			5.0	10.0[5]

[5] In previous reports this sensitivity value was reported as 5.0%. The generation planning sensitivity for the Holyrood CT was updated to 10 % since the last report for system planning purposes.

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, 2016 are presented as well as the data for the 12-month period ending March 31, 2015. These are compared to Hydro's generation planning assumption for the forced outage rate.

Generating Unit	Maximum Continuous Unit Rating (MW)	12 months ending March 2015 (%)	12 months ending March 2016 (%)	Hydro Generation Base Planning Assumption (%)
All Hydraulic Units - weighted	954.4	4.45	2.76	0.90
Hydraulic Units				
Bay D'Espoir 1	76.5	0.03	26.91	0.90
Bay D'Espoir 2	76.5	0.01	0.07	0.90
Bay D'Espoir 3	76.5	0.00	0.00	0.90
Bay D'Espoir 4	76.5	0.64	0.42	0.90
Bay D'Espoir 5	76.5	0.18	3.09	0.90
Bay D'Espoir 6	76.5	45.48	0.00	0.90
Bay D'Espoir 7	154.4	2.10	0.00	0.90
Hinds Lake	75	0.21	0.16	0.90
Upper Salmon	84	2.22	0.00	0.90
Granite Canal	40	0.32	2.07	0.90
Cat Arm 1	67	0.62	0.01	0.90
Cat Arm 2	67	1.34	1.39	0.90
Paradise River	8	0.00	0.24	0.90



The weighted "All Hydraulic Units" DAFOR was 2.76% for the current 12 month period ending March 31, 2016. The forced outage and derating of Unit 1 at Bay d'Espoir was the primary contributor to the DAFOR of 2.76% as compared to a base planning assumption of 0.9%.
Considering the individual units performance, the assumed Hydro generation base planning DAFOR was materially exceeded for Bay d'Espoir Unit 1. Also, there were exceedances compared to base planning assumption for Bay d'Espoir Unit 5, Granite Canal and Cat Arm Unit 2, for the current period.

The Bay d'Espoir Unit 1 DAFOR of 26.91% compared to the base planning assumption of 0.9% was the result of a forced extension of a planned outage. The planned annual maintenance was scheduled from April 26, 2015 to May 15, 2015. The extension is the unanticipated result of having to replace the turbine bearing. It was identified in the annual work plan to check the turbine bearing clearances due to an increase in bearing temperatures. The bearing clearances were checked and damage was found to the turbine bearing. Therefore it was replaced with a new bearing. Vibration issues continued to be experienced at the unit after the bearing was replaced, which extended the planned outage. Two vibration experts, Hydro's Project Execution and Technical Services personnel, as well as the Original Equipment Manufacturer were retained to troubleshooting the issue, with the unit eventually being returned to service at a reduced capacity. The original turbine bearing was reinstalled after being refurbished (with reduced clearances) and, while the vibration issue remained, a further dismantling of the unit revealed other issues including a damaged thrust bearing. Additional repairs were made and a new thrust bearing installed, which resolved the vibration issue, and the unit was returned to service at full capability on September 30, 2015.

The Bay d'Espoir Unit 5 DAFOR of 3.09% compared to the base planning assumption of 0.9% was the result of a forced outage after the completion of planned annual maintenance. The planned annual maintenance was completed from May 27, 2015 to August 7, 2015. Upon starting the unit, a stator ground fault occurred, which required five days to repair before the unit was placed into service on August 12, 2015.

The Granite Canal unit DAFOR of 2.07% compared to the base planning assumption of 0.9% was the result of a forced outage after a lightning strike to transmission line TL263 which connects the unit to the grid. A bearing issue (low water flow on the shaft seal) was experienced on the restart of the unit.

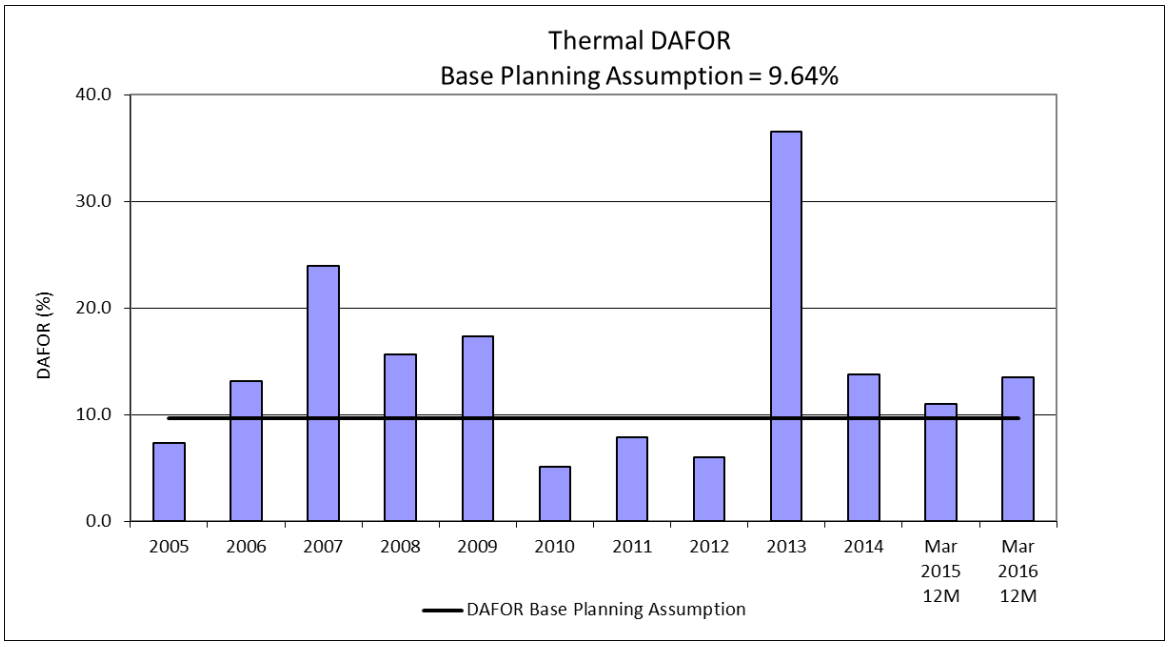
From August 10, 2015 to August 14, 2015, the unit incurred forced unavailability while repairs were completed to resolve this issue. From December 16, 2015 to December 17, 2015, the unit experienced forced unavailability due to debris on the intake trash rack.

The DAFOR for Cat Arm Unit 2 was 1.39% compared to the base planning assumption of 0.9%. On May 12, 2015, the unit experienced a nine hour forced outage due to a faulty unit shutdown relay. On May 21, 2015, the unit experienced a 14 hour forced outage due to a problem with a governor timer on the pump controls. Due a problem with the spherical valve and a governor pressure issue the unit also experienced a forced outage from June 13, 2015 to June 16, 2015.

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, 2016 are presented as well as the data for the 12-month period ending March 31, 2015. These are compared to Hydro's generation base planning assumption for the forced outage rate.

Generating Unit	Maximum Continuous Unit Rating (MW)	12 months ending March 2015 (%)	12 months ending March 2016 (%)	Hydro Generation Base Planning Assumption (%)
All Thermal Units - weighted	490	10.99	13.54	9.64
Thermal Units				
Holyrood 1	170	15.45	12.28	9.64
Holyrood 2	170	11.94	18.33	9.64
Holyrood 3	150	5.55	8.98	9.64



For the 12-month period ending March 31, 2016, the weighted DAFOR for, all thermal units, of 13.54% is above the assumed Hydro generation base planning DAFOR value of 9.64%, and also exceeded the previous 12-month period rate of 10.99%. Unit 1 DAFOR was 12.28% and Unit 2

DAFOR was 18.33%, and the performance for both units was above the base planning assumption of 9.64%. Unit 3 DAFOR was 8.98%, which is better than the base planning assumption of 9.64%.

The DAFOR performance for Holyrood Unit 1 (170 MW) was affected by several events in the current 12 MTD period.

From May 14, 2015 to August 1, 2015, a derating to 155 MW occurred due to airflow limitations. During the 2015 planned maintenance outage from August to October, the air heaters were found to be heavily fouled. They were cleaned during the outage. It was expected that the air flow problem that led to the load restriction has been resolved as a result of this clearing. Testing of the air flow controls during the maintenance outage did not reveal any problems

From November 27, 2015 to February 3, 2016 the unit was derated to 155 MW due to airflow limitations, suspected to be related to the new variable frequency drives on the forced draft (FD) fans. This was a continuation of the problems experienced prior to the annual maintenance outage. The air heater fouling that was discovered and corrected during the outage did not solve the problem with air flow. Boiler tuning may be effective in resolving this issue. This is not possible to complete until after the reheater tubes are replaced (see below).

On February 3, 2016 the east FD fan variable frequency drive failed and caused the unit to trip. Investigation by Siemens (the manufacturer of the drives) and plant engineering was conducted. Under a Siemens recommendation, a control card on the drive unit was replaced and the unit was returned to service on February 5, 2016. Siemens is completing a root cause failure analysis on the control card. When the unit was returned to service the load was limited to 140 MW to make the unit more reliable in consideration of the boiler reheater tube failures experienced in Unit 2.

On February 8, 2016 the unit experienced a tube failure in the reheater section of the boiler. The unit was operated with a deration to 50 MW until an opportune time to shut it down for repairs on February 16, 2016. Hydro considered the risk of additional tube failures and the favorable weather forecast at the time and proceeded with the replacement of the lowest wall thickness tubes during this outage. Sixteen lower reheater tubes were replaced at that time. The unit was

returned to service on February 26, 2016 with a derating to 120 MW to improve the reliability of the reheater until the remaining lower reheater tubes can be replaced during the upcoming scheduled annual maintenance outage.

The DAFOR performance for Holyrood Unit 2 (170 MW) was primarily affected by several events.

On January 6, 2016 the unit experienced a tube failure in the reheater section of the boiler. Upon discovery of the failure the unit was taken offline in a controlled shutdown and allowed to cool for internal inspection. Four failed tubes in the lower section of the reheater were identified and replaced. The unit was returned to service after the repairs on January 15, 2016. As is common practice when returning the unit to service, a stepped approach to loading the unit was employed. Between January 15 and January 19, the unit was gradually loaded in steps between 70 MW and 140 MW. On January 19, 2016, when operating at 140 MW, the unit experienced another failure in the lower reheater section of the boiler. Again the unit was taken offline in a controlled shutdown. Hydro considered the risk of additional tube failures and the favorable weather forecast at the time and proceeded with the replacement of the lowest wall thickness tubes during this outage. Over the period since the unit first went out of service January 6, 2016, 27 lower and three upper reheat tubes were replaced prior to the unit going back in service February 3, 2016. The unit was returned to service with a derating to 120 MW to improve the reliability of the reheater until the remaining lower reheater tubes can be replaced during the upcoming scheduled annual maintenance outage.

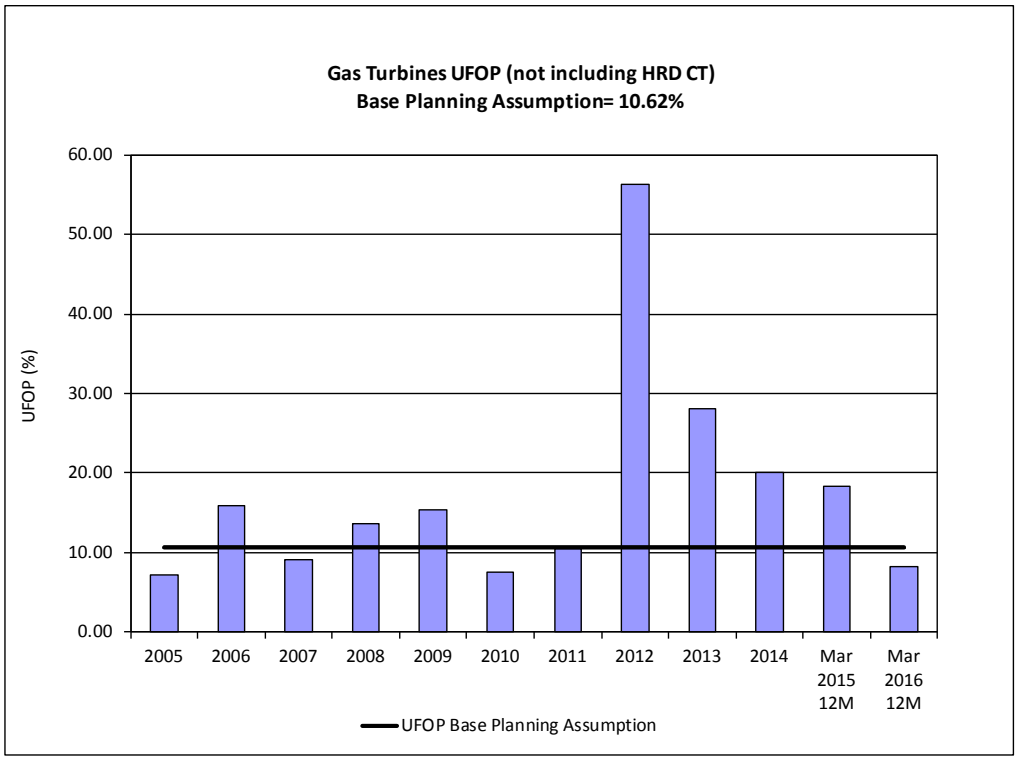
6.0 Gas Turbine UFOP Performance

The combined UFOP for the Hardwoods, Happy Valley and Stephenville gas turbines was 8.29% for the 12-month period ending March 31, 2016. This is better than the base planning assumption of 10.62%. The current period UFOP improved from the previous period UFOP of 18.36%. The Hardwoods UFOP for the current period is 3.05%, which is better than the base planning assumption of 10.62%. The Stephenville unit's current period UFOP is 15.08% compared to that of the previous period of 9.50%. Happy Valley's UFOP is 14.22% for the current period compared to 1.04% in the previous period.

Gas Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2015 (%)	12 months ending March 2016 (%)	Hydro Generation Base Planning Assumption (%)
Combined Gas Turbines	125	18.36	8.29	10.62
Stephenville	50	9.50	15.08	10.62
Hardwoods	50	33.82	3.05	10.62
Happy Valley	25	1.04	14.22	10.62

The Holyrood (HRD) CT UFOP of 2.81% for the current period is better than the base planning assumption of 5.00%.

Combustion Turbine Units	Maximum Continuous Unit Rating (MW)	12 months ending March 2015 (%)	12 months ending March 2016 (%)	Hydro Generation Base Planning Assumption (%)
Holyrood CT	123.5	0.70	2.81	5.00



The Stephenville unit UFOP was affected by three notable events in the reporting period.

The UFOP for Stephenville gas turbine was primarily impacted in 2015 by a forced outage from May 1, to May 27, due to an alternator bearing problem. The bearing was inspected, repaired, and all operating parameters checked and confirmed prior to returning the unit to service.

From February 10, 2016 to February 12, 2016, End B was unavailable due to a stuck solenoid on the fuel shut off valve. Minor maintenance was performed on the valve and the unit was returned to service.

As of March 26, 2016, there is a derating of the unit to 25 MW (from 50 MW). End A tripped and has been unavailable. A report on the unit is expected shortly.

The Happy Valley unit UFOP was primarily affected by the following event in the reporting period.

In 2015, the UFOP for the Happy Valley gas turbine was primarily impacted by a forced outage from September 9 to September 21, due to a vibration issue. The vibration issue was determined to be a result of a broken air pipe which was repaired and the unit was then tested and returned to service.