

Undertaking 81

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Re: Information #30

Re: Plant Life Extensions Upgrade – Hardwoods Gas Turbine, filed June 2009 as part of the 2010 Capital Budget Application

Undertake to provide those criteria (individual numbers for the UFOP, for the capability factor and for the failure rate) broken down by year, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 with whatever explanatory footnotes or text.

Below are the requested criteria for the Hardwoods Gas Turbine. The definitions used in the table are noted below:

- **Failure Rate** is defined as the rate at which the generating unit encounters a forced outage. It is calculated by dividing the number of transitions from an Operating state to a forced outage by the total operating time. It can be greatly influenced by operating time of standby units such as gas turbines.
- **Capability Factor** is defined as unit available time. It is the ratio of the unit's available time to the total number of unit hours.
- **UFOP** is defined as the Utilization Forced Outage Probability. It is the probability that a generation unit will not be available when required. It is used to measure performance of standby units with low operating time such as gas turbines.

Year	Failure Rate		Capability Factor		UFOP	
	Hardwoods GT	CEA ¹	Hardwoods GT	CEA ¹	Hardwoods GT	CEA ¹
2008	85.11	22.88	91.58	85.68	13.23	40.94
2009	168.25	83.04	85.55	88.12	15.40	36.17
2010	0 ²	74.10	76.53	89.92	18.67	12.80
2011	228.22	39.81	92.42	80.18	10.20	20.19
2012	255.10	51.13	86.58	86.55	35.14	20.87
2013	216.34	78.09	69.11	87.13	15.94	18.22
2014	148.16	85.43	68.68	72.95	35.09	12.98

1. CEA Data for 0-10% Operating Factor Classification - All Canada Combustion Turbine Units (GTs)

2. In 2010, there were no instances when a forced outage occurred when generating. The unit would have times when it was not available due to a forced outage if, for example, the forced outage occurred as a result of an issue discovered when it was not operating.

Notes:

In 2010, the capability factor was lower than the previous years due to an extended planned outage from October 25 to December 2. This planned outage included work to replace the engine and upgrades to the unit.

In 2012, the UFOP was affected by 13 forced outages for various causes. The unit had a forced outage duration of 474 hours versus an operating time of 103 hours. Including three forced outages during generating mode.

In 2013, the capability factor was lower than the previous years due to an extended planned outage from October 4 to December 17. This planned outage included work to replace the alternator G1, 66 kV circuit breaker G1T5, cables between breaker G1T5 and transformer T5, fuel valve (End A) and MLO pumps, to upgrade generator protection, to replace building cladding and perform other general corrective maintenance.

In 2014, the capability factor and UFOP were both affected by two forced outages. One forced outage occurred from July 25 to September 25 due to a fire in the motor control center. Also, there was a forced outage from November 27 to December 7 due to a fuel valve failure.

Hydro notes the following for further information:

1. The failure rate is sensitive to the number of operating hours of a unit and can be significantly impacted by a small number of forced outages, in a scenario of lower operating hours. In the requested time period, Hardwoods was not operated for a significant number of hours each year, thus for a small numbers of forced outages, the failure rate is high, which results in making comparisons less meaningful. UFOP brings into account the number of times the unit is required and was successfully or unsuccessfully started. Therefore, UFOP is generally considered a more meaningful comparator for units that have a small number of operating hour requirements.
2. In the requested time period, the CEA capability factor ranged from 72.95 to 89.92. The capability factor for Hydro in that same period ranged from 68.68 to 92.42, comparable to the range seen by other CEA members. The higher the number, the more available the unit.
3. In the requested time period, the CEA UFOP factor ranged from 12.80 to 40.94. The UFOP for the Hardwoods gas turbine ranged from 10.20 to 35.14, comparable to the range seen by other CEA members. The lower the number, the more reliable the unit.