

K5.1

EB-2007-0905

AMPCO Cross-Examination

Document Brief

OPG Panel #5: Nuclear Production
Forecast and Outage OM&A

May 28, 2008

Ontario Energy Board	
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APPENDIX 1

APPENDIX 1																					
Actual Nuclear Output	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Ontario Hydro	68.0	60.5	73.7	66.9	80.9	92.9	87.9	79.4	71.4	60.7	61.9	60.3	63.5	42.1	38.0	42.4	45	46.9	44.2	44.2	
OPG																					
Bruce																					
Forecast Source	Forecast Date																				
OH Business Plan	69.2				98.2				99.7												
OH Business Plan	67.5	72				96.6					96.5										
OH Demand/Supply Plan		70	76	82	88	94	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
OH Business Plan		65.8	72.7				98.8				104.3										
OH Business Plan			59.5	76.4				89.4					100.5								
OH Business Plan					66.2	79.8															
CES 93-4																					
OH Business Plan							86.2	88.6	86.5												
OH Corp Plan 1998-2000							88.8	86.9	87.2												
NAOP/IIP											56.3	59	62.7								
O.Reg 53/05												57						45.2	50.6	53	
OPG Response to AMPCO #29																					

Actuals are taken from IAEA Power Reactor Information System (<http://www.iaea.org/dbpage/>) except 2007 for Bruce Power taken from BP's Year in Review. Note that the IAEA includes commissioning energy, while production forecasts typically include only energy from in-service units.

Ontario Hydro DSP forecast is read from Table 4.19 of the DSP and is approximate.

The NAOP/IIP (Nuclear Asset Optimization Plan/Integrated Improvement Plan) data were referenced in KPMG's 2004 OPG review.

Evidence referenced by footnotes available upon request.

AMPco Evidence
Ex.M Tab 2 Appendix)
Filed: April 24, 2008

Integrated Generation Plan for years 2005 - 2009 - as per BP 2001 through to BP 2007

	BP2001				BP2002				BP2003				BP2004				BP2005				BP2006				BP 2007			
	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
PA - TWh	16.5	16.4	16.7	15.5	4.9	8.5	11.5	15.5	4.3	7.9	10.1	14.4	15.3	7.0	7.3	7.2	7.6	12.0%	10.0%	8.0%	7.5%	7.0	7.3	7.2	7.6	7.5	7.2	7.7
PA - FLR	3.0%	3.0%	4.0%	4.0%	5.0%	5.0%	4.0%	4.0%	15.5%	9.8%	9.9%	9.6%	8.1%	12.0%	10.0%	8.0%	7.5%	77.7	66.2	94.5	63.0	77.7	66.2	94.5	63.0	66.2	94.5	63.0
PA - PO days	70.0	69.0	50.0	63.0	63.0	0.0	36.0	63.0	66.2	14.7	94.5	80.2	108.5	14.8	15.5	16.0	15.9	14.8	15.5	16.0	15.9	14.8	15.5	16.0	15.9	15.5	15.7	15.9
PB - TWh	16.1	15.7	16.4	16.6	14.6	15.2	15.5	16.0	13.3	14.8	15.8	15.8	15.8	14.8	15.5	16.0	15.9	14.8	15.5	16.0	15.9	14.8	15.5	16.0	15.9	15.5	15.7	15.9
PB - FLR	2.5%	2.5%	2.2%	2.1%	7.0%	5.0%	4.0%	3.5%	9.0%	8.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	6%	6%
PB - PO days	127.0	160.0	90.0	90.0	189.6	163.0	152.0	123.0	280.5	155.4	90.3	87.2	84.0	171.0	123.0	84.0	84.0	171.0	123.0	84.0	84.0	171.0	123.0	84.0	84.0	121.0	112.0	93.0
DA - TWh	28.2	28.2	28.6	28.8	28.0	28.1	28.3	28.8	27.6	27.7	27.0	28.2	28.4	27.5	27.1	28.1	26.6	27.5	27.1	28.1	26.6	27.5	27.1	28.1	26.6	26.8	28.2	26.6
DA - FLR	4.0%	4.0%	2.1%	1.5%	3.0%	2.5%	2.0%	1.5%	4.6%	4.0%	4.0%	4.0%	4.0%	4.1%	4.1%	3.8%	3.5%	4.1%	4.1%	3.8%	3.5%	4.1%	4.1%	3.8%	3.5%	4.1%	3.8%	3.5%
DA - PO days	69.0	69.0	75.0	78.0	94.5	94.0	94.0	78.0	85.6	87.2	121.5	64.6	142.8	99.8	116.6	76.1	150.2	99.8	116.6	76.1	150.2	99.8	116.6	76.1	150.2	131.0	73.5	151.6
Nuclear TWh	60.7	60.4	60.7	54.6	59.3	62.0	47.5	51.9	55.3	60.4	45.2	50.5	52.8	58.5	57.6	49.3	49.9	49.3	49.9	51.3	50.1	49.3	49.9	51.3	50.1	49.8	51.1	50.2
Nuclear PO Days	266.0	298.0	290.0	274.0	257.0	215.0	347.1	257.0	282.0	264.0	432.2	257.3	306.3	231.9	335.3	348.5	305.7	348.5	305.7	254.6	297.2	348.5	305.7	254.6	297.2	318.2	280.0	307.6

Actual
Nuclear
Output

2005
44.9

2006
46.9

2007
44.0

45.0

46.9

44.2

OPG update
E2-T1-S1
Table 1

(3)

APPENDIX C

FORCED OUTAGE REPORT AND SUMMARY OF CORRECTIVE ACTIONS TAKEN

Attachments 1, 2 and 3 to this Appendix provide details (i.e. outage type, start date, end date, duration, generation loss, description of reasons for the outage and corrective actions taken) for 2005, 2006 and 2007 (January - July) as contemplated by the OEB's filing guidelines. OPG has a well-established corrective action program that establishes the processes that ensure that all deficiencies that adversely impact, or may adversely impact plant operations, personnel, nuclear safety, the environment or reliability, are identified and corrected.

As set out in the attachments, there are certain events that have significantly impacted the overall forced losses during the period, specifically:

- Pickering A liquid zone control
- Primary heat transport pumps
- The 2006/2007 resin inclusion event
- Pickering A electrical supply system
- Shutdown cooling (SDC) pump seals

To date, OPG has largely been successful in identifying root causes and has taken aggressive actions in an effort to mitigate reoccurrence. Descriptions of these events along with an overview of OPG's corrective actions are provided below:

Pickering A Liquid Zone Control

The liquid zone control ("LZC") system is the primary reactor power control device in a CANDU reactor. As noted at Ex. F2-T2-S1, while OPG's 10 nuclear units are all heavy water moderated CANDU reactors, they reflect three generations of design philosophy and technology. Pickering A was designed in the 1960's, Pickering B in the 1970's, and Darlington in the 1980's. While the

1
2 **Primary Heat Transport Pumps**

3 At Pickering B, the main driver of primary heat transport pump performance is the seals on the
4 primary heat transport main circulating pump. These seals fail due to the failure of pins intended
5 to prevent the spinning of the pump bearing housing. OPG has a program, to be completed by
6 2012, to replace the seals at its Pickering B units based on the age of the seals. New bearing
7 housings fitted with an upgraded design are being installed. The primary heat transport pumps at
8 Pickering A have been inspected and no issues have been found with them.
9

10 **2006/2007 Resin Inclusion Event**

11 All Pickering B units experienced forced outages or planned outage extensions due to steam
12 generator chemistry issues arising from the inadvertent release of a resin into the demineralized
13 water system in late December 2006. This release was by a third-party contractor and the source
14 of the resin was the feed water purification system. Following this event, OPG implemented a
15 resin cleaning strategy review. Teams from Pickering A and Pickering B were established to
16 investigate the extent of the condition across the two stations. They concluded that a failed
17 internal resin screen and a missing downstream resin trap in the vendor owned and operated
18 water treatment plant led to the resin passing into the demineralized water systems at the
19 stations.
20

21 Lessons learned from this investigation are currently being implemented at Pickering B as
22 follows:

- 23 • OPG Staff are meeting routinely with the vendor to ensure that appropriate control measures
24 are being taken.
25 • Daily water treatment plant walk downs are being conducted jointly by OPG staff and the
26 vendor to identify and correct plant deficiencies in a timely manner.
27 • A project is currently underway to install an extra strainer, shut off valve and enhanced
28 monitoring system on the demineralized water line, downstream of the water treatment plant.
29 • OPG is working with the nuclear industry, through World Association of Nuclear Operators
30 ("WANO"), to share its experiences with others.
31

1 Improve Shutdown Cooling (SDC) Pump Seal Performance:

2 In response to previous failures of SDC pump seals at Pickering B, a newly designed pump seal
3 was procured from AECL. During 2006 and 2007 the upgraded pump seals were installed in the
4 shutdown cooling pumps on two of the four Pickering B units based on the original equipment
5 manufacturer's recommendation. Unfortunately, the new pump seals have failed as well. An
6 investigation in conjunction with AECL is underway.

condition, improved forced outage readiness, and improved outage planning based in part on lessons-learned reviews) to transition OPG Nuclear to a more sustainable, reliable, and predictable level of performance by reducing the number of planned outage days and the level of forced production losses can be found in section 3 (OPG Nuclear Production Forecast Trend) in Ex. E2-T1-S1.

OPG Nuclear's planned outage days by month for 2007 - 2009 are set out in Chart 1 below:

Chart 1
Nuclear Planned Outage Days by Month 2007 - 2009¹

	2007 Actual	2008 Plan	2009 Plan
Jan	0	0	0
Feb	0	11	0
Mar	23	35	29
Apr	58	48	68
May	53	31	88
Jun	10	10	30
Jul	0	0	6
Aug	0	0	0
Sep	30	19	13
Oct	77	49	36
Nov	60	47	56
Dec	20	4	17
Total	331	254	343

1. Numbers may not correspond to numbers in Ex. E2-T1-S2 Table 2b due to rounding in Chart 1. The numbers in Ex. E2-T1-S2 Table 2b are based on start dates and end dates that include mid-day starts.

Numbers may not add due to rounding.

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EB-2007-0905

Exhibit E2

Tab 1

Schedule 2

Table 1

Table 1
Production - Nuclear (TWh)

Line No.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
	Budget - Calendar Year Ending December 31, 2005													
1	Nuclear Total	4.2	3.6	3.6	3.1	3.7	3.7	4.2	4.0	3.7	3.3	3.7	4.3	45.2
	Actual - Calendar Year Ending December 31, 2005													
2	Nuclear Total	4.3	3.9	3.9	2.6	3.2	3.6	4.1	4.1	3.8	3.4	3.9	4.4	45.0
	Budget - Calendar Year Ending December 31, 2006													
3	Nuclear Total	4.5	4.2	4.1	3.5	3.8	4.4	4.6	4.6	4.3	3.5	3.4	4.5	49.4
	Actual - Calendar Year Ending December 31, 2006													
4	Nuclear Total	4.0	4.3	4.3	3.6	3.7	3.9	4.2	4.6	4.1	3.6	3.0	3.5	46.9
	Budget - Calendar Year Ending December 31, 2007													
5	Nuclear Total	4.6	4.2	4.2	3.6	4.1	4.5	4.6	4.6	4.2	3.5	3.4	4.3	49.9
	Actual - Calendar Year Ending December 31, 2007													
6	Nuclear Total	3.5	4.0	4.0	3.6	3.9	3.5	3.8	3.7	3.3	3.2	3.2	4.3	44.2
	Plan - Calendar Year Ending December 31, 2008													
7	Nuclear Total	4.7	4.2	4.2	3.7	4.0	4.3	4.7	4.7	4.3	4.1	4.0	4.6	51.4
	Plan - Calendar Year Ending December 31, 2009													
8	Nuclear Total	4.7	4.3	4.4	3.3	2.9	3.9	4.6	4.7	4.4	4.3	3.9	4.5	49.9

8