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## **UNDERTAKING J5.1**

### **Undertaking**

To provide the calculation of NPV.

### **Response**

Attachment 1 provides the workbook used to calculate the Net Present Value of Pickering B Continued Operations. The spreadsheets contain complex formulae and use acronyms which are familiar to users trained in the spreadsheet, but which may not be properly understood by others. Because of the complexity of the spreadsheets, OPG cannot warrant the accuracy of the results obtained by any manipulation of the spreadsheets conducted by third parties.

The first spreadsheet, "PLEP Model", contains the detailed cost and performance projections, including unit by unit projections, for the Pickering A and B Units going out to 2023 (the calculations go out to 2023 in order to allow the running of sensitivities).

The second spreadsheet "PoverP Model" contains the detailed incremental value of the Pickering B Continued Operations generation in the Ontario market, as evaluated by OPG. In addition, this spreadsheet contains the summary data and calculations which are used to derive the Net Present Value.

The third spreadsheet, "PoverP Summary", contains the results of the sensitivity runs presented at Ex. F2-T2-S3, Attachment 1. The results in sheet PoverP Summary are not automatically updated when changes are made in the other spreadsheets.

In the Transcript Volume 5, p. 109, line 7, Ms Chaplin asked whether the costs used in the business case summary analysis were incremental, to which Mr. Pasquet responded that OPG used "all-in" or "total" cost. In this context, the term "all-in" or "total" costs refers to all direct station costs used in the economic analysis (base OM&A, outage OM&A, project OM&A, project capital, and fuel costs), plus incremental Nuclear and Corporate support costs considered to be attributable to the operation of Pickering A and Pickering B. These support costs would be incurred only if the Continued Operations initiative was achieved and they are included in order to capture the full cost of the initiative.





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
118	On/Off																		
119	EFOR - FLR Adjustment (%)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
120	0	P1																	
121		P4																	
122		P5																	
123		P6																	
124		P7																	
125		P8																	
126																			
127	Aging Increment to EFOR (%)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
128		P1																	
129		P4																	
130		P5																	
131		P6																	
132		P7																	
133		P8																	
134																			
135	Sensitivity Adjustment to EFOR (%)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
136		P1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
137		P4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
138		P5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
139		P6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
140		P7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
141		P8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
142																			
143	Modeled EFOR (%)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
144		P1																	
145		P4																	
146		P5																	
147		P6																	
148		P7																	
149		P8																	
150																			
151																			
152	<b>FINAL OUTAGE AND ENERGY PRODUCTION</b>																		
153																			
154	End of Life Data		kEFPH as of 08/12/31	Base Case - Potential kEFPH	Cont. Ops Incremental kEFPH	Capacity (MW)	Next Year Days Reduce PO	Min PO days											
155		P1	86.1	180.0		515	210	30											
156		P4	55.1	180.0		515	210	30											
157		P5	168.7	210.0	30.0	516	90	0											
158		P6	171.4	210.0	30.0	516	210	30											
159		P7	164.7	210.0	30.0	516	90	0											
160		P8	154.5	210.0	30.0	516	0	0											
161																			
162	Base Case - Equivalent Operating Days Prelim.		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
163		P1																	
164		P4																	
165		P5																	
166		P6																	
167		P7																	
168		P8																	
169																			
170	Cont. Ops Case- Equivalent Operating Days Prelim.		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
171		P1																	
172		P4																	
173		P5																	
174		P6																	
175		P7																	
176		P8																	
177																			
178	Base Case - Outages (days)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022			





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
305	<b>EVALUATED STATION FULL-YEAR OPERATING COSTS (Real 2010 \$)</b>																			
306																				
307	Fraction of Support Payments Used																			
308			Nuclear	Corporate																
309	Incremental		60%	23%																
310																				
311	<b>Delta %</b>																			
312	Base Case - Pickering A																			
313	0%	OM&A & CTU	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
314	0%	Nuclear Support Included	342.6	288.0	268.0	286.5	280.4	294.2	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8
315	0%	Corporate Support Included	64.0	66.0	62.5	63.1	62.8	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1
316		Subtotal	15.6	21.4	22.2	23.1	25.3	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
317			422.2	375.5	352.7	372.7	368.4	380.7	377.3	377.3	377.3	377.3	377.3	377.3	377.3	377.3	377.3	377.3	377.3	377.3
318	0%	Fuel (\$/MWh)	2.98	3.46	3.87	4.14	4.22	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12
319		Fuel Waste Provision (\$/MWh)																		
320																				
321	Base Case - Pickering B																			
322	0%	OM&A & CTU	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
323	0%	Nuclear Support Included	426.9	440.3	408.9	471.7	469.9	475.5	461.3	461.3	461.3	461.3	461.3	461.3	461.3	461.3	461.3	461.3	461.3	461.3
324	0%	Corporate Support Included	93.2	90.1	88.7	91.5	88.0	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8	85.8
325		Subtotal	23.3	32.0	33.2	34.6	37.8	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
326			543.3	562.5	530.7	597.7	595.7	597.8	583.6	583.6	583.6	583.6	583.6	583.6	583.6	583.6	583.6	583.6	583.6	583.6
327	0%	Fuel (\$/MWh)	3.31	3.88	4.37	4.67	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74	4.74
328		Fuel Waste Provision (\$/MWh)																		
329																				
330	Inc. Cont. Ops - Pickering B																			
331	0%	Inc. Cont. Ops. Investment	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
332	-100%	Inc. Annual Cost during Cont. Ops	4.0	13.5	49.6	40.5	34.5	43.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
333																				

<b>Ontario CPI (NSA)* (Reference: OPG Economic Outlook (Sept 2009))</b>																
	Jan-09	Jan-10	Jan-11	Jan-12	Jan-13	Jan-14	Jan-15	Jan-16	Jan-17	Jan-18	Jan-19	Jan-20	Jan-21	Jan-22	Jan-23	
CPI Rate	0.7%	1.7%	2.1%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	
CPI Index (2009=1)	1.017	1	0.979	0.960	0.941	0.923	0.905	0.887	0.870	0.853	0.836	0.819	0.803	0.788	0.772	
<b>Discount Rates</b>																
	Dec-09	Jan-10	Jan-11	Jan-12	Jan-13	Jan-14	Jan-15	Jan-16	Jan-17	Jan-18	Jan-19	Jan-20	Jan-21	Jan-22	Jan-23	
Nominal Discount Rate	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%	
Real Discount Rate	6.3%	5.2%	4.8%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	
Nominal PV Index	1.07	1	0.9346	0.8734	0.8163	0.7629	0.7130	0.6663	0.6227	0.5820	0.5439	0.5083	0.4751	0.4440	0.4150	
Real PV Index	1.05	1	0.9542	0.9097	0.8672	0.8267	0.7881	0.7512	0.7161	0.6827	0.6508	0.6204	0.5914	0.5637	0.5374	
Tax Rate	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	
After Tax Rate	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	73.0%	

<b>Sensitivity Flags</b>		
352		
353 <b>Fraction of Support Payments Used</b>		
354 <b>Active:</b>	Nuclear	Corporate
355 1 Incremental	60%	23%
356 <b>Possible Values</b>		
357 1 Incremental	60%	23%
358 2 Total	100%	100%
359		
360		
361 <b>Added Life With Cont. Ops (kEFPH):</b>		
362 <b>Active:</b>		
363 4		
364 4 4 Years	30.0	
365 <b>Possible Values</b>		
366 1 1 Years	7.5	
367 2 2 Years	15.0	





	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	<b>PICKERING A &amp; B: BASE CASE AND CONTINUED OPERATIONS DATA (No Life Management of P7, Bus. Plan FLR &amp; OM&amp;A)</b>																
2																	
3		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	PV, Ave	
4	<b>Base Case</b>																
5	Pickering A&B	Total OM&A (M2010\$)	965.5	938.0	883.5	970.5	964.2	818.7	291.8	39.0						5451.6	
6		Fuel & Waste Provision (M2010\$)	70.0	77.7	98.0	106.7	109.8	80.0	20.6	2.8						521.7	
7		Energy (TWh)	21.8	20.7	23.3	23.7	24.0	17.8	4.3	0.6						126.9	
8		PO Days	266.0	408.0	202.0	191.0	163.0	95.0									
9		ACF (%)	81.1%	76.6%	86.0%	87.4%	88.6%	90.3%	96.0%	96.0%						85.0%	
10	<b>Continued Operations</b>																
11																	
12	Pickering A&B	Total OM&A (M2010\$)	969.5	951.5	933.1	1011.0	998.7	1022.2	960.9	960.9	960.9	896.7	785.8	319.1		8981.1	
13		Fuel & Waste Provision (M2010\$)	70.0	76.4	92.7	103.6	104.6	101.2	97.7	103.4	99.3	85.8	73.0	29.7		857.5	
14		Energy (TWh)	21.8	20.4	22.1	23.1	22.9	22.4	21.6	22.8	22.0	19.1	16.4	6.7		201.6	
15		PO Days	266.0	436.0	304.0	247.0	255.0	308.0	366.0	262.0	317.0	225.0	30.0				
16		ACF (%)	81.1%	75.3%	81.5%	84.9%	84.5%	82.6%	80.1%	84.0%	81.2%	82.6%	91.0%	91.0%		82.4%	
17	<b>Difference: Cont Ops - Base</b>																
18																	
19	Pickering A&B	Total OM&A (M2010\$)	4.0	13.5	49.6	40.5	34.5	203.6	669.1	921.9	960.9	896.7	785.8	319.1		3529.5	
20		Fuel & Waste Provision (M2010\$)		-1.3	-5.3	-3.1	-5.2	21.2	77.1	100.7	99.3	85.8	73.0	29.7		335.9	
21		Energy (TWh)		-0.3	-1.2	-0.7	-1.1	4.5	17.3	22.2	22.0	19.1	16.4	6.7		74.7	
22		PO Days		28.0	102.0	56.0	92.0	213.0	366.0	262.0	317.0	225.0	30.0				
23		ACF (%)		-1.2%	-4.5%	-2.5%	-4.1%	-7.7%	-15.9%	-12.0%	81.2%	82.6%	91.0%	91.0%		43.8%	
24																	
25	Pickering A&B	Revenue/Value (M2010\$)		-13.1	-48.2	-25.2	-44.6	200.0	981.8	1511.1	1616.8	1530.1	1281.7	625.9		5378.3	
26		Net Revenue/Value	-4.0	-25.3	-92.5	-62.6	-73.9	-24.7	235.5	488.6	556.6	547.7	422.9	277.0		1512.9	
27		Cumm. NPV After Tax	0.0	-18.5	-83.0	-124.5	-171.3	-186.2	-50.7	217.2	508.2	781.1	982.0	1107.5	1107.5	1107.5	1107.5
28																	
29																	
30																	
31	<b>CALCULATIONS</b>																
32																	
33		CPI Index (2009=1)	1.017	1	0.979	0.960	0.941	0.923	0.905	0.887	0.870	0.853	0.836	0.819	0.803	0.788	0.772
34		Real PV Index	1.05	1.00	0.95	0.91	0.87	0.83	0.79	0.75	0.72	0.68	0.65	0.62	0.59	0.56	0.54
35		After Tax Rate	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
36																	
37																	
38																	
39	<b>Generation Value</b>																
40																	
41		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		
42	<b>Active:</b>																
43	1 PCO SEV_Base - PNoCO SEV_Base																
44	Gross Benefit (C\$M)		-13	-47	-25	-44	197	965	1485	1589	1504	1260	615	0	0		
45	Energy (TWh) - Nuc --Pick		-0.33	-1.21	-0.66	-1.09	4.53	17.29	22.19	21.96	19.11	16.43	6.67	0.00	0.00		
46																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	PV, Ave	
1	<b>PICKERING A &amp; B: BASE CASE AND CONTINUED OPERATIONS DATA (No Life Management of P7, Bus. Plan FLR &amp; OM&amp;A)</b>																
2																	
3			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	PV, Ave
47			<b>1 PCO SEV_Base - PNoCO SEV_Base</b>														
48																	
49		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.53	17.29	22.19	21.96	19.11	16.43	6.67	0.00	0.00		
50		Gross Benefit (C\$M)	-13	-47	-25	-44	197	965	1485	1589	1504	1260	615	19	22		
51																	
52																	
53																	
54																	
55																	
56			<b>3 PCO225k SEV_Base - PNoCO SEV_Base</b>														
57		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.53	17.89	18.28	14.99	5.54	0.00	0.00	0.00	0.00		
58		Gross Benefit (C\$M)	-13	-47	-25	-44	197	996	1258	1109	531	4	9	12	13		
59																	
60																	
61																	
62																	
63																	
64			<b>5 PCO247k SEV_Base - PNoCO SEV_Base</b>														
65		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.53	17.29	22.19	21.36	22.76	20.67	13.47	9.49	0.00		
66		Gross Benefit (C\$M)	-13	-47	-25	-44	197	965	1485	1553	1731	1590	1052	725	23		
67																	
68																	
69																	
70																	
71																	
72			<b>7 PCOLoCF SEV_Base - PNoCOLoCF SEV_Base</b>														
73		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.53	15.04	19.80	19.11	19.84	14.97	11.99	3.32	0.00		
74		Gross Benefit (C\$M)	-13	-47	-25	-44	197	845	1346	1417	1548	1211	955	327	20		
75																	
76																	
77																	
78																	
79																	
80			<b>9 PCOHiCF SEV_Base - PNoCOHiCF SEV_Base</b>														
81		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.39	18.21	23.36	23.12	18.66	17.32	2.81	0.00	0.00		
82		Gross Benefit (C\$M)	-13	-47	-25	-44	191	1012	1553	1660	1476	1318	363	20	23		
83																	
84																	
85																	
86																	
87																	
88			<b>11 PCO SEV_High - PNoCO SEV_High</b>														
89		Energy (TWh) - Nuc --Pick	-0.39	-1.33	-1.20	-1.40	4.16	16.96	21.95	21.88	19.49	16.66	6.91	0.00	0.00		
90		Gross Benefit (C\$M)	-20	-68	-68	-86	270	1382	2190	2326	2178	1835	915	38	32		
91																	
92																	
93																	
94																	
95																	
96			<b>13 PCO SEV_Low - PNoCO SEV_Low</b>														
97		Energy (TWh) - Nuc --Pick	-0.33	-1.21	-0.66	-1.09	4.53	17.29	22.19	21.96	19.11	16.43	6.67	0.00	0.00		
98		Gross Benefit (C\$M)	-8	-34	-18	-32	133	638	934	987	929	756	318	1	1		

	A	B	C	D	E
4					
5					
6	Scenario		PA + PB		Notes
7					
8	BC no P7 LM, CO with P7 LM, Base ACF, SEV Base		1,107		PCO SEV_Base - PNoCO SEV_Base
9					
10	BC no P7 LM, CO with P7 LM, Base ACF, SEV High		2,863		PCO SEV_High - PNoCO SEV_High
11	BC no P7 LM, CO with P7 LM, Base ACF, SEV Low		-398		PCO SEV_Low - PNoCO SEV_Low
12					
13	BC no P7 LM, CO with P7 LM, Base ACF, SEV Base, 2 x CO Costs		988		PCO SEV_Base - PNoCO SEV_Base
14	BC no P7 LM, CO with P7 LM, Base ACF, SEV Base, 0.5 x CO Costs		1,167		PCO SEV_Base - PNoCO SEV_Base
15					
16	BC no P7 LM, CO with P7 LM, ACF lower by ~ 10% (base EFOR +10%), SEV Base		859		PCoLoCF SEV_Base - PNoCoLoCF SEV_Base
17	BC no P7 LM, CO with P7 LM, ACF higher by ~ 5% (EFOR -5%), SEV Base		1,193		PCoHiCF SEV_Base - PNoCoHiCF SEV_Base
18					
19	BC no P7 LM, CO with P7 LM, Base ACF, SEV Base, 2 yrs CO life		424		PCO225k SEV_Base - PNoCO SEV_Base
20	BC no P7 LM, CO with P7 LM, Base ACF, SEV Base, 5 yr CO life		1,331		PCO247k SEV_Base - PNoCO SEV_Base
21					