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Ontario Energy Board
Commission de l'énergie de l'Ontario

Ontario

EB-2007-0905

IN THE MATTER OF AN APPLICATION BY

ONTARIO POWER GENERATION INC.

PAYMENT AMOUNTS FOR PRESCRIBED FACILITIES

DECISION WITH REASONS

November 3, 2008

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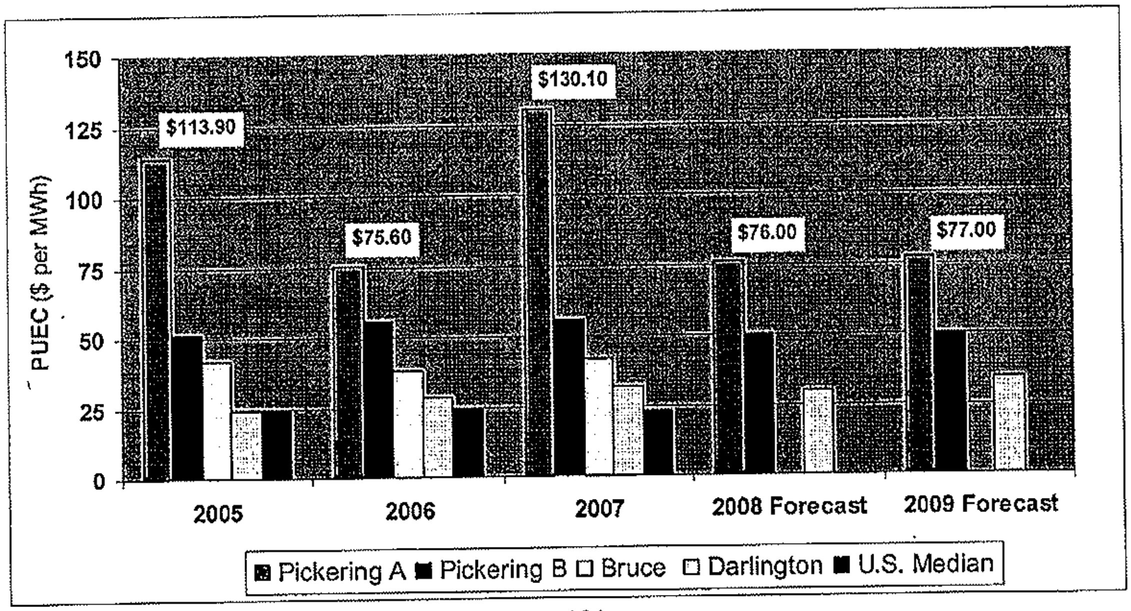
period. The per MWh amounts shown on the face of the chart are for the Pickering A station, which has the highest PUEC of the stations shown on the chart.

Chart 2-1 shows that the production cost per MWh for Pickering A and Pickering B have been substantially greater than for Bruce Power. Over the three years 2005 to 2007, Pickering A's unit production cost was on average three times higher than Bruce Power and four times the U.S. median. Darlington's performance is better than Bruce Power, but is worse than the U.S. median. The average cost per MWh at Pickering A over the three-year period was $107 compared to $24 for the U.S. median and $41 for Bruce Power.

Chart 2-1: Comparative Nuclear PUEC Costs



Sources: Ex. J5.4; Ex. L-4-2, Attachment 3, pp. 18, 21, and 24.

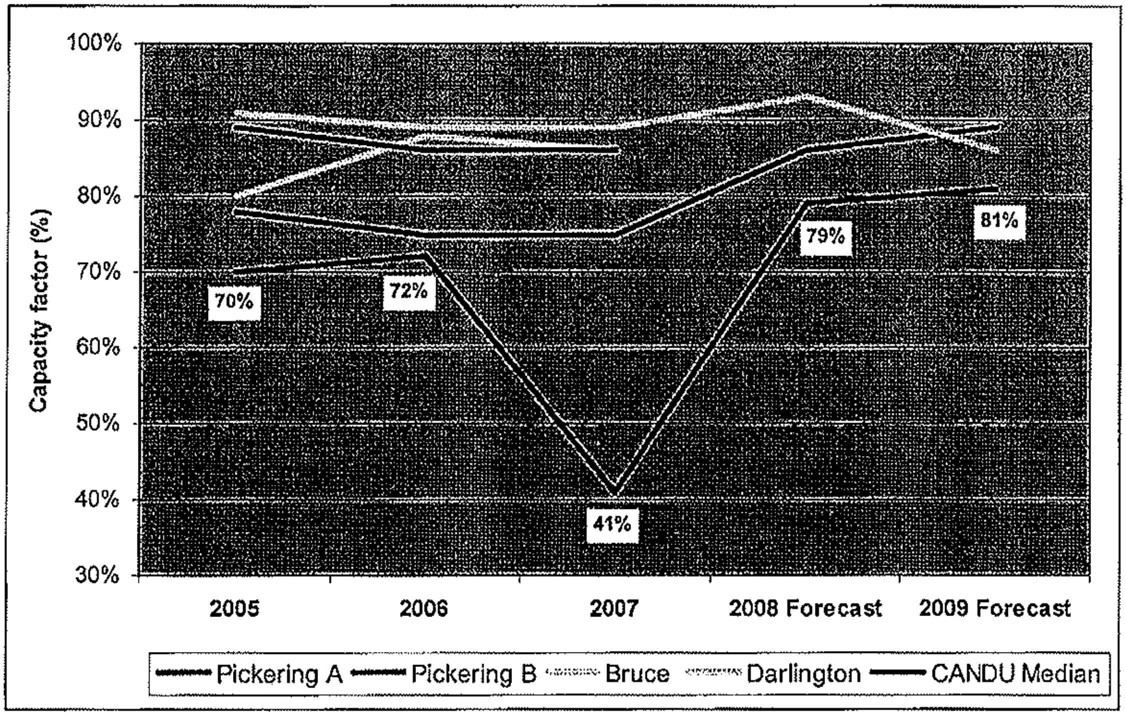
Many intervenors were critical of both the results of OPG's benchmarking and what they viewed as the apparent reluctance to engage in benchmarking. AMPCO submitted that Pickering A is almost five times more costly than the top quartile of U.S. operations, while Pickering B is two and a half times more costly.

The PUEC of a generating plant is a function of both the level of costs incurred and the plant's capacity factor. Even a very low-cost facility can have a high PUEC if the plant has an extended outage in a period.

Chart 2-2 shows the capacity factors for the OPG-operated plants compared to the capacity factors of Bruce Power and the Canadian CANDU median. The capacity factors shown on the face of the chart are for the Pickering A station, which had the lowest capacity factor of the plants included in the chart.

OPG stated that in the first quarter of 2008, the capacity factors achieved at its nuclear stations were: Darlington – 99%; Pickering A – 79%; and Pickering B – 86%.

Chart 2-2: OPG's Nuclear Capacity Factors Compared to Bruce and Canadian CANDU Median



Source: Ex. J5.4, Ex. L-4-2, Attachment 3

Darlington's performance over the three-year period 2005 to 2007 was similar to that of Bruce Power and the Canadian CANDU median; however, Pickering A and Pickering B operated at lower capacity factors, especially in 2007. Over the three-year period 2005 to 2007, the average capacity factor at Pickering A was 61% compared to 85% at Bruce Power and 87% for the CANDU median.

A number of parties questioned the long-term viability of the Pickering plants, particularly Pickering A. Energy Probe noted that the operating costs of Pickering A exceeded the value of the electricity generated and asked the Board to withhold payments for any facility that raises the cost of power for consumers.

AMPCO argued that over the 2005 to 2007 period, the average cost of Pickering A power was double the Hourly Ontario Energy Price and the nuclear payment amount received by OPG under O. Reg. 53/05. AMPCO concluded that even with the forecasted cost of 8.1 cent/kWh (AMPCO's calculation) in the test period, the prudence of continued operation of Pickering A remains a concern. AMPCO argued that OPG should be required to file a long-term assessment of the viability of Pickering A in the next rates application. SEC also argued that OPG should be directed to file a plan which demonstrates that Pickering A and Pickering B can operate at costs similar to other generators.

OPG responded that the Board's role in this application is to review the costs of Pickering A, and based on these costs, set reasonable payment amounts. OPG argued that the Board should not, and cannot, decide the ultimate viability of Pickering A, as this is beyond the scope of Section 78.1 of the *OEB Act*.

Regarding the AMPCO and SEC submissions that OPG's costs are excessive given the benchmarking results, OPG responded that the intervenors used selective data and disregarded technical differences regarding Pickering A and Pickering B. OPG also argued that AMPCO's assertion that OPG was resistant to benchmarking was unsupported. OPG maintained that it is committed to benchmarking and is in full compliance with the requirements in the MOA.

OPG also noted that it expects Pickering A and B's performance to improve substantially in the future and submitted that Darlington will continue to perform as well as it has in the past. Most of the intervenors countered that the forecasted results for 2008 and 2009 are unduly optimistic and the Board should discount these projections.

OPG also questioned the arguments by a number of intervenors that the Navigant Study supports the conclusion that 2006 staffing levels were 12% higher than benchmark. OPG claimed that the Navigant Study cannot be used to test the level and reasonableness of OPG's labour cost because the Navigant Study is not representative of staffing levels in the test period.

Regarding the suggestion that the OM&A budget should be treated on an envelope basis, OPG responded that while it should be free to manage specific expenditures within an OM&A envelope, it is opposed any determination of the OM&A costs through a benchmarking exercise.

Board Findings

This aspect of the decision gives rise to two significant issues. The first is whether the Board has the jurisdiction to determine the viability of the Pickering stations. The second is the extent to which the Board should use the detailed benchmarking evidence to assess the reasonableness of the costs OPG seeks to recover.

With respect to the first issue, the Board agrees with OPG that the Board's role in this application is to review the proposed costs of the prescribed facilities and to order reasonable payment amounts.

As discussed in Chapter 9 of this decision, the Board has rejected OPG's proposed payment structure for the nuclear plants (which was to include a fixed amount of $1.2 billion during the test period plus a per MWh payment amount to cover the balance of the revenue requirement). Instead, the Board has decided to retain the current variable payment structure of an amount per MWh regardless of the level of production. If OPG operates its plants at a unit cost higher than the approved payment amount, the excess costs will be borne by OPG and its shareholder. Consumers will not be at risk for costs in excess of the costs used to set the payment amount. Therefore, the Board does not accept the suggestion of intervenors that it order OPG to file a study on the long-term viability of Pickering. The long-term viability of the Pickering stations is an assessment more properly made by the shareholder knowing that the Board will only allow the recovery of reasonable costs and that the payment structure will be such that consumers will not bear production risk.

The benchmarking issue is more important. The direction given by the Province to OPG in the MOA is very specific. OPG is directed to seek "continuous improvement in its nuclear generation business." To this end, the MOA states: "OPG will benchmark its performance in these areas against CANDU Nuclear plants worldwide as well as against the top quarter of private and publicly owned nuclear electricity generators in North America." And finally, the MOA states: "OPG's top operational priority will be to improve the operation of its existing nuclear fleet."

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The Board in this proceeding is faced with the task of determining whether the costs OPG seeks to recover are reasonable. A very important tool available to the Board is the benchmarking analysis.

Very little benchmarking evidence was filed by OPG in its initial application. This evidence was largely produced during cross-examination when OPG filed the Navigant Study.

The most common measure of productivity in nuclear generation industry is PUEC. The PUECs of the two Pickering stations are far above industry averages as Chart 2-1 indicates; in fact, the operating cost performance of Pickering A may be the worst of any nuclear station in North America. In 2006, Pickering A had a PUEC three times the U.S. average ($75.60 per MWh compared to $24.00 for the U.S. Median) and twice the Bruce unit cost of $38.00 per MWh; in 2007 Pickering A had increased to $130.00 per MWh compared to $23.00 for the U.S. median and $42.00 at Bruce.

Pickering B's 2006 PUEC was better at $55.00 per MWh but was still more than twice the U.S. median and significantly above Bruce. In 2007, Pickering B remained relatively constant at $56.00 per MWh, which was still more than twice the U.S. median and 30% greater than Bruce. The Darlington plant demonstrates a more respectable performance at $29.00 per MWh in 2006 and $32.00 per MWh in 2007.

The unit costs at Pickering A and Pickering B are forecast to improve in 2008 due to higher planned capacity factors. OPG claimed that the Pickering A operating costs will decline from $130.10 per MWh in 2007 to $76.00 in 2008 and $77.00 in 2009. Similarly, OPG claimed that the Pickering B costs will decline from $56.00 in 2007 to $50.00 in both 2008 and 2009. A number of intervenors were skeptical of these promised results.

OPG made two arguments concerning the PUEC benchmarking data. The first argument made by OPG was that the productivity results flow from technology decisions made in the past that should not be questioned using hindsight. In other words, the Board must assume that the technology decisions were prudent at the time they were made and the poor productivity results evident today, while unfortunate, are consequences of those decisions to be borne by the Ontario consumer. The Board finds this an unsatisfactory response.

OPG's primary argument was that the benchmarking data is unreliable.

The Board does not believe it is sufficient for OPG to simply discount the benchmarking studies on the basis of data quality. The studies are all based on standard measures used by the nuclear industry throughout the United States and Canada. While caution should be exercised when reviewing such data, the Board is satisfied that the studies provide meaningful insights into OPG's operations. Moreover, even if there are frailties in the data, the differentials remain striking, particularly with respect to Pickering A. The reason why the MOA emphasized benchmarking was because such studies can and do shine a light on inefficiencies and lack of productivity improvement.

While OPG criticizes the data, the Board notes that few steps have been taken to improve the quality of studies. The Board also notes that benchmarking studies were not filed as a matter of course but rather were reluctantly produced during the course of cross-examination.

Moreover, the Board was surprised that OPG has not followed up with the suggested Phases 2, 3 and 4 of the benchmarking analysis suggested by Navigant. While the benchmarking is critical to the Board (and it would seem to the shareholder), it appears that OPG has done little since the completion of the Navigant Study. The Navigant Study was delivered two years ago on September 15, 2006. There appear to be no benchmarking studies underway. And OPG has not decided what benchmarking evidence, if any, it will present at the next rates case.

Navigant completed Phase I of its study in 2006. Phase 2 as described at page 9 of the Navigant Report was to set OPG's strategy and performance targets. Specifically, Phase 2 was to address the question "what level of cost and operational performance improvement is justified". Phase 3 was to develop and execute an implementation plan. Specifically, Phase 3 was to address the questions "what specific initiatives and actions are needed to achieve identified performance improvement targets".

The questions Navigant suggested should be addressed in the second and third phases of the study are important questions. They are directly responsive to paragraph A.3 of the MOA.[14]

[14] "OPG will seek continuous improvement in its nuclear generation business and internal services. OPG will benchmark its performance in these areas against CANDU nuclear plants worldwide as well as against the top quartile of private and publicly-owned nuclear electricity generators in North America. OPG's top operational priority will be to improve the operation of its existing nuclear fleet."

The Board directs OPG to produce further benchmarking studies in its next application that specifically address the questions raised in the proposed Phase 2 and Phase 3 of the Navigant Report. Whether these studies are performed by Navigant or another firm is a matter to be determined by the applicant.

The production costs of the Pickering A station are a particular concern. In the past, a major reason for the high PUEC for Pickering A has been the extent of unplanned outages and the resulting low capacity utilization. OPG has forecast significantly higher capacity factors for Pickering A in 2008 and 2009. But, as Chart 2-1 illustrates, even at those higher production levels, the PUEC for Pickering will still remain well above the PUEC for Pickering B, will be significantly higher than the PUEC of the Darlington station, and will stay well above the PUEC achieved by the Bruce station over the period 2005 to 2007. Thus, poor capacity factors are not the whole reason for a high PUEC at Pickering A.

The Board estimated the PUEC for Pickering A assuming it were able to reach the forecast capacity factors of the Pickering B station in 2008 and 2009. Even if Pickering A were able to increase its planned capacity factors by that much (from 79% in 2008 and 81% in 2009 to 86% in both years), the Board estimates that the PUEC of Pickering A would only fall to around $70 per MWh, a level that is still much higher than the next highest cost station in Chart 2-1. In the Board's view, this indicates an issue with the overall level of production costs at Pickering A.

Under these circumstances, the Board believes that a reasonable action is to disallow 10% of the Base OM&A costs of Pickering A. This represents a test period disallowance of $14.9 million in 2008 and $20.1 million in 2009. Even with those amounts removed from the revenue requirement, the amount of the operating costs of Pickering A will still remain well above those of other nuclear plants.

The Board will have an opportunity to reexamine this issue when the benchmarking studies are updated in the next proceeding. At that time the Board will examine any improvement or deterioration in production unit energy costs compared to other utilities, and the reasons for those changes.

Aside from this adjustment, the Board will allow the OM&A forecast by OPG. The Board understands the concern of the intervenors regarding the level of costs, but believes it is important to examine underlying cost drivers. A number of the planned expenditures are

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related to safety and cost improvements. The Board's main concern is that there be a significant improvement in operating costs. As the MOA stated, "OPG's top operational priority will be to improve the operation of its existing nuclear fleet." The Board recognizes that new investments will be necessary to reduce these costs.

2.3 Nuclear Advertising

OPG included in its revenue requirement for the test period $3 million for membership in the Canadian Nuclear Association (CNA). Of this amount, $2.3 million is for OPG's contribution to CNA's advertising program. OPG forecast an additional expenditure of $3.7 million on advertising in support of nuclear generation. In total, $6 million is forecast to be spend on advertising related to nuclear generation.

The OPG position was that this advertising is designed to create public support for nuclear generation and communicate to the public that nuclear generation is safe and environmentally friendly. SEC claimed this was not the purpose of the advertising. Rather SEC claimed it was an attempt to influence public opinion on the future of Ontario's supply mix. SEC asked the Board to disallow all the advertising expense.

Energy Probe also submitted that customers should not pay for nuclear advertising intended to influence public opinion or public policy. It cited numerous examples where U.S. regulators disallowed such expenditures and concluded that the entire nuclear advertising expenditure of $6.7 million should be disallowed.

OPG responded that its nuclear advertising activities have nothing to do with the future power supply but are designed to inform Ontario residents about nuclear safety and environmental benefits. OPG stated that Energy Probe's arguments were questionable characterizations of statements by OPG's witnesses and should not be treated as evidence. In addition, OPG noted that Energy Probe failed to acknowledge that some of the U.S. rules cited allowed for exemptions.

OPG also disputed that nuclear advertising can influence the outcome of the IPSP proceeding noting that the Province has already decided the future course for nuclear generation in Ontario. OPG claimed that a full discussion of nuclear energy, by both proponents and opponents, is in the public interest and OPG's communication is an essential part of that discussion.

effect for almost three years, the proposed increases are quite small. This is indicative of OPG's efforts since the last payments proceeding to engage in a continuing process to control operating expenses.

Operating Expense

OPG's evidence on operating expenses illustrates its progress in cost control. For example, for regulated hydroelectric, a comparison between the OM&A costs requested in this Application and those approved in the last application shows an increase of approximately 4.5 per cent over a three-year period from the end of 2009 to the end of 2012 (see Ex. I1-T1-S1 Table 2). Considering that labour costs, the major component of OM&A costs, reflect general wage increases of between 2 and 3 per cent per year over this same period, the test period OM&A request embodies substantial cost savings.

In Nuclear, an extensive benchmarking effort led to the development of challenging five-year operational and financial performance targets as explained in Ex. F2-T1-S1. To help meet these targets, nuclear has developed seven key initiatives as part of the 2010 - 2014 Nuclear Business Plan (Ex. F2-T1-S1, Attachment 1). Based on these initiatives and other cost control measures explained in Ex. F2-T1-S1, OPG's 2010 - 2014 Nuclear Business Plan shows more than $200M in OM&A cost savings in the test period.

Corporate groups have also embarked on significant cost savings initiatives. Corporate group costs increase by approximately 5 per cent over the 2007 - 2012 period and incorporate savings in the test period based on the 2010 - 2014 Business Plan. Specific cost savings initiatives by the corporate groups are discussed in Ex. F3-T1-S1.

Of the total corporate group costs, 68 per cent are attributable to the prescribed facilities, which compares favourably to the 72 per cent of OPG's generation that is produced by the prescribed facilities. OPG is using essentially the same cost allocation methodology employed in EB-2007-0905. OPG's corporate cost allocation has been reviewed and endorsed by independent cost allocation experts, Black and Veatch Corporation ("Black and Veatch"). The Black and Veatch study is presented in Ex. F5-T2-S1.

- Targeting better than industry performance on safety.

- Targeting a significant improvement in reliability metrics (currently in the lowest quartile), while maintaining top quartile performance in other metrics.

- Incorporating plan over plan cost reductions of $293 million with the investment in the Pickering B Continued Operations initiative. Yearly cost savings (compared to the 2009 Nuclear Business Plan) over the planning horizon are as follows:

	2010	2011	2012	2013	Total
2010-2014 Business Plan with Continued Operations	84.0	43.0	68.0	98.0	**293.0**

- Targeting generation increases in 2010 to 2013 by 0.5 TWh (reduced by 2.6 TWh with Pickering B Continued Operations).

- Incorporating net reductions of 791 staff over the period from 2009 to 2014.

OPG's achievement in introducing a gap-based business planning process was also noted by ScottMadden in its Phase 2 transmittal letter (Ex. F5-T1-S2), as follows:

> It is our opinion that OPGN has undertaken the actions necessary to successfully pilot a gap-based business planning process as originally envisioned. These actions include: (a) fairly benchmarking the company's operational and financial performance to external peers, (b) using the benchmarking results to establish performance improvement targets that will achieve, or significantly drive the company closer to, top quartile industry performance, and (c) developing and implementing a gap-based business planning process that identified the improvement initiatives best able to close the identified performance gaps.
>
> Improvements in the OPGN planning process include the following: (a) establishment of top-down quantitative operational and financial targets for each year and each business unit, (b) identification of site, business unit, and functional improvement initiatives that are tied to specific operational and

financial targets, (c) designation of accountability points for the delivery of all improvement initiatives, (d) linkage of improvement initiatives to closure of documented performance gaps, and (e) incorporation of improvement initiatives into the site and support unit business plans and budgets."

3.0 NUCLEAR BUSINESS PLANNING AND BENCHMARKING

3.1 Nuclear Business Planning

OPG Nuclear's business planning for OPG's nuclear operations group is undertaken annually as part of and consistent with the OPG corporate business planning process (Ex. A2-T2-S1). The business planning process is focused on establishing strategic and performance objectives for nuclear in alignment with OPG's corporate objectives and identifying the initiatives and resources required to achieve these objectives.

The nuclear business planning process starts in the spring of each year with internal reviews of the current planning framework, the confirmation and updating of business objectives and priorities, a review of business planning instructions from Corporate Finance, a review of the status of operational and performance plans and related capital and OM&A expenditures, and the identification of emerging issues. Out of this process, strategic and performance objectives for OPG Nuclear are determined and prioritized. A consolidated preliminary business plan is developed for review and approval by the Chief Nuclear Officer ("CNO") in late August/early September. Thereafter the nuclear business plan is submitted for review by the President and Chief Executive Officer ("CEO") for final submission to the OPG Board of Directors, as discussed at Ex A2-T2-S1.

3.2 Benchmarking Initiative Overview

Consistent with the 2005 Memorandum of Agreement between OPG and its shareholder (provided at Ex. A1-T4-S1 Attachment 2), OPG Nuclear has benchmarked its performance against CANDU ("Canadian Deuterium Uranium") nuclear plants as well as against U.S. nuclear generators to identify opportunities for improvement. In 2009, OPG undertook a major new nuclear benchmarking initiative in conjunction with the development of its 2010 - 2014 Business Plan. This initiative was in response to the OEB directive in EB-2007-0905 Decision with Reasons (page 37) that OPG should target cost and operational performance

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team decided to procure external resources to assist in this work. The project management team has been up and running since January 2010.

Another step undertaken was to build management accountability for the timely implementation of the improvement initiatives into Nuclear's 2010 scorecard, which is the basis for the annual incentive plan payout.

3.4 Discussion of Phase 2 Benchmarking Results

3.4.1 Target Setting

As described in ScottMadden's Phase 2 Final Report, the Nuclear Executive Committee ("NEC") held two target setting sessions in June 2009 focused on setting operational and financial performance targets.

Attachment 5 is from the ScottMadden Phase 2 report (page 15). It shows a hypothetical comparison of OPG performance to industry benchmarks in 2014 assuming OPG achievement of the 19 key benchmark performance indicators established during the target setting process. This comparison indicates the degree of improvement targeted by OPG over the five year business plan. As noted by ScottMadden in its Phase 2 report, the targets represent performance improvement that will achieve or significantly move OPG Nuclear towards top quartile industry performance based on current levels of industry performance.

so the comparisons for 2014 don't include the inflation

The targeted performance improvement by 2014 with respect to Total Generating Cost for the Pickering stations is below median. This reflects the reality of OPG's initial starting point in terms of the material condition of these plants. Also, in OPG's view, there are various structural factors that influence costs and impact on OPG's ability to close the performance gap relative to top quartile cost performance (Attachment 3). These factors include nuclear generation complexity, safety and regulatory considerations, different generations of technology within the OPG Nuclear fleet, extensive training requirements in critical areas, demanding material standards, and a challenging work environment.

ONTARIOPOWER GENERATION

Executive Summary

OPG Nuclear will continue to deliver on its mission of proudly generating clean, safe, low-cost electricity through dependable performance. This business plan outlines Nuclear's operational and financial performance targets for the next 5 years and the plan to meet this commitment.

With the use of external benchmarking, aggressive yet balanced targets have been set by the CNO under the 4 Cornerstones areas of Safety, Reliability, Human Performance and Value for Money:

- Nuclear will continue to target better than industry Safety performance.
- Reliability metrics currently in the lowest quartile will improve significantly, while maintaining top quartile performance in others.
- Plan over plan costs will be reduced by $423 million (or $293 million with investment in Pickering B Continued Operations).
- Generation will increase in 2010 to 2013 by .5 TWh (reduced by 2.6 TWh with Continued Operations).
- This plan incorporates net staff reductions of 791 from 2009 to 2014.

Using a fleet-wide peer team approach, Nuclear has developed an action plan to address the gaps between targets and current performance levels. 7 key initiatives have been identified that will drive significant performance improvement.

ONTARIO POWER GENERATION

5 Year Performance Plan

Metric	2008 Pickering A	2008 Pickering B	2008 Darlington	2014 Pickering A	2014 Pickering B	2014 Darlington
Safety						
All Injury Rate	0.73	0.96	1.04	1.2	1.2	1.2
2-Year Industrial Safety Accident Rate	0.14	0.07	0.04	0.15	0.15	0.15
2-Year Collective Radiation Exposure (man-rem per unit)	44.2	95.81	72.83	125	82	66
Airborne Tritium (TBq) Emissions per Unit	101.0	50.7	40.0	81.1	36.6	27.0
Fuel Reliability (microcuries per gram)	0.00059	[redacted]	0.00025	0.0005	0.0005	0.0005
2-Year Reactor Trip Rate (# per 7,000 hrs)	[redacted]	0.26	0.00	0.50	0.50	0.50
3-Year Auxiliary Feedwater System Unavailability	0.0119	0.0040	0.0017	0.0200	0.0200	0.0200
3-Year Emergency AC Power Unavailability	0.0031	0.0091	0.0020	0.0250	0.0250	0.0250
3-Year High Pressure Safety Injection Unavailability	0.0012	0.0001	0.0001	0.0200	0.0200	0.0200
Reliability						
WANO NPI (Index)	60.84	60.93	95.67	70.9	81.3	99.1
2-Year Forced Loss Rate (%)	[redacted]	[redacted]	0.93	4.00	4.00	1.25
2-Year Unit Capability Factor (%)	[redacted]	[redacted]	91.99	84.3	81	93.3
2-Year Chemistry Performance Indicator (Index)	[redacted]	[redacted]	1.00	1.04	1.04	1.01
1-Year Online Elective Maintenance (work orders/unit)	[redacted]	[redacted]	313	278	300	214
1-Year Online Corrective Maintenance (work orders/unit)	[redacted]	[redacted]	8	9	[redacted]	4
Value for Money						
3-Year Total Generating Costs per MWh ($/Net MWh)	[redacted]	[redacted]	30.08	[redacted]	[redacted]	36.76
3-Year Non-Fuel Operating Costs per MWh ($/Net MWh)	[redacted]	[redacted]	25.10	[redacted]	[redacted]	28.82
3-Year Fuel Costs per MWh ($/Net MWh)	2.64	2.68	2.62	6.01	7.45	5.43
3-Year Capital Costs per MW DER**($/MW)	32.07	32.44	18.79	34.73	34.67	20.37

- Continue to lead industry in overall conventional and nuclear safety performance.
- Increase fuel reliability.
- Strengthen equipment reliability and human performance to reduce reactor trips.
- Focus on work order readiness, reducing backlogs, improving maintenance effectiveness, and work management.
- Reduce base and outage operating costs to improve fleet-wide total generating costs per MWh. Darlington becomes industry leader in costs. Pickering A and B narrow gaps.

2014 WANO indicator targets are set to provide maximum NPI points only. 2014 Cost Targets are above 2008 due to expected cost escalation of Median and Best Quartile Costs per EUCG panel historical trend. 2010-2014 values represent annual targets. Actuals will be calculated based on rolling average definitions.

(operations related) results are averaged at the unit level and EUCG (cost related) results are averaged at the plant level. Included are a few key operational metrics and total generating costs.

Section 6.0 provides an appendix of supporting information, including common acronyms, definitions and panel composition details. Zero values are excluded from all calculations except where zero is a valid result. Missing data was imputed by averaging the prior and subsequent year if possible. If this was not possible, the average of the two most recent years was used.

Benchmarking Results – Plant Level Summary

Table 2 provides a summary of OPG's performance compared to the benchmark panel. For the WANO metrics with two panels (i.e. all COG CANDU; all North American PWR and PHWR), the all COG CANDU panel was used. Calculations in the table are at the plant level.

For reference, green shaded boxes indicate that performance is above best quartile or maximum NPI points are achieved if applicable, white shaded boxes indicate between best quartile and median, yellow shaded boxes indicate that performance is between median and the worst quartile, and red shaded boxes indicate that performance is within the worst quartile. Each metric represented here is analyzed in this report.

Table 2: Plant Level Performance Summary

Metric	Best Quartile*	Median*	Pickering A	Pickering B	Darlington
Safety					
All Injury Rate			[redacted] ↑	[redacted] ↑	[redacted] ↑
2-Year Industrial Safety Accident Rate	0.05	0.09	[redacted] ↓	[redacted] ↑	[redacted] ↑
2-Year Collective Radiation Exposure (man-rem per unit)	62.15	81.84	[redacted] ↑	95.81 ⇧	72.83 ⇧
Airborne Tritium (TBq) Emissions per Unit	48.0	101.0	101.0 ⇧	50.7 ⇧	[redacted] ↓
Fuel Reliability (microcuries per gram)	0.000001	0.000165	0.00059 ⇧	[redacted] ↓	[redacted] ↑
2-Year Reactor Trip Rate (# per 7,000 hrs)	0.00	0.33	[redacted] ↓	[redacted] ↔	[redacted] ↔
3-Year Auxiliary Feedwater System Unavailability	0.0014	0.0020	[redacted] ↑	[redacted] ↑	[redacted] ↑
3-Year Emergency AC Power Unavailability	0.0024	0.0076	[redacted] ↓	[redacted] ↑	[redacted] ↔
3-Year High Pressure Safety Injection Unavailability	0.0001	0.0037	[redacted] ↑	[redacted] ↑	[redacted] ↑
Reliability					
WANO NPI (Index)	96.19	62.46	60.84 ⇧	60.93 ⇔	95.67 ⇔
2-Year Forced Loss Rate (%)	0.68	3.79	[redacted] ↓	[redacted] ↓	[redacted] ↑
2-Year Unit Capability Factor (%)	90.97	84.31	[redacted] ↓	[redacted] ↔	[redacted] ↔
2-Year Chemistry Performance Indicator (Index)	1.00	1.01	[redacted] ↑	[redacted] ↓	[redacted] ↔
1-Year Online Elective Maintenance (work orders/unit)	218	278	[redacted] ↑	[redacted] ↑	311 ⇧
1-Year Online Corrective Maintenance (work orders/unit)	4	7	[redacted] ↑	[redacted] ↑	[redacted] ↑
Value for Money					
3-Year Total Generating Costs per MWh ($/Net MWh)	28.66	32.31	[redacted] ↑	[redacted] ↔	30.08 ⇔
3-Year Non-Fuel Operating Costs per MWh ($/Net MWh)	18.06	21.28	[redacted] ↑	[redacted] ↔	25.10 ⇔
3-Year Fuel Costs per MWh ($/Net MWh)	5.02	5.37	[redacted] ↔	[redacted] ↔	[redacted] ↔
3-Year Capital Costs per MW DER	32.79	46.22	[redacted] ↓	[redacted] ↑	[redacted] ↔

*Panel used for WANO quartile and median data was All COG CANDU

⇧ = overall upward trend during reporting period

⇩ = overall declining trend during reporting period

⇔ = consistent performance during the reporting period

Green = best quartile performance/max NPI points achieved if applicable
White = 2nd quartile performance
Yellow = 3rd quartile performance
Red = lowest quartile performance

Benchmarking Results – Operator Summary

Operator level summary results for a specific metric are the average (mean) of the results across all plants managed by the given nuclear operator, providing a comprehensive overview of a nuclear operator's financial and operating performance. While the operator level summary results presented in Section 5.0 include a calculation for Unit Capability Factor (UCF) as well as WANO Nuclear Performance Index (WANO NPI) and Total Generating Costs per MWh, this executive summary only addresses WANO NPI and Total Generating Costs per MWh. This is because UCF is a subcomponent of WANO NPI. Full details of the operator summary results can be found in Section 5.0.

SEC Interrogatory #029

Ref: Ex. F2-T1-S1, Attachment 8, Darlington Benchmark Targets

Issue Number: 6.5
Issue: Has OPG responded appropriately to the observations and recommendations in the benchmarking report?

Interrogatory

The targeted benchmark for Total Generating Costs per Net MWh, is $35.70 and $36.69 for 2011 and 2012 for the Darlington GS. Please provide the rationale for selecting benchmarks approximately 19% above 22% above the achieved benchmark for Darlington in 2008? Please also provide the inflation assumptions that were used to set the 2011 and 2012 benchmarks.

Response

The actual Total Generating Costs/MWh in 2008 for Darlington was $31.56. The annual targets set for 2011 and 2012 are therefore 13 per cent and 16 per cent higher than the 2008 performance, not 19 per cent and 22 per cent. The annual targets for 2011 and 2012 were set above the performance achieved in 2008 to recognize industry inflation. As explained below, the overall industry inflation assumption is for Total Generating Costs to increase by approximately 4 per cent per annum. Darlington's projected increase of 13 per cent over three years and 16 per cent over four years is therefore reasonable when benchmarked against these industry projections.

During the target setting process (Ex. F2-T1-S1, page 13) industry "inflation" assumptions were derived by ScottMadden and applied to the 2014 industry targets based on historical escalation rates derived from the Electric Utility Cost Group ("EUCG") database. Industry Non-fuel costs were escalated approximately 4.5 per cent per annum, fuel costs by 7.2 per cent per annum, and capital costs by 1.33 per cent per annum based on the EUCG historical data. This equates to an annual increase in Total Generating Costs of approximately 4 per cent.

The four components that make up Total Generating Costs (Total Non-fuel Operating Costs; Fuel Costs; Capital Costs and Net Electrical Production) and their respective 2008, 2011 and 2012 amounts for Darlington Generating Station can be found in the table below. As shown in the table, Total Non-fuel Operating Costs, Fuel Costs and Capital Costs are increasing, while Net Electrical Production is flat.

Total Non-fuel Operating Costs consist of station costs (inclusive of Nuclear support costs), corporate cost allocations and pension burden costs. For these items, Darlington Generating Station's costs are targeted to reduce from the 2008 levels by 9 per cent and 7 per cent in

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2011 and 2012, respectively, offset by increases in corporate cost allocations and pension burden costs. Fuel costs from inventory are projected to increase as discussed in Ex. F2-T5-S1. The increase in Darlington Generating Station capital costs is based on an increase projected allocation from the fixed capital portfolio and align with the assumption that more capital will be invested in Darlington Generating Station as it ages and less in Pickering Generating Station as it nears its end of life (see Ex. L-11- 015).

Darlington	2008	2011	2012
Total Non-Fuel Operating Costs (k$)	718,895	765,312	782,611
Fuel Costs (k$)	91,080	134,426	145,646
Capital Costs (k$)	101,887	130,757	136,014
Total Generating Costs (k$)	911,862	1,030,495	1,064,272
Net Electrical Production Target (TWh)	28.89	28.86	29.00
Total Non-Fuel Operating Costs per Net MWh ($/MWh)	$ 24.88	$ 26.52	$ 26.98
Fuel Costs per Net MWh ($/MWh)	$ 3.15	$ 4.66	$ 5.02
Capital Costs per MW DER (k$/MW DER)	$ 29.01	$ 37.23	$ 38.73
Total Generating Costs per Net MWh ($/MWh)	$ 31.56	$ 35.70	$ 36.69

KT1.7

Filed: 2010-08-26
EB-2010-0008
BStaff TC #5b and CME TC #3

CANADIAN FORECAST EXECUTIVE SUMMARY

AUGUST 2010

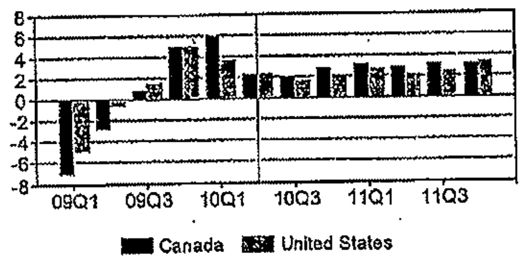
Update of the Canadian Short-Term Outlook

Slowing Growth in Canada

Evidence is growing that real economic output in both the United States and Canada is slowing significantly. Second-quarter real GDP growth in the United States was weak at 2.4%. The outlook for the third quarter is the worst yet of this year, as real GDP growth is expected to decelerate to a dismal 1.7%. The forecast calls for a marked slowdown in fixed non-residential investment and government sectors. The biggest drag on the U.S. outlook is the retrenchment of residential construction investment, plunging at a double-digit pace in the third quarter. The U.S. economy is forecasted to grow by 2.8% this year and a slightly milder 2.4% in 2011.

The euphoric feeling of Canada's strong growth prospects expected earlier this year has diminished now to a tiny hope. The weakness experie nced south of the border and in Europe is spreading to Canada. As well, slowing demand is spreading throughout most sectors, particularly consumer spending, residential investment, and trade. We have downgraded our economic outlook for both second- and third-quarter growth. Real GDP will grow around 2.4% in the second quarter and closer to 2.0% in the third quarter as these headwinds weigh on domestic and foreign demand. We are still expecting Canadian real GDP growth to outperform that of the United States this year and next, with output growing 3.2% and 2.9%, respectively.

Canada and U.S. — Slowing Growth
(Real GDP, percent change, annualized)



Canada's domestic demand is already wavering and we judge that the consumer will probably not be a significant contributor to growth over the next few quarters. A deteriorating trade balance is evidence that economic woes in the United States and Europe are affecting Canada, and that weakening foreign demand will weigh on Canada's economic output as well. Some commodity prices have bounced back since June, particularly oil. Rising commodity prices will prop up Canada's nominal trade balance, but the ongoing deceleration in the growth of real exports will act as a fairly major drag on overall real GDP growth in the second half of 2010.

Canadian real GDP by industry edged up by 0.1% in May. This was a welcome advance after the flat reading in the prior month. There were mixed results as the advances and

In This Issue

Recent and Upcoming Special Reports/Presentations

Canadian Economic Outlook Seminar: "Charting the North American Economic Recovery: Key Drivers of the Economic Expansion Beyond 2010" (September 22, 2010). Please visit the website, http://www.ihsglobalinsight.com/Events/EventDetail104825.htm

IHS GLOBAL INSIGHT

TABLE 2
Canadian Short-Term Forecast Update

	09Q4	10Q1	10Q2	10Q3	10Q4	11Q1	2010	2011	2012	2013	2014	2015
Real GDP (Bil. chained 2002 $)	1296.4	1315.6	1323.3	1330.1	1339.5	1350.1	1327.1	1365.4	1405.6	1444.2	1481.3	1518.1
Annual % Ch.	4.9	6.1	2.4	2.1	2.8	3.2	3.2	2.9	2.9	2.7	2.6	2.5
Consumer	825.2	834.1	839.2	844.0	848.7	853.2	841.5	860.4	880.0	900.8	921.3	941.3
Annual % Ch.	3.9	4.4	2.5	2.3	2.2	2.2	3.3	2.2	2.3	2.4	2.3	2.2
Government	331.3	333.1	333.8	338.3	341.1	341.3	336.6	344.3	350.2	353.0	358.7	366.7
Annual % Ch.	9.1	2.3	0.7	5.5	3.4	0.2	4.7	2.3	1.7	0.8	1.6	2.2
Bus. Res. Investment	75.4	79.5	82.6	83.0	83.5	84.0	82.2	84.8	87.2	89.0	90.2	91.5
Annual % Ch.	26.3	23.6	16.6	1.9	2.2	2.5	15.4	3.3	2.8	2.1	1.3	1.5
Bus. Non-Res. Inv.	154.7	155.1	158.6	160.8	162.6	164.1	159.3	166.4	172.2	177.3	181.2	184.7
Annual % Ch.	-9.8	0.9	9.5	5.6	4.5	3.9	-0.5	4.5	3.5	3.0	2.2	1.9
Exports	428.0	440.3	449.9	456.8	463.4	470.4	452.6	481.0	511.4	541.1	571.6	605.2
Annual % Ch.	13.8	12.0	9.0	6.2	5.9	6.1	8.4	6.3	6.3	5.8	5.6	5.9
Imports	525.3	542.9	553.0	560.1	566.4	573.0	555.6	582.5	609.3	636.7	664.6	694.6
Annual % Ch.	12.4	14.1	7.6	5.3	4.6	4.7	11.2	4.8	4.6	4.5	4.4	4.5
Business Inventory Ch.	-1.2	8.2	11.1	6.3	5.5	8.9	7.8	9.7	12.3	18.0	20.6	20.4
Statistical error	0.0	-1.4	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0
Nominal GDP (Billion $)	1561.2	1600.5	1624.2	1643.5	1663.7	1685.1	1633.0	1719.8	1816.4	1911.3	2002.2	2090.0
Annual % Ch.	9.9	10.4	6.1	4.8	5.0	5.2	6.9	5.3	5.6	5.2	4.8	4.4
Raw Mat. Price Index	163.0	168.7	162.8	162.8	161.7	160.5	164.0	159.7	159.5	161.6	163.9	167.1
% Ch. Year Ago	7.6	23.7	6.8	3.8	-0.8	-4.9	7.8	-2.6	-0.1	1.3	1.4	2.0
Industry Price Index	115.9	116.9	117.1	117.8	117.8	118.8	117.4	120.3	122.7	124.9	126.9	128.5
% Ch. Year Ago	-3.4	-0.6	0.5	1.7	1.6	1.6	0.8	2.5	2.0	1.8	1.6	1.3
GDP Deflator	120.4	121.7	122.7	123.6	124.2	124.8	123.1	125.9	129.2	132.3	135.2	137.7
Annual % Ch.	4.4	4.4	3.5	2.7	2.1	2.0	3.6	2.4	2.6	2.4	2.1	1.9
CPI	114.9	115.4	116.2	117.0	117.4	117.7	116.5	118.6	120.9	123.3	125.8	128.3
% Ch. Year Ago	0.8	1.6	1.4	2.0	2.2	2.0	1.8	1.8	1.9	2.0	2.0	2.0
Employment (Thousands)	16876	16944	17119	17188	17280	17355	17133	17461	17700	17957	18235	18484
Annual % Ch.	1.3	1.6	4.2	1.6	2.1	1.8	1.7	1.9	1.4	1.5	1.5	1.4
Unemployment Rate (%)	8.4	8.2	8.0	7.9	7.7	7.6	8.0	7.5	7.3	7.1	6.8	6.5
Productivity (Annual % Ch.)	3.7	4.4	-1.8	0.5	0.7	1.5	1.5	1.0	1.6	1.3	1.0	1.1
Average Hourly Earnings	20.52	20.58	20.75	20.87	20.99	21.12	20.80	21.34	22.06	22.96	23.87	24.78
Annual % Ch.	1.0	1.2	3.3	2.4	2.4	2.5	1.7	2.6	3.4	4.1	4.0	3.8
3-Month T-Bill Rate (%)	0.22	0.21	0.47	0.82	1.00	1.44	0.63	2.18	3.38	4.31	4.75	4.75
US 3-Month T-Bill Rate (%)	0.06	0.11	0.15	0.18	0.22	0.23	0.16	0.38	2.38	3.45	4.07	4.60
Canada-U.S. Differential (% pts.)	0.16	0.11	0.32	0.65	0.79	1.20	0.47	1.80	1.00	0.86	0.67	0.15
Prime Rate (%)	2.25	2.25	2.33	2.75	2.82	3.28	2.54	4.03	5.38	6.31	6.75	6.75
Overnight Rate (%)	0.24	0.25	0.33	0.75	0.82	1.28	0.53	2.03	3.38	4.31	4.75	4.75
Bank Rate (%)	0.50	0.50	0.58	1.00	1.07	1.53	0.79	2.28	3.63	4.56	5.00	5.00
GOC Bond Rate (1-3 yrs.) (%)	1.26	1.34	1.59	1.75	1.86	2.13	1.64	2.62	3.74	4.52	4.99	5.18
GOC Bond Rate (3-5 yrs.) (%)	2.34	2.35	2.43	2.42	2.47	2.63	2.42	2.93	3.99	4.67	5.16	5.49
GOC Ten-Year Bond Rate (%)	3.43	3.45	3.33	3.15	3.14	3.18	3.27	3.28	4.28	4.83	5.35	5.83
U.S. Ten-Year T-Note Rate (%)	3.46	3.72	3.49	3.00	2.99	3.03	3.30	3.13	4.13	4.68	5.20	5.68
U.S. Real GDP (Bil. 2000 US$)	13019.0	13138.8	13216.5	13271.8	13345.1	13432.9	13243.0	13555.5	13952.8	14353.7	14816.4	15262.5
Annual % Ch.	5.0	3.7	2.4	1.7	2.2	2.7	2.8	2.4	2.9	2.9	3.2	3.0
Household Credit (Billion $)	1395.7	1422.2	1449.7	1477.8	1506.5	1535.6	1464.0	1578.7	1685.0	1779.1	1865.9	1949.6
Annual % Ch.	8.3	7.8	7.9	8.0	8.0	8.0	7.9	7.8	6.7	5.6	4.9	4.5
Standard of Living Canada/U.S. (Nominal GDP per Capita at PPP Can/U.S.)							0.831	0.836	0.838	0.837	0.832	0.826
Exchange Rate (U.S.-Can.)	94.7	96.1	97.3	96.3	97.0	99.0	96.7	98.4	94.9	93.7	92.1	89.0
Curr. Acct. Bal. (Billion $)	-40.8	-31.3	-36.9	-37.1	-30.0	-23.2	-33.8	-15.4	-0.2	7.7	13.9	16.2
Fed. Gov't. NA Bal.(Billion $)	-37.5	-24.0	-21.4	-20.5	-19.2	-17.6	-21.3	-15.7	-11.6	-8.8	-2.2	3.5
% GNP	-2.4	-1.5	-1.3	-1.3	-1.2	-1.0	-1.3	-0.9	-0.6	-0.5	-0.1	0.2
Before-Tax Profit (Billion $)	158.9	172.6	192.0	196.5	200.4	201.3	190.4	209.0	225.6	234.7	246.3	248.5
Annual % Ch.	36.8	39.1	53.4	9.7	8.2	1.7	29.6	9.8	8.0	4.0	5.0	0.9
Housing Starts (Thousands)	178	193	199	186	179	174	189	177	180	185	185	183
Auto Sales (Thous. SAAR)	1550.9	1591.5	1543.7	1557.0	1534.4	1578.3	1556.6	1635.7	1687.6	1735.7	1757.4	1718.7
Nominal Exports (Billion $)	450.9	470.7	481.6	491.5	501.1	511.0	486.2	525.9	569.7	612.0	655.0	700.2
Nominal Imports (Billion $)	471.3	484.2	496.6	505.5	513.6	521.9	500.0	533.2	566.9	602.3	639.6	682.8
Nominal Trade Balance (Billion $)	-20.5	-13.6	-15.0	-14.0	-12.5	-10.9	-13.8	-7.3	2.8	9.6	15.4	17.4
Personal Saving Rate (%)	3.5	2.8	3.0	3.2	3.4	3.4	3.1	3.7	4.5	5.3	5.5	5.8
Real Disp. Inc. - Annual % Ch.	0.1	1.1	2.8	2.6	2.7	2.1	1.5	2.5	3.0	3.2	2.5	2.5
Industrial Production - Annual % Ch.	9.4	11.4	1.3	7.3	10.8	8.7	4.6	8.2	6.3	4.2	4.1	3.7

ATTACHMENT 3

Key Drivers of Total Generating Costs

OPG Nuclear business planning has historically been driven by certain key factors that drive costs, many of which are unique to CANDU (Canadian Deuterium Uranium) operations:

Complexity: Nuclear plants are technologically sophisticated facilities, with a large number of safety and process systems, and a high level of redundancy for critical components within the plant. In addition to the complexity inherent in boiling or pressurized water reactors, on-line refueling and functions associated with heavy water management add significantly to the cost and complexity of CANDU operations.

There are numerous differences between CANDU and other reactors that result in different costs. Of the world reactor fleet of 436 units, 265 or 61 per cent are pressurized water reactors. Ninety-two or 21 per cent are boiling water reactors, and 39 or 9 per cent are CANDU type. The remaining units are mainly gas cooled reactors. Some of the most significant technological differences driving costs are noted here.

Technology Differences between CANDU and Pressurized Water Reactors/Boiling Water Reactors

Components	Pickering A	Pickering B	Darlington	Pressurized Water Reactor	Boiling Water Reactor
Reactor	Horizontal pressure tubes	Horizontal pressure tubes	Horizontal pressure tubes	Pressure vessel	Pressure vessel
Reactor coolant and associated systems	Heavy water	Heavy water	Heavy water	Light water	Light water
Generator Output	540MW	540MW	934MW	500-1400 MW	500 – 1400 MW
Steam Generators (SG)/unit	12	12	4	2 - 4	NA
Main Coolant Pumps/unit	16	16	4	2 - 4	2
Large Isolation Valves Main Circuit	40/unit	40/unit	0	0	4/unit
Standby Generators & Emergency Power Generator	6 for 4 units	8 for 4 units	6 for 4 units	2/unit	2/unit
Computers/unit	2	2	8	1	1
Shut Down Systems/unit	2	2	2	2	2
On line Fuelling Machines	8 for 4 units	8 for 4 units	6 for 4 units	NA	NA
Tritium Removal Facility	0	0	1	NA	NA
Heat Transport System	Carbon steel	Carbon steel	Carbon steel	Stainless steel	Stainless steel

- **Generation Technology:** OPG's nuclear stations contain the first large-scale commercial CANDU units ever built, the result being that many of the technological issues OPG faces are being addressed for the first time in the nuclear industry. Addressing issues affecting critical components such as steam generators, feeder pipes, and pressure tubes has demanded and will continue to demand extensive effort. This work includes high cost maintenance activities such as the feeder replacement program, and preservation of fuel channels through restoration of spacing margin to prevent deterioration (spacer location and relocation program). Aging technology also drives OPG's ongoing investment in research and development programs. To the greatest extent possible, life cycle plans for all major components assist in ensuring fitness for service.

- **Safety and Regulatory:** OPG must ensure that the stations are operated and maintained safely at all times, and remain safe even when non-operational. For example, even when a unit is shut down, nuclear fuel continues to produce heat that must be removed.

  The requirement to meet nuclear safety regulations and standards imposed by the federal *Nuclear Safety and Control Act*, and the need to satisfy OPG's nuclear regulator, the CNSC, as described in Ex A1-T6-S1, drives a large number of ongoing work activities and costs. These include scheduled "periodic inspections" of specified equipment, in-depth analysis and assessments of systems, systems operations and component conditions, and preventive and remedial activities. In addition to ongoing activities, there is also extensive effort for re-licensing of each station every five years and the potential of additional requirements and costs associated with the license renewal.

  While nuclear safety is an obvious driver of maintenance and monitoring activities and therefore of costs, there has also been a trend in recent years for the CNSC to mandate changes to organizations and facilities to address changing requirements in such areas as physical security and fire protection.

- **Training:** A further consequence of complexity is that OPG must hire staff with special skills that require extensive and ongoing training. The following provides an example of the impact of training in the critical area of nuclear operators obtaining their station-specific certification:
  - Non-licensed Operators: When a new field operator is hired, it typically takes approximately two years of training before the operator is able to perform work in the station. At this point, the non-licensed operator is able to work independently, but may still be required to work alongside an experienced operator for sensitive activities.

- Licensed Operators: As opposed to the field-based non-licensed operators, licensed operators are authorized to physically operate the station within the main control room. Certification to become a fully authorized nuclear operator typically requires two to six years of field work as a trained operator, followed by four to five years of study and regulatory examination, to be allowed to operate as a unit panel operator on an independent basis. Certification further requires ongoing training (generally, one week out of five).

- **Material Standards:** Equipment in a nuclear station can be subjected to demanding conditions on an ongoing basis and may be required to operate in a harsh environment (e.g., steam environment, increased radiation, high temperature and pressure or seismic acceleration) under postulated accident conditions. The harsh environment not only necessitates more frequent maintenance or replacement of parts, but also requires tightly-specified replacement parts that are environmentally-qualified for operations under such conditions, and detailed maintenance procedures to ensure that such qualification is not inadvertently compromised. Supply Chain must create and maintain the infrastructure to identify and audit vendors who can meet the stringent requirements from both a technical and quality assurance program standpoint, complying with all applicable codes and standards. "Cradle to grave" traceability (from the material manufacturer of record, to the exact end use location within the station along with the qualifications of all staff who handled the item while in process), is an example of the very costly process that is required for many components.

- **Work Environment:** In addition to the direct impact on materials costs and demanding maintenance procedures as noted above, work environment (primarily radiation) also constrains labour productivity, since maintenance in some physical locations of the nuclear plant requires both protective procedures and equipment (e.g., the wearing of cumbersome plastic suits, with dedicated breathing air). Furthermore, within and outside radiation areas, labour productivity is significantly impacted by the need for:
  - Stringent security procedures required of all staff prior to entering protected areas of the plant (such as badging, security clearances, and metal detection).

- Turnover communications/pre-job briefing for all staff, including procedure review for the specific job at hand.
- Obtaining radiation protection approvals, and adjusting protective equipment or receiving additional briefing as required.
- Having equipment physically taken out-of-service, or appropriately isolated, such that work can proceed safely.

AMPCO Interrogatory #023

Ref: Ex. F5-T1-S1, page 13

Issue Number: 6.4
Issue: Is the benchmarking methodology reasonable? Are the benchmarking results and targets flowing from those results for OPG's nuclear facilities reasonable?

Interrogatory

Regarding the statement "Additionally, the WANO NPI results of all CANDU operators are concentrated at the bottom of the peer group for the period 2006-2008":

a) Please provide the year by year WANO NPI results for Candu vs. PWR.

b) Is it the opinion of ScottMadden that the above statement reflects a temporary anomaly? Alternatively, is it the opinion of ScottMadden that the above statement is likely to prevail in future? In either case, please comment on the reasons for the opinion expressed.

Response

a) Year-by-year World Association of Nuclear Operators ("WANO") Nuclear Performance Index ("NPI") results for CANDU vs. PWR are presented in the table below:

Average WANO NPI Rankings

	2006	2007	2008
U.S. PWR 1	10	9	1
U.S. PWR 2	4	5	2
U.S. PWR 3	2	1	3
U.S. PWR 4	8	3	4
U.S. PWR 5	19	17	5
U.S. PWR 6	13	14	6
U.S. PWR 7	5	10	7
U.S. PWR 8	3	4	8
U.S. PWR 9	7	11	9
U.S. PWR 10	12	7	11
U.S. PWR 11	9	12	12
U.S. PWR 12	11	8	13
U.S. PWR 13	1	2	14
U.S. PWR 14	14	13	15

U.S. PWR 15	15	15	16
International CANDUs	6	6	10
OPG CANDU	16	16	17
Canada CANDU 1	20	19	18
Canada CANDU 2	17	20	19
Canada CANDU 3	18	18	20

Q4 2008 OPG NPI Scores vs. CANDU NPI Scores:

OPGN Median = 65.8
OPGN Average = 74.5

Candu World Median = 67.2
Candu World Average = 53.1
(excludes OPGN)

Note that in the chart showing ordinal rankings, "International CANDUs" exclude Canadian CANDU, whereas the "Candu World Median" and "Candu World Average" results include Canadian CANDU.

b) Over the 2006 – 2008 time period, CANDU operators have been concentrated at the bottom of the WANO NPI rankings as compared to PWRs. Since the lower NPI results for CANDU have been consistent over this period, these results are not an anomaly during the period examined. ScottMadden has advised OPG that it cannot predict if the results will continue into the future.

Differences between PWR and CANDU generation technologies impact many of the ten metrics that comprise the Nuclear Performance Index. Unit Capability Factors for CANDUs are typically lower than PWRs due to longer planned outages. Longer outages, in turn, result in higher Collective Radiation Exposure which is another NPI component. In addition, CANDU units are more complex with higher number of components which can be linked to higher FLRs in CANDU technology as well as the potential for greater unplanned work during outages.

AMPCO Interrogatory #022

Ref: Ex. F2-T1-S1

Issue Number: 6.3
Issue: Is the test period Operations, Maintenance and Administration budget for the nuclear facilities appropriate?

Interrogatory

a) How much station service power has been or will be paid by the nuclear business each year since 2005 through to the end of the test period? Please include a breakout of GA costs.

b) Please provide an estimate of the impact of the AMPCO High 5 proposal as described in EB-2008-0272 if it were to apply during the test period.

c) Please update Chart 2-1: Comparative Nuclear PUEC Costs from the EB-2007-0905 Decision with Reasons.

Response

a) At the nuclear stations, some electricity consumption is self-supplied (i.e., supplied directly from the generators), and some consumption is supplied from the Independent Electricity System Operator ("IESO") -controlled grid (i.e., grid withdrawals). As outlined in OPG's response to the interrogatory in Ex. L-01-088 part b), the IESO does not meter self-supplied consumption but the IESO does meter grid withdrawals. All station electricity consumption, self-supplied or grid withdrawals, is paid by OPG:

- Self-supplied consumption reduces the station electricity output into the IESO-controlled grid. Because this consumption is not metered by the IESO, it does not attract non-energy load charges and OPG does not explicitly track the value of this consumption.

- Grid withdrawals are metered by the IESO and they attract non-energy load charges.

Table 1 below outlines the value of grid withdrawals by calendar year from 2005 - 2009. The first column shows the value of grid withdrawals. The second column shows the total non-energy load charges while the third column shows the Global Adjustment component included in the total non-energy load charges.

Table 1
Nuclear Grid Withdrawal Values: 2005 – 2009

Year	Value of Withdrawals ($M)	Total Non-Energy Load Charges (Including Global Adjustment)[1] ($M)	Global Adjustment (Included in Total Non-Energy Load Charges) ($M)
2005	55.5	10.8	(6.7)[2]
2006	39.5	10.1	3.2
2007	38.0	9.8	3.3
2008	38.6	10.6	4.9
2009	24.8	36.1	26.8

In Table 2 below, an explicit forecast of the cost of grid withdrawals is not available. The first column shows the total non-energy charge forecast while the second column shows the Global Adjustment component of the total forecast non-energy load charge.

Table 2
Nuclear
Forecast Non-Energy Costs: 2010 – 2012

Year	Total Non-Energy Load Charges (Including Global Adjustment)[3] ($M)	Global Adjustment ($M)
2010	26.3	17.0
2011	30.3	21.0
2012	33.5	24.2

b) OPG has no estimate of the impact on its station service costs of this proposal. OPG notes that this matter is before the OEB in EB-2010-0002 and that Hydro One suggests an implementation date of January 1, 2012 in the event that the OEB decides to adopt this proposal.

c) OPG has updated the chart as indicated. OPG does not accept that the Bruce definition of "All In" costs is comparable to the Production Unit Energy Cost ("PUEC") definition used by OPG.

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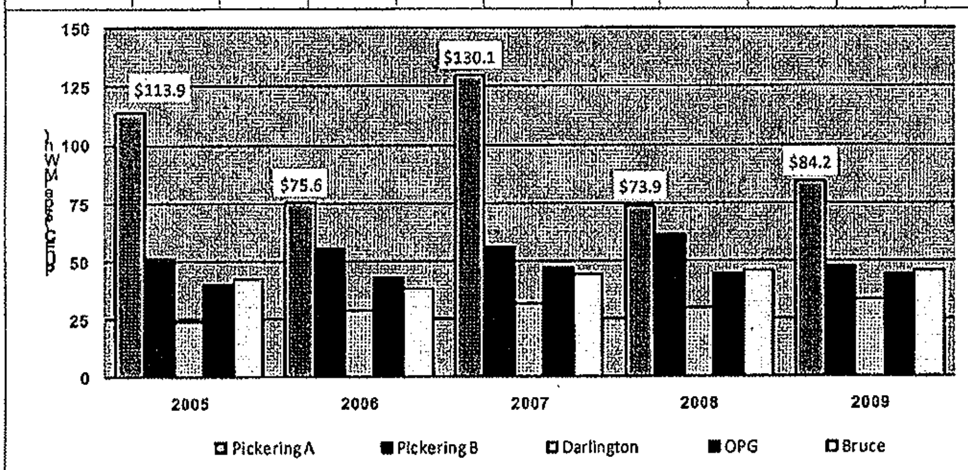
[1] Values from 2005 – 2007 from EB 2007-0905, Ex. F3-T1-S1, Table 12. Values from 2008 – 2009 from Ex. F4-T4-S1, Table 3.
[2] Note that the Global Adjustment in 2005 was a credit and not a cost.
[3] Values from Ex. F4-T4-S1, Table 3.

Update to Chart 2.1 from EB-2007-0906



	Production Unit Energy Cost (PUEC) $/MWh				
	2005	2006	2007	2008	2009
Pickering A	113.9	75.6	130.1	73.9	84.2
Pickering B	51.3	55.5	55.9	61.3	47.3
Darlington	23.9	28.7	31.6	29.7	33.1
OPG	39.7	42.9	47.2	44.0	43.9
Bruce *	42.0	38.0	44.0	46.0	46.0

* Bruce data for 2007, 2008 and 2009 from Bruce Annual Review documents on its website, defined as "All in Costs". Please note that the 2007 figure was revised by Bruce Power from $42 to $44 and the 2008 number was revised from $45 to $46 as per the 2009 Annual Review document. No disclosure of the change or rationale was provided.

NOTE: The U.S. Median in EB-2007-0905 Chart 2.1 was extracted by OEB staff from a Nuclear Energy Institute report. OPG does not know the context of this report, nor have direct access and does not represent OPG evidence. Therefore, that data has been removed.

Witness Panel: Hydroelectric
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Nuclear Base OM&A & Revenues