CONTINUED OPERATIONS AT PICKERING

1.0 PURPOSE

This evidence presents the costs and status of the activities associated with the Continued Operations initiative at Pickering ("Pickering Continued Operations").

2.0 OVERVIEW

The Pickering Continued Operations initiative will achieve a short-term extension to the operating life of Pickering Units 5-8. The initiative, which is over 75 per cent complete, is on budget and on schedule. It will be finished by the end of 2014 as originally planned. In November 2012, OPG achieved high confidence that the fuel channels for Pickering Units 5-8 can attain an operational life of 247,000 Effective Full Power Hours ("EFPH"). This is 7,000 EFPH more than the 240,000 EFPH assumed in the business case filed in EB-2010-0008.

The 2014 nuclear revenue requirement includes $37.1M of OM&A costs (Base, Outage and Project) for the Pickering Continued Operations initiative. There is also $1.8M of costs in 2014 representing Pickering Continued Operations' share of the Fuel Channel Life Cycle Management ("FCLM") project costs. The nuclear production forecast also reflects the incremental outage days associated with Pickering Continued Operations, which reduce nuclear production by 0.5 TWH in 2014.

OPG completed an updated Pickering Continued Operations business case in 2012. It reconfirmed the value of extending the operating life of the Pickering B units beyond 2014 - 2016 by achieving 247,000 EFPH. The net present value of this initiative was estimated to be approximately $520M (2012 PV dollars). The extension of Pickering's operating life will provide approximately 109.3 TWh of additional electricity supply to the province of Ontario over the period 2013 to 2020. A copy of the updated business case for this initiative is provided as Attachment 1.

Seeking to confirm its positive assessment, OPG approached the Ontario Power Authority ("OPA") and requested that it provide an independent assessment of the system benefits

associated with the Pickering Continued Operations initiative. The OPA undertook the requested assessment and concluded that it "…supports Ontario Power Generation's proposals for expenditures in 2013 and 2014 to maintain the options of continued operation at Pickering and refurbishment of Darlington NGS". The OPA's response, dated August 15, 2012, can be found at Attachment 2.

Section 3.0 provides background on the Pickering Continued Operations initiative including status of work activities and costs. Section 4 presents a summary of OPG' s updated 2012 business case and Section 5 summarizes the OPA's assessment of Pickering Continued Operations.

3.0 BACKGROUND

As stated in EB-2010-0008, the originally-assumed end of life for the Pickering Units 5-8 was 2014 (for Units 5 and 6), 2015 (for Unit 7), and 2016 (for Unit 8). The end of life estimate for the station was predicated on the originally assumed design life of the key major component (i.e., the pressure tubes). The design life of the pressure tubes was originally projected to be 210,000 EFPH.

The ability of OPG to operate the Pickering Units 5-8 beyond 210,000 EFPH also has implications for Pickering Units 1 and 4. OPG has determined that when there are less than two of the four Pickering Units 5-8 in operation, there are significant technical and economic challenges to the economic operation of Pickering Units 1 and 4. Therefore, OPG is not planning to operate Pickering Units 1 and 4 when more than 2 of the four Pickering Units (5-8) are shut down. OPG intends to extend the service life of Pickering Unit 7 from 2019 to the end of 2020 to match the end of life for Unit 8. This will be accomplished by incremental maintenance and inspections and potential life management outages (there are no life management outages planned in the test period). Having Unit 7 and Unit 8 in operation to 2020 will allow Units 1 and 4 to operate until the end of 2020.

3.1 Project Results and Plans

The Pickering Continued Operations initiative is a multi-year project that required incremental operating and maintenance work effort (e.g. additional inspections to confirm component

fitness-for-service; incremental maintenance to improve the material condition of the plant) and additional planned outage days.

Major work program activities completed or planned during 2013 and 2014 include fuel channel inspections (e.g. spacer location and relocation) consistent with the fuel channel life cycle plans to support continued operations. Steam generator tube inspections and enhanced water lancing (i.e. steam generator cleaning campaigns) were also completed, or are planned, in order to preserve the health of the asset. In addition, a number of equipment reliability improvements were completed or are planned. The summary of expenditures by work program is found in Appendix C of Attachment 1.

The impact of the initiative on outage duration has been included in the 2013-2015 Business Plan with 40 additional planned outage days in 2014 relative to the base case of no Pickering Continued Operations. This corresponds to a reduction of 0.5TWh in 2014 nuclear production.

The Pickering Continued Operations initiative also addresses fuel channel aging issues. Fuel channels are the most critical life limiting component in a CANDU reactor. A Fuel Channel Life Management ("FCLM") project was undertaken in co-operation with Bruce Power, AECL, and the CANDU Owners Group. As the Fuel Channel Life Cycle Management project supports both Pickering Continued Operations and Darlington Refurbishment, a portion of the costs from this project has been assigned to Pickering Continued Operations. This project has completed the necessary laboratory testing and technical work allowing OPG to confirm high confidence that the fuel channels for Pickering Units 5-8 can attain an operational life of 247,000 EFPH. Work continues in 2013 and 2014 related to maintaining OPG's high confidence in achieving the 247,000 EFPH.

To facilitate CNSC acceptance of the results from the FCLM project, an agreement on criteria for demonstration of continued fitness for service was entered into with the CNSC. On August 9, 2013, the CNSC announced its decision to renew Pickering's power reactor operating licence for a 5 year period from September 1, 2013 to August 31, 2018, but will

require OPG to make submissions on operating beyond 210,000 EFPH to demonstrate that OPG is in compliance with the agreed upon criteria. OPG is currently in the process of preparing submissions to comply with the CNCS decision.

In summary, the results to-date from the Pickering Continued Operations initiative indicates that the Pickering facility can operate until year-end 2020 and that:

- The material condition of Units 5-8 is good and no issues have emerged that would question OPG's ability to demonstrate continued fitness-for-service of the plant's major components to 247,000 EFPH.
- The Fuel Channel Life Management project has met the end of 2012 milestone of achieving high confidence that the fuel channels for Pickering Units 5-8 can reach an operational life of 247,000 EFPH.

3.2 Cost Summary

Chart 1, below summarizes the OM&A actual and forecast expenditures on Pickering Continued Operations, from 2010 to 2014.

Chart 1

Summary of Pickering Continued Operations Expenditures

Costs ($M)	Actual 2010	Actual 2011	Actual 2012	Budget 2013	Plan 2014	Total
Pickering B Continued Operations Initiative						
Base OM&A	4.8	17.5	18.5	14.6	12.6	68.0
Outage OM&A	3.0	22.3	23.7	20.2	18.5	87.8
Project OM&A	1.7	1.0	3.5	6.0	6.0	18.2
Subtotal	**9.5**	**40.9**	**45.7**	**40.8**	**37.1**	174.0
FCLM- PB Con Operations	**2.9**	**4.6**	**5.2**	**4.4**	**1.8**	19.1
Total PB Con Ops	**12.4**	**45.5**	**50.9**	**45.2**	**38.9**	192.8

Total expenditures (2010-2014) are forecast to be $192.8M, essentially on budget with the $190.2M projected in the economic analysis filed in EB-2010-0008. While the Fuel Channel

Life Management project expenditures exceeded initial estimates, OPG was able to offset these costs by lower operational and maintenance expenditures on the Pickering Continued Operations initiative. An updated BCS for the Fuel Channel Life Management project can be found as an attachment to Ex. F2-3-3.

4.0 UPDATED 2012 BUSINESS CASE

In 2012 OPG completed an updated Pickering Continued Operations business case that reconfirmed the value of extending the operating life of the Pickering B units beyond 2014 – 2016 (Attachment 1). OPG estimated the net present value of extending this initiative to be approximately $520M (2012 PV dollars). As with the original business case filed in EB-2010-008, this net present value is based on the difference between the estimated cost of Pickering's output and the estimate cost of replacement generation.

The analysis in the updated business case assumed operation of Pickering Units 5 and 6 to 2019 and Pickering Units 7 and 8 to the end of 2020. OPG estimates that the net total additional generation resulting from the extension to the operating life of the Pickering units would be 109.3 TWh over the period 2013-2020. This generation would be available to the system at a time when several nuclear units in the Province are planned to be unavailable because of refurbishment outages.

Compared with the business case provided in EB-2010-0008, the system benefit from the initiative has declined, albeit remaining at a positive net present value ("NPV"). Factors contributing to the change in NPV (see page 10 of Attachment 1) include a reduction in the value of Pickering's generation relative to alternatives as a result of a lower electricity demand forecast and lower replacement generation costs (e.g., lower gas price forecast) compared to the 2010 BCS assumptions and this was partially offset by an increase in the assumed operating life of Pickering Units 5-8 from 240,000 to 247,000 EFPH.

A list of the cost and operating assumptions used in the revised business case scenarios can be found at Appendix B and C of the BCS (Attachment 1).

In addition, beyond the economic benefits included in the NPV calculation, other identified benefits that result from the Pickering Continued Operations initiative include:

1. Improved supply reliability by having Pickering available to provide baseload generation during the period 2016 - 2020 when Darlington is scheduled to undergo refurbishment.
2. The deferral of new transmission infrastructure in the Oshawa area that would be required with the shut-down of the Pickering stations.

5.0 OPA EVALUATION

Seeking to confirm its positive assessment of extending Pickering's operating life, OPG approached the OPA and requested that it provide an independent assessment of the system benefits associated with the Pickering Continued Operations initiative. OPG provided the OPA with updated incremental costs and generation impacts. The OPA conducted its assessment and summarized its conclusions (see Attachment 2) by advising that it "supports Ontario Power Generation's proposals for expenditures in 2013 and 2014 to maintain the options of continued operation at Pickering and refurbishment of Darlington NGS".

The OPA's independent analysis concluded that "…on balance, the OPA's assessment of system cost impacts suggests an expected cost advantage to Pickering continued operation (in the order of approximately $100 Million**)".** The OPA also performed a sensitivity analysis of the broader uncertainties (e.g. price of natural gas, length of continued operation period, overall costs, generation performance etc) that represented a combination of factors that together would increase or decrease the cost advantage of Pickering Continued Operations. The OPA's assessment found that "…based on evaluation to date of the broader uncertainties, the OPA estimates a range of up to approximately $1.3 billion in potential net-benefit of Pickering continued operation to $0.76 billion in potential net cost (net dis-benefit)".

The OPA also highlighted non-quantitative benefits from Pickering Continued Operations. These included:

- an approximately 11 megatonne reduction in Ontario CO2 emissions between 2015 and 2020.
- the potential for the deferral of some investments in transmission enhancements

- the hedge that Pickering Continued Operations could provide against mid-term uncertainties that would otherwise result in additional replacement requirements (i.e. the availability of Pickering's 3000 MW was viewed as insurance during the period 2015 to 2020, when Ontario's electrical system will be subject to significant uncertainties, including multiple concurrent refurbishment outages and restarts, and potential natural gas-fired generator retirements).

The OPA concluded that "…continued operation at Pickering is seen by the OPA as a timely and potentially helpful source of insurance within this dynamic context".

6.0 COST VARIANCES

OPG is seeking recovery of the variance between actual and forecast 2013 OM&A costs for Pickering Continued Operations and Fuel Channel Life Management project through the Capacity Refurbishment Variance Account as detailed in Ex. H1-2-1. As noted above, OPG is forecasting that the multi-year project will be completed on schedule at the end of 2014 and essentially on budget with the $190.2M projected in the economic analysis filed in EB-2010-0008.

LIST OF ATTACHMENTS

Attachment 1:	2012 Business Case Update - Pickering Continued Operations
Attachment 2:	Letter from Amir Shalaby, Ontario Power Authority to Pankaj Sardana, OPG dated August 15, 2012, Re: Pickering NGS Continued Operation and Darlington NGS Refurbishment