David I. Poch Barrister tel. (613) 264-0055 fax (613) 264-2878

30 May 2014

Ontario Energy Board
2300 Yonge St., 27th Floor
Toronto, ON
M4P 1E4

Attn: Ms Kirsten Walli
Board Secretary

By electronic filing and e-mail

Dear Ms Walli:

Re: EB-2013-0321 – OPG Payments – Issues Prioritization

I am counsel for the Green Energy Coalition. This letter is sent to request that the Board reprioritize (or partially reprioritize) a small number of issues from Secondary to Primary, so that the Board and parties can test new evidence on those issues through oral evidence. The request arises because GEC has just obtained information that was previously unavailable and that appears to significantly contradict and/or shed new light on evidence filed by OPG in this proceeding.

The details of this new evidence are discussed in the attached affidavit of Shawn-Patrick Stensil. As indicated therein, based on OPA information, it appears that the continued operation of Pickering units 5-8 will likely result in a net loss on the order of 1.5 billion dollars, severely exacerbate the surplus baseload generation situation requiring the curtailment of renewable generation and increased payments to OPG, and result in a lowering of export revenues.

Given the extremely poor economic performance of the Pickering units, and the apparent lack of need for most of the energy they would generate, subject to the constraints indicated by the IESO in regard to transmission support, it may be advisable for the Board to consider a reduction of payments reflecting the fact that continued operation of 6 units throughout the 2014-15 period at the costs being proposed is an unreasonable expense. Further, given the recent LTEP reference to the possible shutdown of the plants upon in-service of the Clarington TS (now expected in 2017) we suggest that the new evidence increases the need to reconsider OPG's depreciation schedule and nuclear liabilities funding schedules and to consider appropriate rate mitigation if needed.

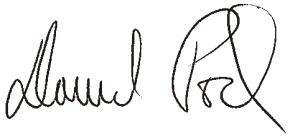
1649 Old Brooke Road, Maberly, Ontario K0H 2B0 e-mail: dpoch@eelaw.ca

We note the following related issues:

> 5.5 Primary - Is the proposed nuclear production forecast appropriate?
>
> 6.3 Oral Hearing - Is the test period Operations, Maintenance and Administration budget for the nuclear facilities appropriate?
>
> 5.2 Secondary - Is the estimate of surplus baseload generation appropriate?
>
> 6.6 Secondary - Are the test period expenditures related to continued operations for Pickering Units 5 to 8 appropriate?
>
> 6.11 Secondary - Is the proposed test period depreciation expense appropriate?
>
> 8.2 Secondary - Is the revenue requirement impact of the nuclear liabilities appropriately determined?

Much of the new evidence will be relevant to primary issue 5.5 and oral issue 6.3 and it is our intention to put these matters to OPG in that context. However, we believe that the implications for the secondary issues listed above are not insignificant and are deserving of consideration in the oral hearing. As we will already be discussing these factual matters under issues 5.5 and 6.3 we would not expect that the reclassification of the other issues would result in any significant expansion of cross-examination, but would allow OPG to respond on the record so that we can then properly address their views in argument. The Board may wish to limit the re-prioritization of the secondary issues to matters that arise from the new information on Pickering.

Sincerely,



David Poch

Encl.: Affidavit of Shawn-Patrick Stensil
Cc: all parties

EB-2013-0321

IN THE MATTER OF the Ontario Energy Board Act, 1998, S. O. 1998, c. 15, Schedule B;

AND IN THE MATTER OF an application by Ontario Power Generation Inc. pursuant to section 78.1 of the Ontario Energy Board Act, 1998 for an order or orders determining payment amounts for the output of certain of its generating facilities.

Affidavit of Shawn-Patrick Stensil

1. I, Shawn-Patrick Stensil, am a nuclear energy researcher employed by Greenpeace Canada which is a member of the Green Energy Coalition (GEC), an intervenor in this proceeding, and as such have knowledge of the matters hereinafter deposed.

2. In the interrogatory and technical conference processes GEC sought information concerning the cost-effectiveness of Pickering operations. Among other requests, GEC sought information on the net benefit or costs of Pickering operations, and the impact on surplus baseload generation. In its responses OPG witnesses referenced pre-filed Exhibit F2-2-3, Attachment 2, which is an August 15, 2012 letter from OPA concerning the net cost or benefit of the continued operation of Pickering units 5-8. The letter offers an estimate of a net benefit "on the order of approximately $100 Million dollars" with a range of "up to approximately $1.3 billion in potential net-benefit from Pickering continued operation to $0.76 billion in potential net-cost (dis-benefit). In undertaking response JT1.18 OPG indicated that no evaluation of the impact on surplus baseload generation had been made by OPG or OPA.

3. On May 22nd, 2014, after the deadline for interrogatories and after the deadline for submission on the prioritization of the issues list in this proceeding, I received a response from the Ontario Power Authority (OPA) to a Freedom of Information (FOI) request submitted on October 16th, 2013. My FOI request sought background

information supporting the OPA letter which appears as Exhibit F2-2-3, Attachment 2 in this proceeding. Attached as exhibit A to this affidavit are excerpts from the 964 page FOI response from OPA.

4. Pages 1 to 30 of the FOI response which appear as pages 1 to 30 of exhibit A to this affidavit are the April 16th, 2012 OPA study underlying its letter to the OPG (Ex. F2-2-3 Att. 2). The document is stamped 'DRAFT' and 'Confidential' but is in fact the only study produced in response to the FOI request, suggesting that no further version was completed. By reason of its production in response to the FOI request, it is no longer confidential.

5. Page 137 of the FOI response which appears as page 31 to exhibit A is a memo from Bashir Bhana, a Planner in the Power System Planning Division of the OPA, dated April 24th, eight days after the production of the study noted above. The memo indicates that a new energy demand forecast was available and that the changed forecast (an average of 3 TWh/yr lower) would be expected to result in a net *cost* of Pickering continued operations "similar to that in the low demand sensitivity case (net cost of $760M)." This is in contrast the $100 million net *benefit* that the OPA letter filed by OPG references.

6. Exhibit L, Tab 6.6, Schedule 8 (GEC-007) indicates that the forecast underlying the OPA 2012 assessment of Pickering continued operations net benefit was for 147 TWh in 2014 growing to 148.9 TWh in 2020 whereas the 2013 LTEP forecast is for 140.8 TWh in 2014 and reaches only 141.5 by 2020 (all net of conservation). Given the reduction of over 6 TWH/yr and the OPA statement noted above (at page 137 of the FOI response) that a 3TWh/yr reduction would lead to a $760 million net loss, assuming that the impact is linear, the continued operations can now be expected to create a net loss to ratepayers approaching 1.6 billion dollars less the expenses to date, a significant deviation from the net benefit values that OPG filed in evidence.

7. Page 23 of the FOI response which appears as page 23 to exhibit A indicates a very significant 45 TWh increase in Potential Surplus Energy (PSE) due to Pickering continued operations. This compares to the 110 TWh the OPA assumes for the added generation from Pickering. Given the subsequent drop in the load forecast of 6TWh/yr referred to above, over the 5 years the PSE could be as high as 75 TWh, calculated as 45 TWh + (5yrs X 6 TWH/yr). This large amount of PSE will dramatically increase the amount of surplus baseload generation and in turn increase the expected payments to OPG to compensate it for its curtailment of hydraulic generation.

8. Page 772 of the FOI response which appears as page 32 to exhibit A is a memo from Bashir Bhana, a Planner in the Power System Planning Division of the OPA, dated August 2, 2012. Despite the higher PSE, the memo indicates that Pickering continued operation will result in lower forecast export revenues due to its impact on HOEP.

9. Page 718 of the FOI response which appears as page 33 to exhibit A is a memo from Bashir Bhana, a Planner in the Power System Planning Division of the OPA, dated March 21st, 2012 which indicates that Pickering continued operation will result in a forecast constraint of renewable generation of 9 TWH. Given the lower load forecast this value would now be considerably higher and will impose system costs accordingly.

10. In the 2013 LTEP the possible earlier shutdown of Pickering on the in-service date of the Clarington Transformer Station is specifically referenced. In Exhibit L, Tab 6.6, Schedule 8 GEC-005 OPG provides an IESO reference for an expected date for Clarington TS in-service of Fall 2017. Despite the immense economic cost of continued operation of Pickering and the expected 2017 in-service date for Clarington, OPG currently proposes depreciating the Pickering facilities based on an end of service life of 2020 (Ex. F-4-1-1). A change in service life would result in a significant impact to 2014-15 payments to OPG due to changes in the depreciation period and in the payments for decommissioning and fuel management.

11. In Ex. Exhibit L, Tab 6.6, Schedule 8 GEC-006 OPG indicates that only 2 units at Pickering are required to run to ensure transmission system support prior to the in-service date of Clarington TS. For economic and safety reasons discussed in Exhibit L, Tab 6.6, Schedule 8, GEC-008 OPG indicates that it is not possible to run the two operating Pickering A units for any extended period without at least two Pickering B units operating. It is my understanding that at least some of the concerns outlined in OPG's response would not apply if OPG were to run part or all of units 5-8 without Pickering A in operation.

Sworn before me this)
29th day of May, 2014)
at Toronto, Ontario)

Shawn-Patrick Stensil

A commissioner of oaths

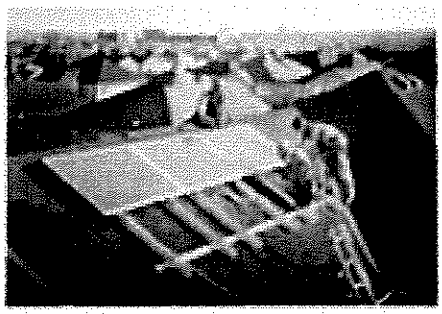
T. A. McClenaghan
Barrister & Solicitor

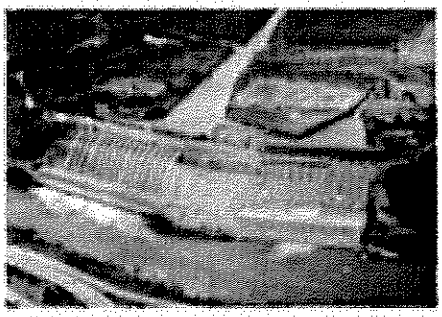
Exhibit A to the Affidavit of Shawn-Patrick Stensil dated 29, May, 2014

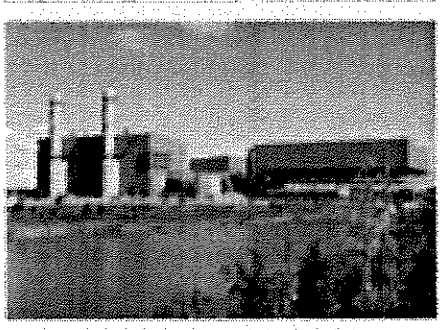
_____ a commissioner etc.

CONFIDENTIAL

PRELIMINARY DRAFT PREPARED IN CONTEMPLATION OF LITIGATION







Report on the Integrated Power System Planning Impacts of Pickering NGS Continued Operation

April 16, 2012

ONTARIO POWER AUTHORITY

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REPORT ON THE INTEGRATED POWER SYSTEM PLANNING IMPACTS OF PICKERING NGS CONTINUED OPERATION

EXECUTIVE SUMMARY

This report provides an assessment of the integrated power system planning impacts of Ontario Power Generation's (OPG) proposal for continued operation of the Pickering Nuclear Generation Station ("Pickering NGS") between approximately 2015 and 2020.

The Ontario Power Authority's (OPA) assessment indicates that the net system benefit of Pickering NGS continued operation is expected to be $182 million, but could range from -$0.76 billion to $1.33 billion depending on a number of factors. These include higher or lower than forecast natural gas prices; implementation of carbon prices; a shorter continued operation period; higher or lower capital and fixed operating costs; and/or higher or lower production at Pickering NGS during the continued operation period.

There are several potential benefits to Pickering NGS continued operation. These include:

- A reduction in the need for replacement capacity and energy during the nuclear refurbishment period (2016 to 2024) and associated acquisition costs;
- A hedge against factors including increased demand, delay in achieving conservation targets, higher natural gas or carbon prices, nuclear refurbishment delays, or delays in the in-service of directed resources;
- Compliance with the Ontario government Supply Mix policy direction of 50% nuclear energy;
- A reduction in Ontario CO_2 emissions; and
- Deferral of transmission enhancements needed to maintain reliable load supply to customers in the east GTA upon retirement of Pickering NGS.

The OPA therefore considers it prudent, on balance, to spend funds in 2013 and 2014 for Pickering NGS continued operation should it prove to be technically feasible.

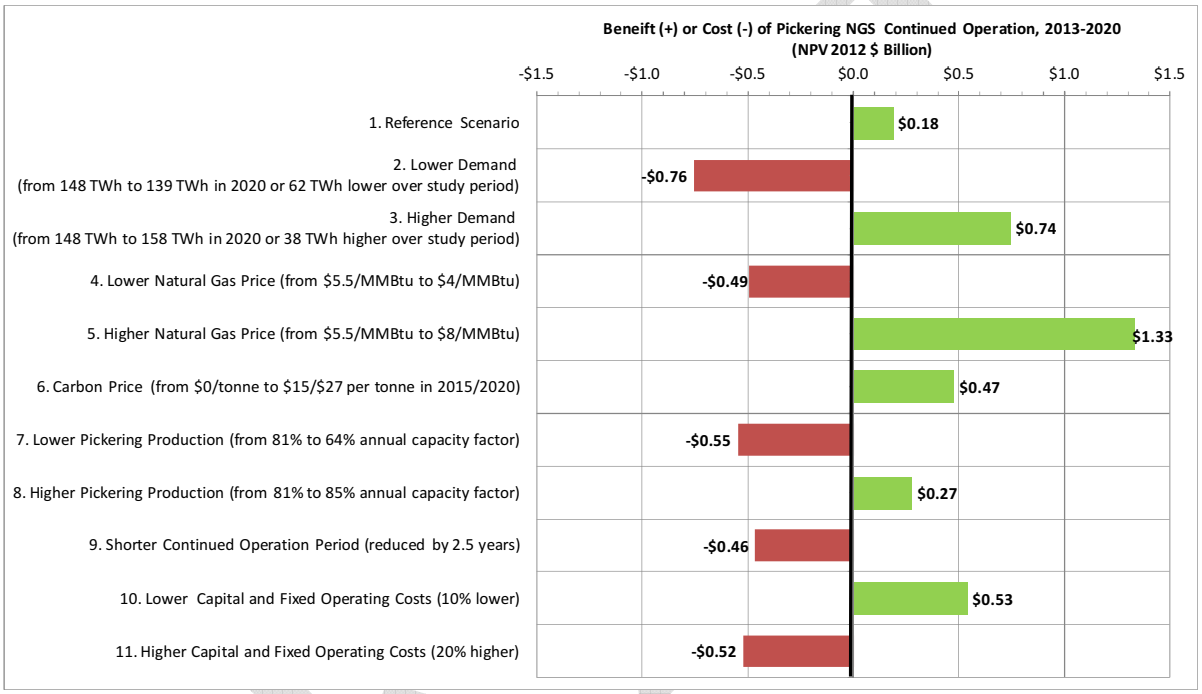
The technical feasibility of continued operation is expected to be known in 2012. A study is currently being conducted under the auspices of the CANDU Owner's Group to establish the technical feasibility of extending by approximately four years the operating life of each of the generating units that are in current operation. If feasible, it would provide the option to continue to operate the units at Pickering NGS through to approximately 2020. In the absence of continued operation, the six generating units that are currently in operation at Pickering NGS are expected to cease operation by approximately 2015.

From 2013 to 2014, it will be necessary for OPG to incur $190 million in additional capital and operating related costs associated with Pickering NGS. Of this, $85 million is associated with preserving the option of continued operation through additional inspection and maintenance work. It will be necessary for OPG to increase the number of generating unit planned outage hours at Pickering NGS during the 2013 to 2014 period to perform this

work. The remaining $105 million is associated with the operation of Pickering NGS during the 2013 to 2014 period.

The OPA has evaluated the effect of Pickering NGS continued operation on various factors including capacity and energy requirements, system costs, Ontario CO_2 emissions, and transmission impacts. The OPA's assessment assumes that resources directed by the Ontario government will proceed as planned.

Figure 1: Net System Benefit–Cost of Pickering Continued Operation for a Range of System Conditions 2013 – 2020



Source: OPA

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REPORT ON THE INTEGRATED POWER SYSTEM PLANNING IMPACTS OF PICKERING NGS CONTINUED OPERATION

1.0 INTRODUCTION

In the absence of continued operation, the six generating units that are currently in operation at the Pickering Nuclear Generating Station ("Pickering NGS") are expected to cease operation beginning in approximately 2015. A study is currently being performed under the auspices of the CANDU Owner's Group to establish the technical feasibility of extending by approximately four years the operating life of each of the generating units that are in current operation. If feasible, it would provide the option to continue to operate the units at Pickering NGS through to approximately 2020.

The technical feasibility of continued operation is expected to be known in 2012. If feasible, it will be necessary for Ontario Power Generation (OPG) to incur $190 million in additional capital and operating related costs from 2013 to 2014 with respect to Pickering NGS. Of this, $85 million is associated with preserving the option of continued operation through additional inspection and maintenance work. It will be necessary for OPG to increase the number of generating unit planned outage hours at Pickering NGS during the 2013 to 2014 period to perform this work. The remaining $105 million is associated with the operation of Pickering NGS during the 2013 to 2014 period.

In April 2010, the Ontario Power Authority (OPA) supported a decision by OPG to proceed with an initial expenditure of funds in the period 2010 to 2012 to assess the feasibility of continued operation of Pickering NGS and to maintain the option for continued operation should it prove to be feasible. The OPA stated system benefits should be re-assessed before committing additional funds required beyond 2012.

The purpose of this report is to provide an assessment of the integrated power system planning impacts of OPG's proposal for the continued operation of Pickering NGS between approximately 2015 and 2020. The assessment provided herein is an independent study performed by the OPA based on information provided by OPG and on OPA's assessment of system impacts. Updated Pickering NGS capital and operating related cost and production information provided by OPG is accepted as given. The information covers the period from 2013 to 2020.

2.0 PLANNING CONSIDERATIONS

A number of planning considerations are used to evaluate Pickering NGS continued operation, consistent with the OPA's integrated planning criteria. These include:

- Integrated power system impacts;
- Opportunities and risks;
- Supply mix policy direction;
- Ontario CO_2 emissions; and
- Transmission requirements.

Each is described further below.

2.1 Integrated Power System Impacts

The availability of Pickering NGS between approximately 2015 and 2020 affects various aspects of Ontario's electricity system. These include:

- Need and timing of capacity and associated transmission investments;
- Production from available generation resources;
- Electricity imports and exports;
- Amount of potential surplus energy; and
- System capital and operating costs.

A capacity shortfall may arise in the mid-term period (2016 to 2024) driven primarily by the refurbishment of nuclear units at Darlington NGS and Bruce NGS. A capacity shortfall arises if the total system capacity at the time of peak demand is less than the resource requirement at that time. During this period the availability of Pickering NGS could reduce or avoid short-term capacity purchases and associated transmission enhancements to meet system requirements.

If continued operation is determined to be technically feasible, it will be necessary for OPG to increase the number of generating unit planned outage hours at Pickering NGS during the period prior to 2015 to perform the necessary incremental inspection and maintenance work. These outages could result in additional system costs, as the energy which would otherwise have been produced during these hours by Pickering NGS is replaced by energy from more expensive supply resources or electricity imports in some hours. In other hours, where there is surplus energy, some of the generation from Pickering NGS would be replaced by renewable resources that would have otherwise been curtailed.

During the continued operation period beginning in approximately 2015, lower cost energy production from Pickering NGS could displace more expensive supply resources including imports, resulting in lower overall system costs during this period. During this period, generating units at Darlington NGS and at Bruce B NGS are expected to be out of service for refurbishment and gas-fired generation will therefore be on the margin for many hours. Generation from Pickering NGS will replace generation from gas-fired resources or similarly-priced imports, resulting in lower overall system costs. During some hours, however, generation from Pickering NGS could be surplus to Ontario's need, resulting in the curtailment of other baseload resources, primarily renewables, and increased exports. This would reduce the benefit of Pickering NGS operation in those hours.

2.2 Opportunities and Risks

Pickering NGS continued operation has a number of system impacts. Under certain conditions, these impacts could result in net system benefits or net system costs. Potential system impacts can be influenced by:

- Changes in demand for electricity and conservation;
- Impact of Ontario's supply mix;
- Performance of generators, including Pickering NGS; and
- Cost of Pickering NGS continued operation relative to other supply or conservation sources.

For example, lower demand for electricity would reduce the potential of Pickering NGS to offset more expensive production from other resources (such as natural gas-fired resources); whereas higher demand would increase this potential. Increased electricity demand could come about through, for example, increased economic activity, electrification of transportation, or delays in achieving conservation targets. Likewise, greater amounts of relatively low operating cost or self-scheduling resources within Ontario's supply mix would limit incremental opportunities to offset more expensive production, while lesser amounts would have the opposite effect.

The following factors would reduce the extent of potential benefits to continued operation at Pickering NGS: Less than expected performance of Pickering NGS units during the continued operation period, higher costs associated with achieving continued operation, lower fuel costs of competing resources, or lower carbon emission penalties on competing resources.

2.3 Supply Mix Policy Direction

The Ontario government has outlined its supply mix policy through the Supply Mix Directive[1] and the Long Term Energy Plan (LTEP)[2]. This includes:

- The refurbishment of 10,000 MW of nuclear generating capacity at Darlington NGS and Bruce NGS;
- Phasing-out of coal-fired generation by 2014;
- The conversion of Atikokan GS to biomass by 2013 and of Thunder Bay GS to natural gas by 2014;
- Installed hydroelectric capacity to reach 9,000 MW by 2018; and
- Installed non-hydroelectric renewable capacity of 10,700 MW by 2018.

The OPA's assessment of Pickering NGS continued operation assumes that resources directed by the Ontario government proceed as planned. Delays in achieving directive requirements could increase the amount of capacity and energy needed to meet system supply requirements. Pickering NGS continued operation could mitigate potential impacts if these delays were to materialize.

[1] Supply Mix Directive. February 17, 2011.
http://www.powerauthority.on.ca/sites/default/files/new_files/IPSP%20directive%2020110217.pdf

[2] Ontario's Long-Term Energy Plan. November 23, 2010.
http://www.energy.gov.on.ca/docs/en/MEI_LTEP_en.pdf

2.4 Ontario CO_2 Emissions Impact

The Ontario government has firm targets for reducing Ontario's greenhouse gas emissions including a 15% (27 megatonne) reduction below 1990 levels by 2020.[3] In the absence of Pickering NGS continued operation, emissions would be expected to increase as a result of increased energy production from gas-fired facilities. Availability of Pickering NGS during the continued operation period could reduce emissions from gas-fired generation.

2.5 Transmission Requirements

As described in the 2007 Integrated Power System Plan (IPSP), Pickering NGS provides approximately 3,100 MW of supply in the east GTA.[4] Pickering NGS is connected to the Cherrywood Transformer Station ("Cherrywood TS") and its output reduces loading on the 500/230 kV transformers at Cherrywood TS by providing supply to local loads at the 230 kV voltage level. When the Pickering NGS units cease to operate, additional transformation capacity will be needed to maintain reliable load supply to customers in the GTA. These facilities must be timed to precede the absence of Pickering NGS generation and in the absence of continued operation, the timing is advanced.

3.0 METHODOLOGY AND APPROACH

The evaluation of Pickering NGS continued operation was performed using a reference scenario and a number of sensitivity scenarios that considered potential benefits of continued operation against factors that could either support or erode those benefits. The economic performance of continued operation against these conditions helped inform the OPA's conclusions on the economic merits of Pickering NGS continued operation.

Each scenario studied includes the evaluation of two cases: (1) a resource portfolio "without" Pickering NGS continued operation and (2) a resource portfolio "with" Pickering NGS continued operation. Each portfolio is derived and assessed using the following steps:

1. Identify the amount and timing of existing, committed, or directed resources[5];
2. Determine the contribution of resources during peak periods;
3. Determine the amount of resources needed for adequacy;
4. Determine the extent to which existing, committed, and directed resources meet the resource requirement and identify the capacity gap;
5. Determine the transmission enhancements that are required to connect committed and directed resources;
6. Identify resource options to fill any remaining capacity gap; and

[3] Ontario's Climate Change Action Plan, Annual Report 2008-2009 (December 2009). http://www.ene.gov.on.ca/environment/en/resources/STD01_076569.html

[4] Integrated Power System Plan (IPSP). EB-2007-0707. http://www.powerauthority.on.ca/integrated-power-system-plan

[5] Existing resources are those generation resources in current operation. Committed resources are those generation resources currently under construction or development. Directed resources are those generation resources that have been directed or have been committed to by government.

7. Perform simulations to give insight into the operation of the proposed resource mix using the OPA's energy production simulation software. Simulations consider intra- and inter-jurisdictional electricity transactions for each hour of each year between 2013 and 2020.

Each case is based on reference scenario conditions as described in Section 4.0 and modified as required for each sensitivity scenario as described in Section 4.3. Economic advantages or disadvantages of continued operation of Pickering NGS were identified by comparing the net present value of costs of the "with continued operation" case for the period 2013 to 2020 to the net present value of costs of the "without continued operation" case for the same period. The net present value of costs consisted of the following cost components:

- Generation operating costs;
- Capital investments in electricity resources; and
- Import costs and export revenues.

In practice, there could be opportunity for deferring or avoiding other supply investments that would otherwise have been made in absence of continued operation. It is assumed the capacity and energy supplied by Pickering NGS during the continued operation period would be replaced by alternative sources of supply *as needed to meet system requirements.*

A number of options were considered to meet additional short-term capacity and energy needs that may arise in the absence of Pickering NGS continued operation:

- Gas-fired Generation – May consist of new simple-cycle gas turbines or equivalent coal units converted to gas for capacity and existing combined-cycle gas turbines for energy. The lead time required is shorter than other alternatives and capital costs are lower. Operating costs are higher and CO_2 emissions are increased as compared to a case with continued operations.
- Additional Conservation and Demand Response – This alternative would require a large amount of energy savings to offset the reduction in energy production from Pickering NGS. The additional effort to achieve this, beyond the current aggressive conservation targets, was considered to be an unrealistic planning assumption.
- Firm Imports – An option that would require a significant amount of firm inter-tie capacity to be purchased and is expected to be priced similar to gas-fired generation capacity.

Based on the above considerations, gas-fired generation ("unspecified gas-fired generation") was assumed to be a feasible alternative for meeting additional short-term capacity and energy needs.

4.0 ASSUMPTIONS

In formulating each case, it is necessary to make assumptions with respect to the continued operation of Pickering NGS and with respect to future system demand and supply. The study period is from 2013 to 2020, as preparation for continued operation occurs during the

period from 2013 to 2014 and continued operation itself would occur during the period from approximately 2015 to 2020.

4.1 Reference Scenario Assumptions Regarding Pickering NGS

Assumptions with respect to the continued operation of Pickering NGS were based on information provided by OPG and are summarized in Table 1. These include the cost of continued operation, the length of the continued operation period, and the capability of the Pickering NGS units during the continued operation period.

Table 1: OPG's Pickering NGS Operating Costs and Production Related Assumptions

OPG Pickering NGS Assumptions	No Continued Operation	With Continued Operation
Unit Availability		
Operating Period	2013-2016	2013-2020
Capacity	3,094 MW (all 6 units operating)	3,094 MW (all 6 units operating)
Capital and Fixed Operating Costs		
Total (NPV $ 2012)	$2.5 billion	$6 billion
Average Per Unit Energy ($ 2012)	*~45/MWh*	
Fuel and Fuel Related Costs		
Total (NPV $ 2012)	$290 million	$780 million
Average Per Unit Energy ($ 2012)	*~6/MWh*	
Production Related Data (Including P7 Life Management)		
Average Forced Loss Rate	Pickering A: 13.2% Pickering B: 4.4%	Pickering A: 10.8% Pickering B: 5.0%
Average Capability Factor	Pickering A: 78% Pickering B: 80%	Pickering A: 80% Pickering B: 82%
Total Planned Outage Unit Days	Pickering A: 277 Unit Days Pickering B: 658 Unit Days	Pickering A: 603 Unit Days Pickering B: 1,435 Unit Days
Total Energy Production	56 TWh	166 TWh

Source: OPG

4.2 Reference Scenario Assumptions Regarding Supply and Demand

The demand and supply assumptions used in this report are based on information contained in the Supply Mix Directive and the Ontario government's LTEP. These were updated to reflect current information on Darlington NGS and Pickering NGS availability as provided by OPG. Key demand and supply assumptions for the period 2013 to 2020 are related to:

- The forecast demand net of conservation;
- The resource mix—the amount of existing and future nuclear, renewables, coal and gas-fired generation;
- The price of natural gas; and,
- The price of CO_2 emissions.

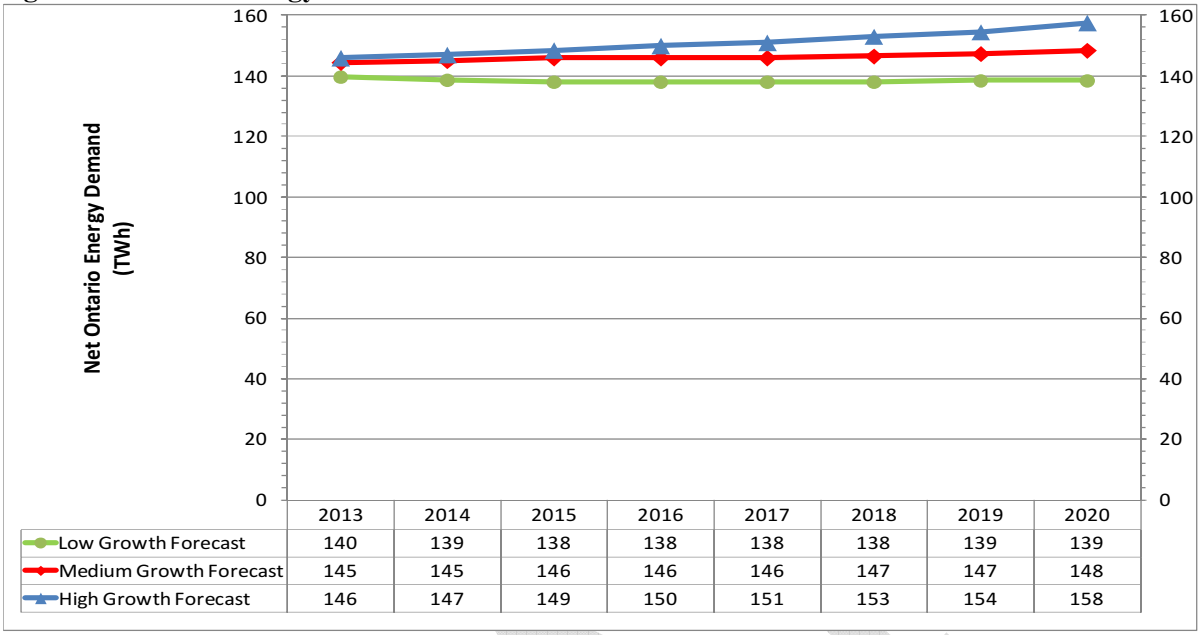
These are further described in Sections 4.2.1 to 4.2.7.

4.2.1 Demand Forecast and Conservation

The study relied on the low-, medium-, and high-growth electricity demand forecast (net of conservation and excluding dispatchable demand response resources) illustrated in Figure 2

and Figure 3. The reference scenario assumes the medium demand growth forecast consistent with the Supply Mix Directive.

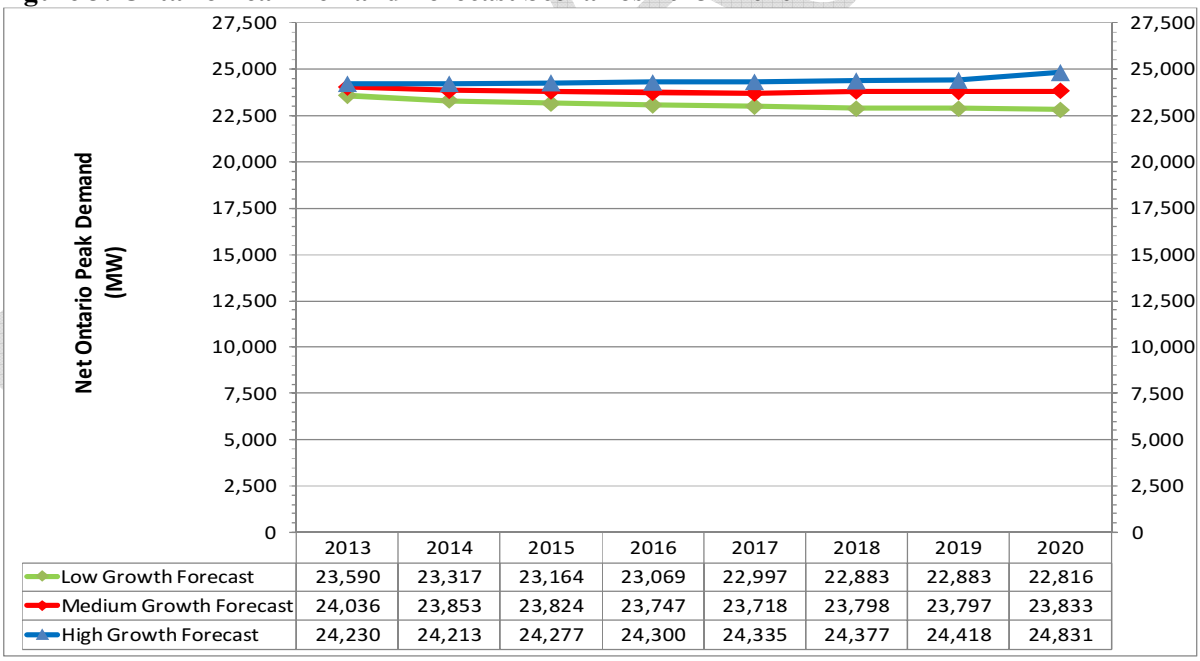
Figure 2: Ontario Energy Demand Forecast Scenarios 2013 – 2020



	2013	2014	2015	2016	2017	2018	2019	2020
Low Growth Forecast	140	139	138	138	138	138	139	139
Medium Growth Forecast	145	145	146	146	146	147	147	148
High Growth Forecast	146	147	149	150	151	153	154	158

Source: OPA

Figure 3: Ontario Peak Demand Forecast Scenarios 2013 - 2020



	2013	2014	2015	2016	2017	2018	2019	2020
Low Growth Forecast	23,590	23,317	23,164	23,069	22,997	22,883	22,883	22,816
Medium Growth Forecast	24,036	23,853	23,824	23,747	23,718	23,798	23,797	23,833
High Growth Forecast	24,230	24,213	24,277	24,300	24,335	24,377	24,418	24,831

Source: OPA

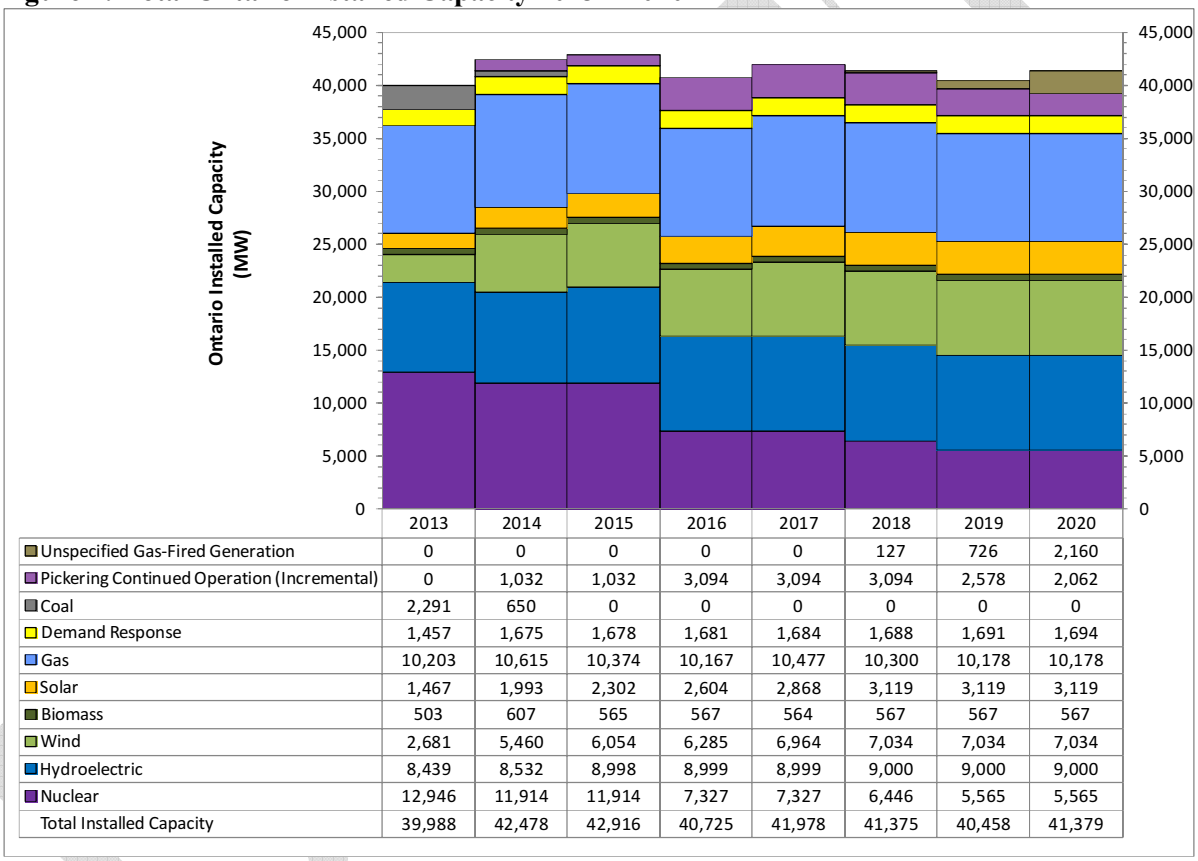
Under the reference scenario, the energy demand forecast grows by 3 TWh from 145 TWh in 2013 to 148 TWh in 2020. During this period, peak demand is forecast to decrease by about 200 MW from about 24,000 MW in 2013 to about 23,800 MW in 2020. These scenarios are further described in the LTEP.

The conservation assumptions used in this forecast reflect recent experience and the expectation of accelerated conservation levels consistent with the Supply Mix Directive (4,550 MW and 13 TWh by the end of 2015; 5,840 MW and 21 TWh by the end of 2020). These more aggressive conservation forecasts offset the economic growth impacts in the forecast period.

4.2.2 Supply Resources

Figure 4 illustrates total Ontario installed capacity by fuel type. The supply mix includes contribution from demand response and reflects the resources described in section 2.3.

Figure 4: Total Ontario Installed Capacity 2013 – 2020

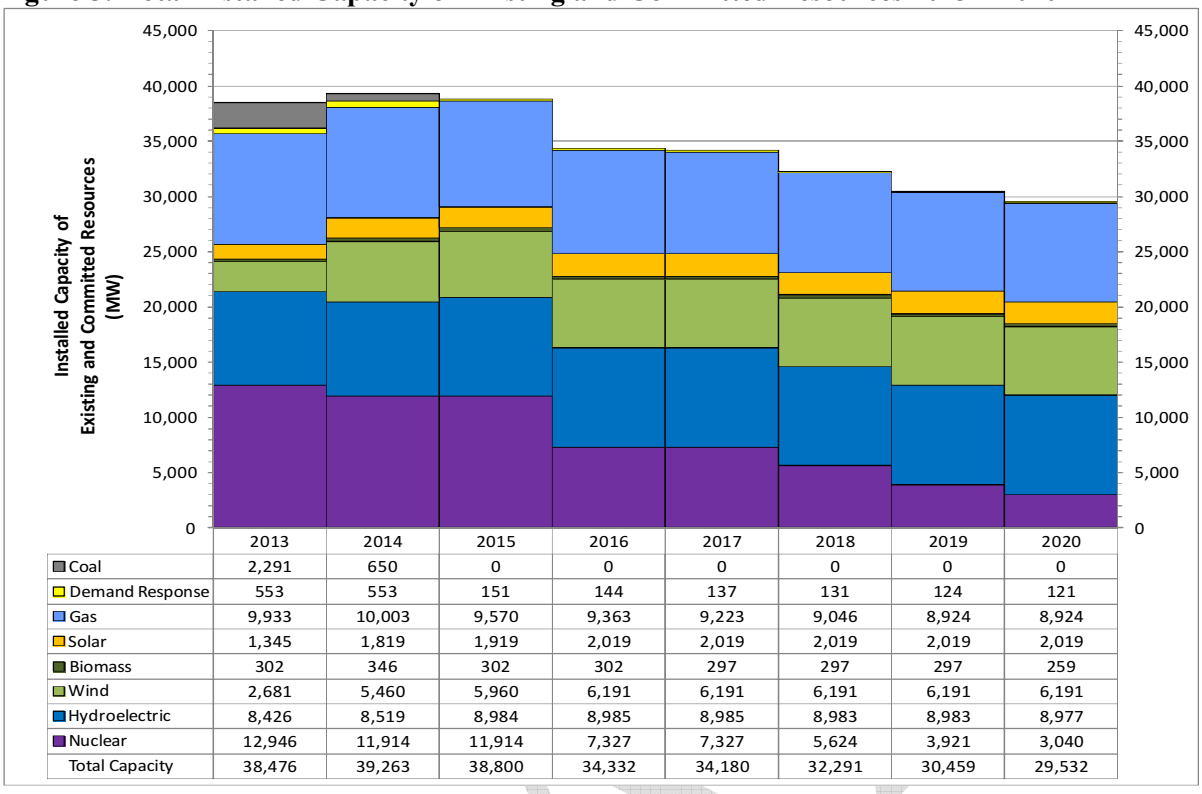


	2013	2014	2015	2016	2017	2018	2019	2020
Unspecified Gas-Fired Generation	0	0	0	0	0	127	726	2,160
Pickering Continued Operation (Incremental)	0	1,032	1,032	3,094	3,094	3,094	2,578	2,062
Coal	2,291	650	0	0	0	0	0	0
Demand Response	1,457	1,675	1,678	1,681	1,684	1,688	1,691	1,694
Gas	10,203	10,615	10,374	10,167	10,477	10,300	10,178	10,178
Solar	1,467	1,993	2,302	2,604	2,868	3,119	3,119	3,119
Biomass	503	607	565	567	564	567	567	567
Wind	2,681	5,460	6,054	6,285	6,964	7,034	7,034	7,034
Hydroelectric	8,439	8,532	8,998	8,999	8,999	9,000	9,000	9,000
Nuclear	12,946	11,914	11,914	7,327	7,327	6,446	5,565	5,565
Total Installed Capacity	39,988	42,478	42,916	40,725	41,978	41,375	40,458	41,379

Source: OPA

The total installed capacity of Ontario resources is about 41,000 MW. By 2020, existing and committed resources represent about 71% or 29,500 MW as shown in Figure 5. About 11,800 MW of installed capacity, as shown in Figure 6, are subject to meeting directive requirements or are options to be determined.

Figure 5: Total Installed Capacity of Existing and Committed Resources 2013 – 2020

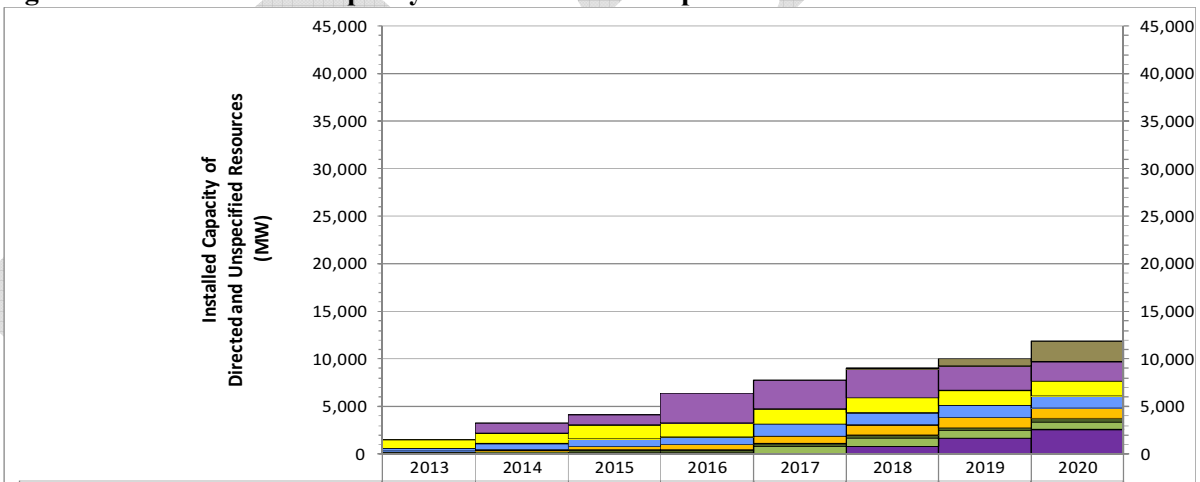


	2013	2014	2015	2016	2017	2018	2019	2020
Coal	2,291	650	0	0	0	0	0	0
Demand Response	553	553	151	144	137	131	124	121
Gas	9,933	10,003	9,570	9,363	9,223	9,046	8,924	8,924
Solar	1,345	1,819	1,919	2,019	2,019	2,019	2,019	2,019
Biomass	302	346	302	302	297	297	297	259
Wind	2,681	5,460	5,960	6,191	6,191	6,191	6,191	6,191
Hydroelectric	8,426	8,519	8,984	8,985	8,985	8,983	8,983	8,977
Nuclear	12,946	11,914	11,914	7,327	7,327	5,624	3,921	3,040
Total Capacity	38,476	39,263	38,800	34,332	34,180	32,291	30,459	29,532

Source: OPA

1

Figure 6: Total Installed Capacity of Directed and Unspecified Resources 2013 – 2020



	2013	2014	2015	2016	2017	2018	2019	2020
Unspecified Gas-Fired Generation	0	0	0	0	0	127	726	2,160
Pickering Continued Operation (Incremental)	0	1,032	1,032	3,094	3,094	3,094	2,578	2,062
Demand Response	905	1,122	1,527	1,537	1,547	1,557	1,567	1,573
Gas	270	612	804	804	1,254	1,254	1,254	1,254
Solar	122	173	382	585	849	1,100	1,100	1,100
Biomass	201	261	263	265	267	269	269	307
Wind	0	0	94	94	773	843	843	843
Hydroelectric	14	14	14	14	14	17	17	23
Refurbished Nuclear	0	0	0	0	0	822	1,644	2,525
Total	1,512	3,214	4,116	6,393	7,798	9,084	9,998	11,847

Source: OPA

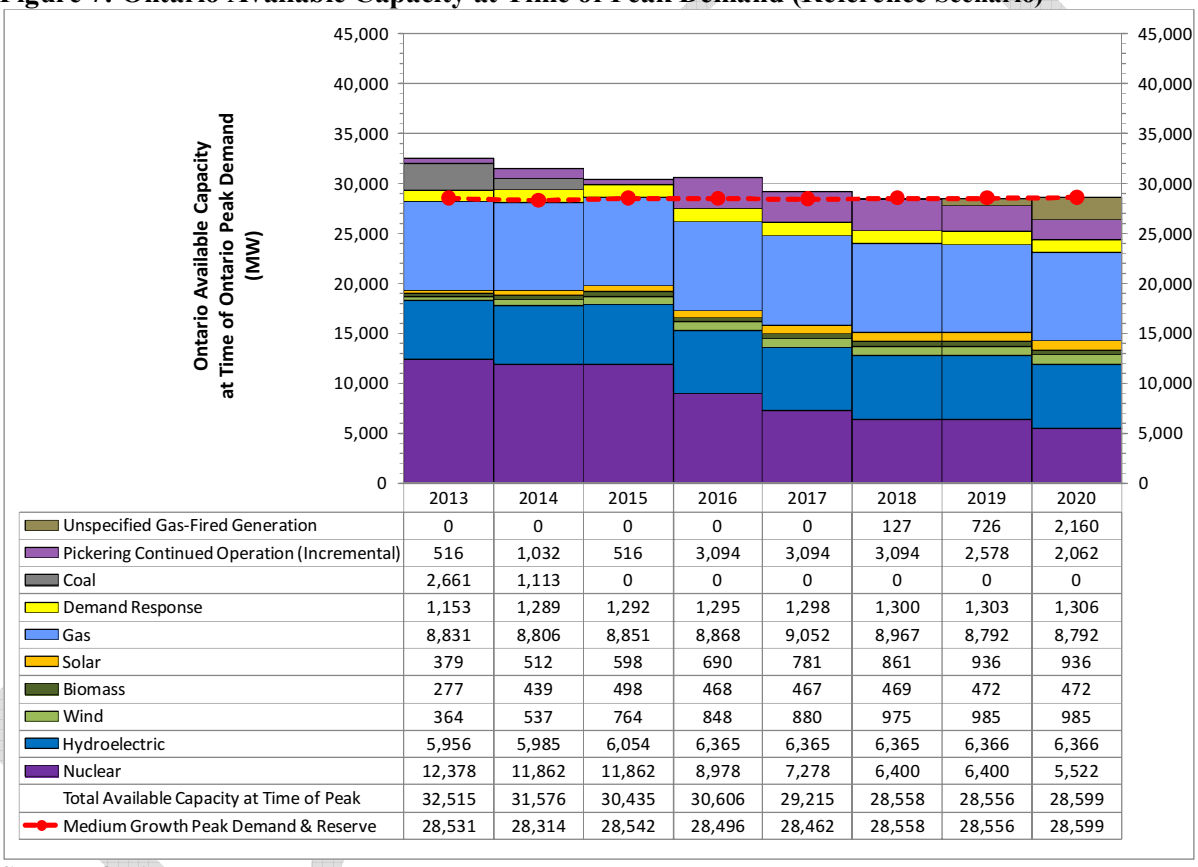
2

As described in Section 3.0, unspecified gas fired-generation is assumed to meet the incremental need for capacity identified. Options for meeting this need could include the conversion of Lambton GS and Nanticoke GS, extension of non-utility generation ("NUG") contracts, or firm imports.

4.2.3 Demand-Supply Balance

The contribution during peak periods of the resources described in Section 4.2.2 is less than the installed capacity. This is due to the intermittent and energy-limited nature of renewable resources, as well as the decline in the output of thermal generating units during high summer ambient temperatures. Figure 7 shows the supply mix contribution at time of peak to meet peak demands plus NPCC reserve requirements.[6]

Figure 7: Ontario Available Capacity at Time of Peak Demand (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020
Unspecified Gas-Fired Generation	0	0	0	0	0	127	726	2,160
Pickering Continued Operation (Incremental)	516	1,032	516	3,094	3,094	3,094	2,578	2,062
Coal	2,661	1,113	0	0	0	0	0	0
Demand Response	1,153	1,289	1,292	1,295	1,298	1,300	1,303	1,306
Gas	8,831	8,806	8,851	8,868	9,052	8,967	8,792	8,792
Solar	379	512	598	690	781	861	936	936
Biomass	277	439	498	468	467	469	472	472
Wind	364	537	764	848	880	975	985	985
Hydroelectric	5,956	5,985	6,054	6,365	6,365	6,365	6,366	6,366
Nuclear	12,378	11,862	11,862	8,978	7,278	6,400	6,400	5,522
Total Available Capacity at Time of Peak	32,515	31,576	30,435	30,606	29,215	28,558	28,556	28,599
Medium Growth Peak Demand & Reserve	28,531	28,314	28,542	28,496	28,462	28,558	28,556	28,599

Source: OPA

Where a capacity gap exists, it is assumed to be met by unspecified gas-fired resources as described in Section 3.0.

[6] The amount of resources needed in a given year is equal to the forecast annual peak demand plus planning reserve requirements. Planning reserve requirements are determined through the use of a model that takes into consideration load forecast uncertainty, the unreliability of generating units, and the variability of renewable resources. The reserve margins are in accordance with the Northeast Power Coordinating Council (NPCC) resource adequacy criterion and are consistent with North American Electric Reliability Corporation (NERC) policies and standards.

4.2.4 Transmission Requirements

The transmission plan for east GTA involves constructing a new 500/230 kV transformer station in the Oshawa area as illustrated in Figure 7. This facility is estimated to cost $270 million (or $240 net present value in 2012 dollars) and would address the loss of supply capacity resulting from the retirement of Pickering NGS. Work is currently underway with Hydro One to develop a staged east GTA transmission plan that provides sufficient flexibility to meet the possible earliest need date of approximately 2015 while minimizing ratepayer costs should a decision be made in 2012 to extend the life of Pickering NGS to the year 2020.

Figure 8: Map of Transmission Facilities Supplying the GTA

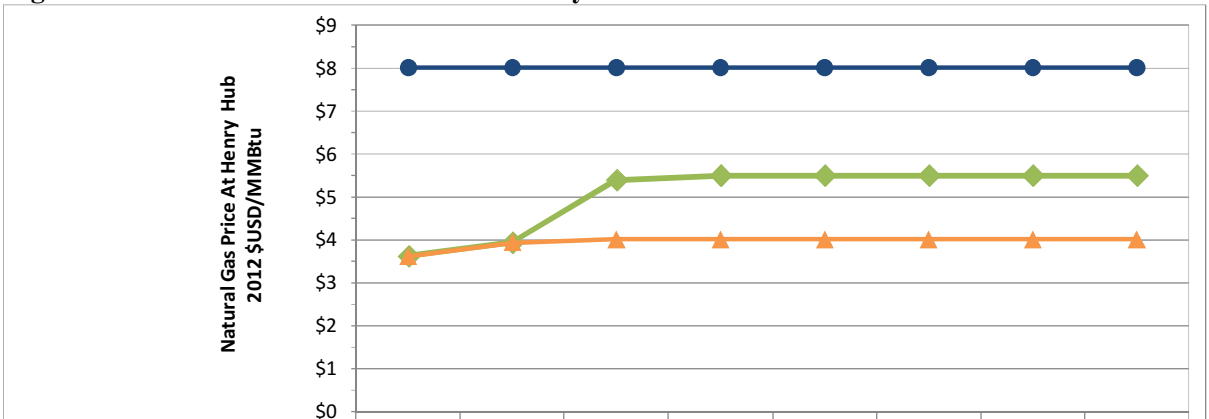
Source: OPA

4.2.5 Forecast Natural Gas Prices

Natural gas prices used in the reference scenario are based on the January 31, 2012 forecast produced by Sproule Associates Limited[7] as shown in Figure 9. Sensitivity scenarios described in Section 4.3 examine the impact of natural gas prices that are higher or lower than the reference scenario prices.

[7] Sproule Associates Limited. www.sproule.com/files/January_31_2012.xls

Figure 9: Forecast Natural Gas Price at Henry Hub



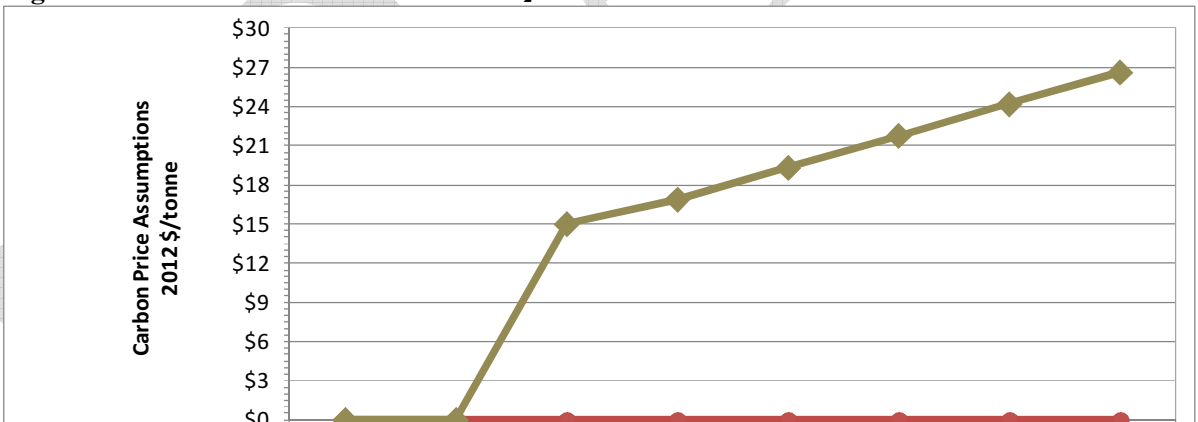
	2013	2014	2015	2016	2017	2018	2019	2020
Reference Scenario	$3.61	$3.93	$5.39	$5.50	$5.50	$5.50	$5.50	$5.50
Lower Natural Gas Price Scenario	$3.61	$3.93	$4.00	$4.00	$4.00	$4.00	$4.00	$4.00
Higher Natural Gas Price Scenario	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00

Source: Sproule, OPA

4.2.6 Price of CO_2 Emissions

Projections of future carbon prices vary widely.[8] Figure 10 shows the carbon price scenario assumed in the reference scenario and sensitivity scenario. The reference scenario assumes a carbon price of $0/tonne between 2013 and 2020 which is consistent with the LTEP.

Figure 10: Carbon Price Scenario for CO_2 Emissions



	2013	2014	2015	2016	2017	2018	2019	2020
Reference Scenario	$0	$0	$0	$0	$0	$0	$0	$0
Carbon Price Scenario	$0	$0	$15	$17	$19	$22	$24	$27

Source: OPA

[8] For example, see "Canada's Energy Future Reference Case and Scenarios to 2030" (NEB, 2007); "Design Recommendations for the WCI Regional Cap-and-Trade Program" (WCI, 2008); "Pricing Carbon: Saving Green" A Carbon Price to Lower Emissions, Taxes and Barriers to Green Technology" (David Suzuki Foundation, 2008); "Achieving 2050: A Carbon Pricing Policy for Canada" (NRTEE, 2009); "Climate Leadership, Economic Prosperity: Final Report on an Economic Study of Greenhouse Gas Targets and Policies for Canada" (Pembina Institute and David Suzuki Foundation, 2009).

4.2.7 Economic Analysis Assumptions

Economic analysis was performed on a societal basis without consideration of taxes, market financing, or other commercial impacts. Future costs were net present valued to 2012 dollars using a 4% real discount rate.

As described in Section 3.0, gas-fired generation was assumed to meet additional short-term capacity needs. The cost of gas-fired capacity is assumed to be $108/kW-year which is the average per unit levelized fixed cost of a simple-cycle gas turbine.

The impacts on economic development, jobs, and community acceptance have not been studied but positive benefits are likely with the continued operation of Pickering NGS.

4.3 Sensitivity Scenarios

The sensitivity of the net benefits or costs to changes in key assumptions is considered to test the robustness of results across a broader range of system conditions. Ten sensitivity conditions were assessed in total and include:

- Lower or higher than forecast demand;
- Lower or higher than forecast natural gas prices;
- Higher than assumed cost of CO_2 emissions;
- Less than or better than expected performance of the Pickering NGS units during the continued operation period;
- Shorter than expected duration of the continued operation period; and
- Lower or higher than forecast capital and operating costs of continued operation.

The first sensitivity illustrates the effect of further demand reduction or demand growth on the value of additional supply from Pickering NGS. The second and third sensitivities illustrate factors that would influence the relative cost competitiveness of energy from Pickering NGS to that of other Ontario-based and external fossil-fuelled sources. The last three sensitivities illustrate implications of better or worse performance from Pickering NGS. These illustrate a range of factors and conditions that could influence the system impact of continued operation and the extent to which the potential benefits of continued operation could be achieved.

Each sensitivity scenario is further described below.

1. Reference Scenario

This scenario assumes the reference scenario conditions described in Sections 4.1 and 4.2.

2. Lower electricity demand in Ontario:

In this sensitivity scenario, annual demand in Ontario during the 2013 to 2020 period was assumed to be approximately 10 TWh lower by 2020 (62 TWh over the study period) as shown in Figure 2 and Figure 3. The effect of this sensitivity was to reduce opportunities for

electricity produced by Pickering NGS under continued operation to offset production from other, more expensive resources.

3. Higher electricity demand in Ontario:

In this sensitivity scenario, annual demand in Ontario during the 2013 to 2020 period was assumed to be approximately 10 TWh higher by 2020 (38 TWh over the study period) as shown in Figure 2 and Figure 3. The effect of this sensitivity was to increase opportunities for electricity produced by Pickering NGS under continued operation to offset production from other, more expensive resources.

4. Lower natural gas prices:

In this sensitivity scenario, natural gas prices were assumed to be $4/MMBtu or approximately 40% lower than under the reference scenario. The effect of this assumption was to improve the cost competitiveness of production from natural gas-fired resources relative to production from Pickering NGS during the continued operation period.

5. Higher natural gas prices:

In this sensitivity scenario, natural gas prices were assumed to be $8/MMBtu or approximately 40% higher than under the reference scenario. The effect of this assumption was to decrease the cost competitiveness of production from natural gas-fired resources relative to production from Pickering NGS between during the continued operation period.

6. Higher carbon prices:

In this sensitivity scenario, carbon penalties on electricity production from fossil sources were assumed to be as shown in Figure 10. This sensitivity represents a possibility of some form of carbon pricing being applied in accordance with government policy during the continued operations period. The effect of this assumption was to decrease the cost competitiveness of production from fossil fuel sources relative to production from Pickering NGS between approximately 2015 and 2020.

7. Lower annual production from Pickering NGS during continued operations:

In this sensitivity scenario, Pickering NGS was assumed to have an average annual capacity factor of approximately 64% during the continued operation period. This is based on the worst five-year average in the plant's history. The effect of this assumption was lower annual energy production (34 TWh less) from Pickering NGS during the continued operation period.

8. Higher annual production from Pickering NGS during continued operations:

In this sensitivity scenario, Pickering NGS was assumed to have an average annual capacity factor of approximately 85% during the continued operation period. This is based on the best five-year average in the plant's history. The effect of this assumption was higher annual energy production (8 TWh more) from Pickering NGS during the continued operation period.

9. Shorter than planned duration of the continued operation period:

In this sensitivity scenario, the duration of the continued operation period was assumed to be 50% of the planned duration. Accordingly, less total energy was produced (57 TWh less) from Pickering NGS during the continued operation period.

10. Lower capital and fixed operating costs related to Pickering NGS:

In this sensitivity scenario, capital and fixed operating costs related to Pickering NGS between 2013 and 2020 were assumed to be 10% lower than the planned expenditures in the reference scenario.

11. Higher capital and fixed operating costs related to Pickering NGS:

In this sensitivity scenario, capital and fixed operating costs related to Pickering NGS between 2013 and 2020 were assumed to be 20% higher than the planned expenditures in the reference scenario.

5.0 RESULTS OF ASSESSMENT

The results of this assessment are further described in Sections 5.1 through 5.5 below.

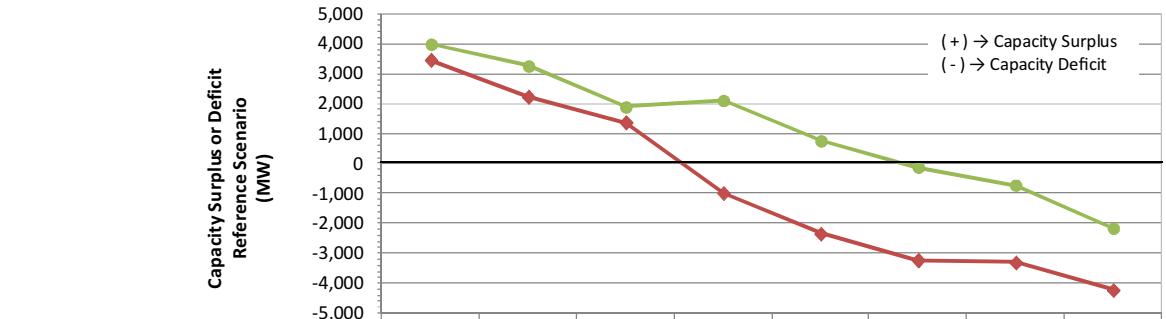
5.1 Integrated Power System Impacts

5.1.1 Capacity Investments

To meet NPCC reliability criteria, sufficient capacity must exist to meet peak demand and system reserve requirements. Between 2016 and 2020, in the absence of Pickering NGS continued operation and assuming that directed resources proceed as planned, between approximately 980 MW and 3,100 MW of capacity would have to be replaced in the reference scenario as shown in Figure 11.

In 2016 and 2017, only a portion of the capacity forgone by Pickering NGS would need to be replaced due to surplus capacity that could be available in these years. Between 2018 and 2020, all of the capacity otherwise provided by Pickering NGS would likely have to be replaced. As described in Section 3.0, gas-fired generation is assumed to provide the replacement capacity.

Figure 11: Capacity Impact (Reference Scenario)



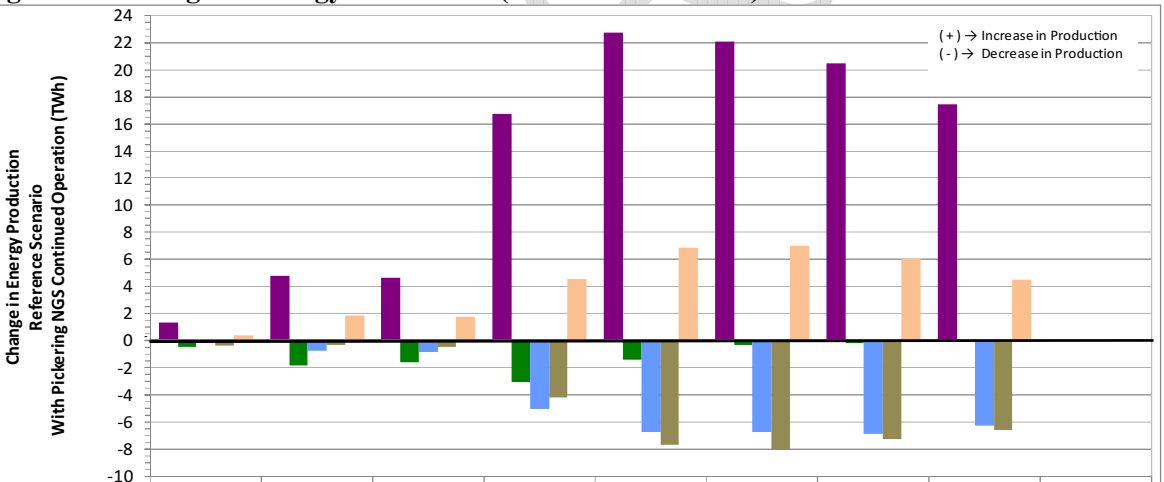
	2013	2014	2015	2016	2017	2018	2019	2020
Without Pickering NGS Continued Operation	3,468	2,230	1,378	-985	-2,341	-3,221	-3,304	-4,222
With Pickering NGS Continued Operation	3,984	3,262	1,894	2,109	753	-127	-726	-2,160
Change in Capacity Gap (Required Replacement Capacity)	0	0	0	985	2,341	3,094	2,578	2,062

Source: OPA

5.1.2 Energy Production from Available Resources

In the reference scenario, nuclear energy production increases by 110 TWh between 2013 and 2020 with Pickering NGS continued operation as illustrated in Figure 12.

Figure 12: Change in Energy Production (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020	Total
Nuclear	1.3	4.7	4.6	16.8	22.7	22.1	20.4	17.4	110.0
Renewables/CHP	-0.4	-1.8	-1.6	-3.0	-1.4	-0.3	-0.2	-0.1	-8.9
Gas/Fossil	-0.1	-0.8	-0.8	-5.0	-6.8	-6.7	-6.9	-6.2	-33.3
Imports	-0.4	-0.3	-0.5	-4.2	-7.7	-8.0	-7.3	-6.6	-35.0
Exports	0.4	1.8	1.8	4.5	6.9	7.0	6.1	4.5	32.9

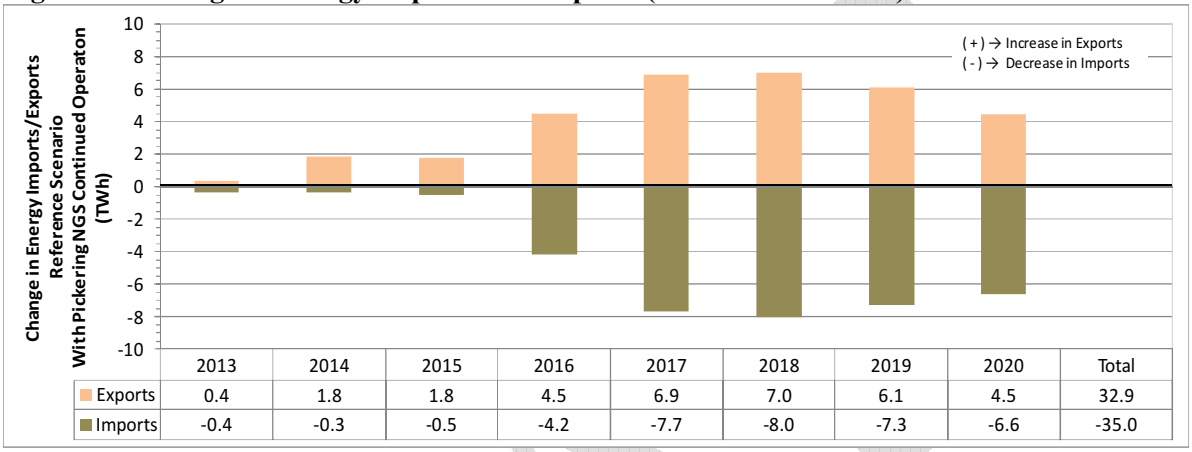
Source: OPA

The increase in energy production from Pickering NGS results in the displacement of approximately 9 TWh of energy production from renewable and CHP resources and the displacement of approximately 68 TWh of energy production from gas-fired generation and imports. During this period, energy exports increase by approximately 33 TWh.

5.1.3 Electricity Imports and Exports

Between 2013 and 2020, Pickering NGS continued operation increases electricity exports by about 33 TWh under the reference scenario as a result of the increase in nuclear energy production from Pickering NGS (see Figure 13). This is equivalent to 30% of the increase in nuclear energy production during this period. During the same period, electricity imports decrease by about 35 TWh.

Figure 13: Change in Energy Imports and Exports (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020	Total
Exports	0.4	1.8	1.8	4.5	6.9	7.0	6.1	4.5	32.9
Imports	-0.4	-0.3	-0.5	-4.2	-7.7	-8.0	-7.3	-6.6	-35.0

Source: OPA

5.1.4 Potential Surplus Energy

Potential surplus energy ("PSE") is a condition that occurs when electricity production from facilities that are self-scheduling or have limited dispatch capability (i.e. baseload resources) is greater than the Ontario demand. Generation resources that are self-scheduling or have limited dispatch capability include facilities such as wind, non-utility generation, and nuclear.

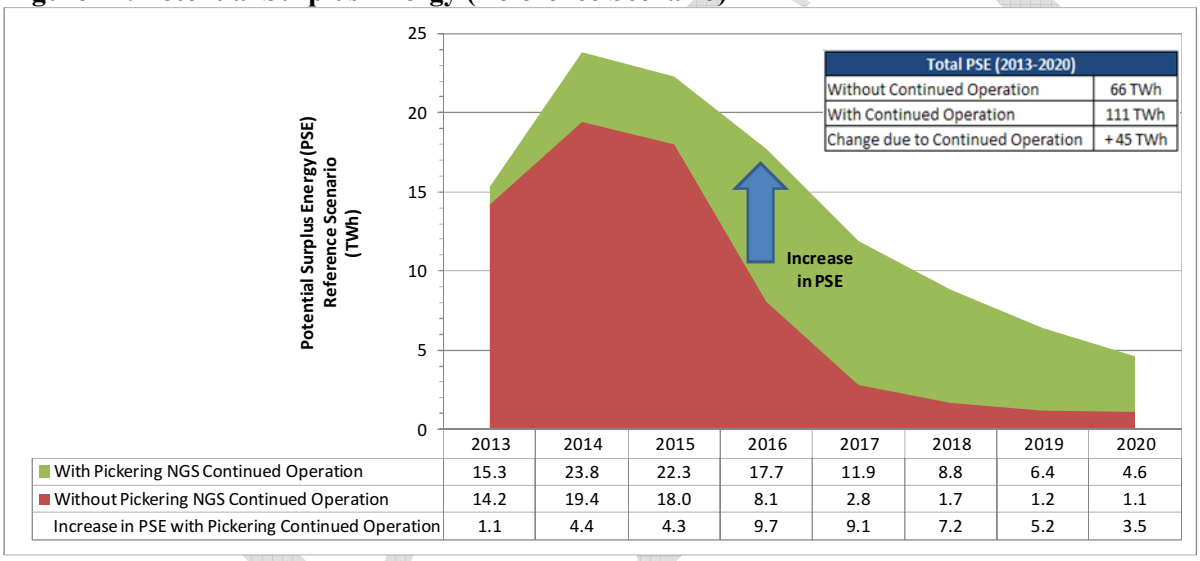
The potential for these periods of surplus to occur has, and is expected to, increase in the near-term in frequency, duration, and volume as overall electricity demand declines and new non-dispatchable and intermittent resources are added. Then, in the mid-term, the potential for surplus energy is expected to decline as nuclear units are refurbished. When these units return to service, PSE is expected to rise again but at somewhat lower levels as the load grows. As the amount of baseload resources increase, so does the frequency for periods with surplus energy.

Figure 14 illustrates the amount of generation produced from self-scheduling and baseload resources that are in excess to Ontario demand and prior to exercising actions to manage and mitigate the surplus energy. In practice, surplus energy does not exist in real time operation of the power system as electricity production matches demand for electricity. The mechanisms the system has to mitigate potential surplus energy include exporting the surplus energy, strategically scheduling outages, spilling hydro, and curtailing generation including wind and solar in order to balance the system. In real time, the amount of potential surplus energy that could be experienced may be quite different from the planned or expected

amounts due to even minor changes in actual production by specific generators like hydroelectric or nuclear facilities or due to changes in demand (due to, for example, weather).

Between 2013 and 2020, PSE exists in all years but is observed to increase by 45 TWh due to Pickering NGS continued operation. The increase in PSE is equivalent to 40% of the increase in Pickering NGS energy production during the period 2013 through 2020 (Table 2). This means that in the absence of Pickering NGS continued operation, 60% of the energy that would have been produced by Pickering NGS throughout the continued operation period would be replaced by renewable resources that would have otherwise been curtailed and by additional gas-fired generation (as seen in Figure 12). The remaining 40% would have been surplus to Ontario.

Figure 14: Potential Surplus Energy (Reference Scenario)



Source: OPA

Table 2: Potential Surplus Energy (PSE) Production from Pickering

	2013	2014	2015	2016	2017	2018	2019	2020	Total
Change in PSE Relative to the Increase in Nuclear Energy Production Due to Pickering NGS Continued Operations	87%	93%	94%	58%	40%	32%	25%	20%	40%

Source: OPA

5.1.5 System Operating and Capital Costs

The availability of Pickering NGS affects the operating cost of Ontario's electricity system and associated capital investments.

In the reference scenario, the net system operating cost ("system variable costs"), which include variable operating costs and fuel costs, decrease by $2.51 billion (net present value) between 2013 and 2020 with Pickering NGS continued operation (Figure 15).

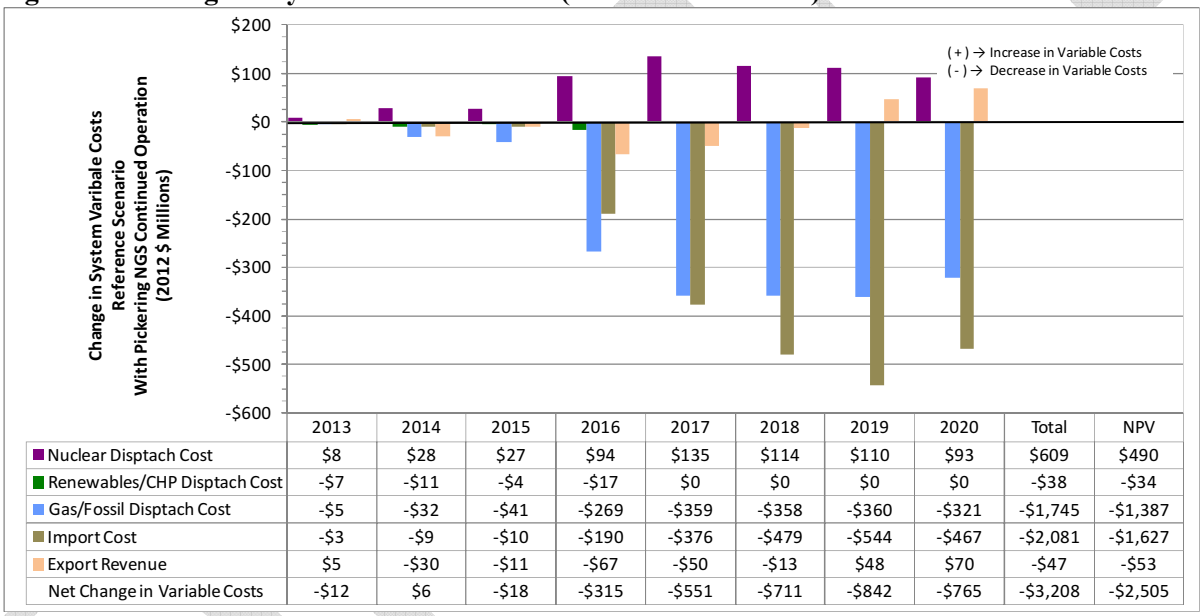
The savings in system variable costs consist of approximately $1.42 billion in reduced dispatch costs from Ontario resources (as production from Pickering NGS offsets production

from higher cost gas-fired resources in Ontario) and $1.63 billion in reduced import costs. Some of these savings are offset by ongoing nuclear variable costs during this period amounting to $0.49 billion namely due to the increased fuel and fuel related costs associated with Pickering NGS continuing to operate for additional years.

Hourly exports occur due to economic opportunities that exist between Ontario and external electricity markets. The revenues associated with these transactions are based on the Hourly Ontario Electricity Price (HOEP). Export revenues decrease by $0.05 billion over the period as the average value of HOEP decreases due to the lower cost of supply resulting from Pickering NGS continued operation.

Almost 47% of the savings in system variable costs were seen to come from reduced amounts of more expensive supply in Ontario. About 53% of the savings were a result of lower import requirements.

Figure 15: Change in System Variable Costs (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020	Total	NPV
Nuclear Disptach Cost	$8	$28	$27	$94	$135	$114	$110	$93	$609	$490
Renewables/CHP Disptach Cost	-$7	-$11	-$4	-$17	$0	$0	$0	$0	-$38	-$34
Gas/Fossil Disptach Cost	-$5	-$32	-$41	-$269	-$359	-$358	-$360	-$321	-$1,745	-$1,387
Import Cost	-$3	-$9	-$10	-$190	-$376	-$479	-$544	-$467	-$2,081	-$1,627
Export Revenue	$5	-$30	-$11	-$67	-$50	-$13	$48	$70	-$47	-$53
Net Change in Variable Costs	-$12	$6	-$18	-$315	-$551	-$711	-$842	-$765	-$3,208	-$2,505

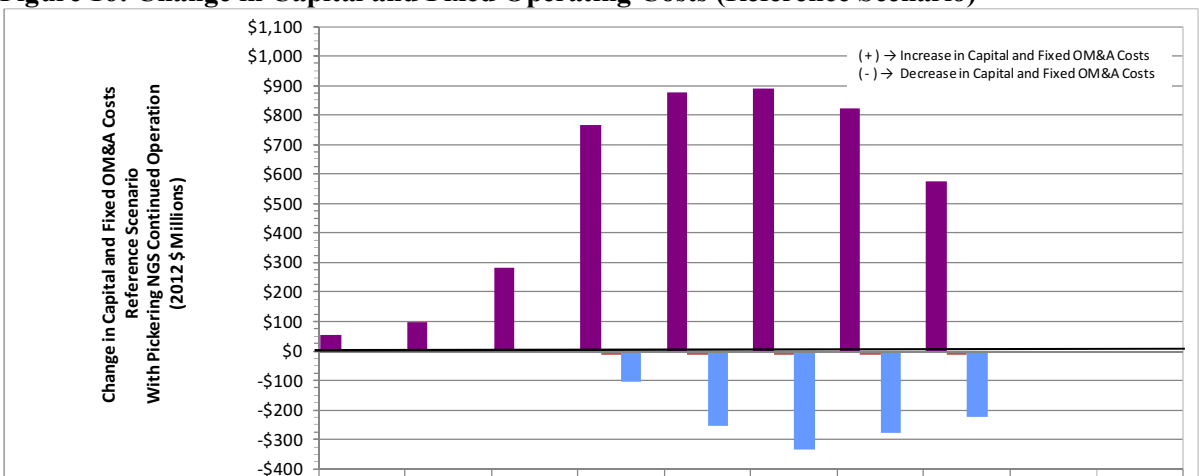
Source: OPA

The net savings in system variable costs are offset by a net increase in system capital and fixed operating costs in the reference scenario. Net system capital and fixed operating costs increase by $2.53 billion (net present value) between 2013 and 2020 with Pickering NGS continued operation (Figure 16).

The net increase in system capital and fixed operating costs is primarily due to the cost of operating units at Pickering NGS for additional years, amounting to $3.52 billion (net present value). However, Pickering NGS continued operation does reduce or avoid the need for capacity investments in some years. In addition to providing capacity, Pickering NGS continued operation would defer the need for transmission investments for the GTA. Together, the savings from these is estimated to be $985 million consisting of $937 million from reduced capacity costs and $48 million from the deferral of Oshawa Area TS.

In addition, OPG estimates $120 million (net present value) in savings in deferring decommissioning of the Pickering NGS units until at least 2020 and $90 million savings in severance related costs.

Figure 16: Change in Capital and Fixed Operating Costs (Reference Scenario)

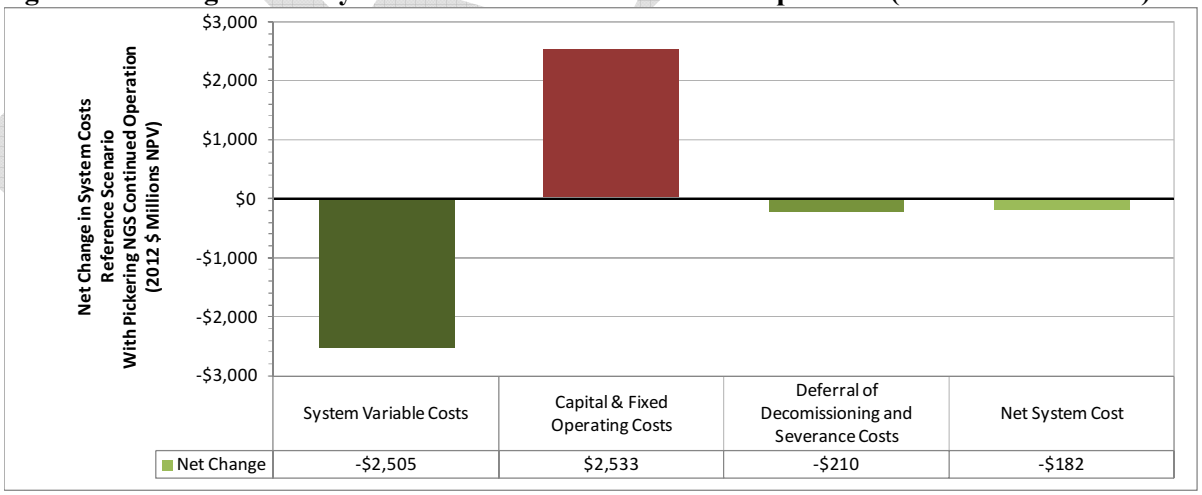


	2013	2014	2015	2016	2017	2018	2019	2020	Total	NPV
Pickering Capital and Fixed Costs	$56	$98	$282	$764	$878	$889	$821	$575	$4,365	$3,518
Oshawa Area TS Cost	$0	$0	$0	-$12	-$12	-$12	-$12	-$12	-$60	-$48
Replacement Capacity Cost	$0	$0	$0	-$106	-$253	-$334	-$278	-$223	-$1,194	-$937
Net Change in Capital & Fixed Costs	$56	$98	$282	$646	$614	$543	$531	$340	$3,110	$2,533

Source: OPA

Thus over the study period and under the reference scenario, the $2.51 billion decrease in system variable costs, $2.53 billion increase in system capital and fixed operating costs, and $210 million savings in deferring decommissioning and severance results in a net system benefit of $0.18 billion as a result of Pickering NGS continued operation (Figure 17).

Figure 17: Change in Net System Benefit-Cost of Continued Operation (Reference Scenario)



	System Variable Costs	Capital & Fixed Operating Costs	Deferral of Decomissioning and Severance Costs	Net System Cost
Net Change	-$2,505	$2,533	-$210	-$182

Source: OPA

Expenditures in support of continued operation and additional fuel and fixed operating costs associated with operating Pickering NGS over the continued operation period, net of

decommissioning and severance related savings, total approximately $3.80 billion. This is exceeded by system savings of approximately $3.98 billion from avoiding generation from more expensive sources, reducing capacity purchases during the continued operation period, and deferring transmission investments.

The timing and amount of replacement capacity in the absence Pickering NGS continued operation was assumed to exactly match system requirements (NPV cost of $937 million). This likely underestimates the benefit of avoiding replacement capacity related investments as in reality, replacement capacity would likely be procured in advance of the timing of need and, depending on the nature of the procurement, may remain in service beyond the period of need. In addition, building new facilities to replace Pickering NGS is also not a practical option as the capacity gap is temporary (primarily during the nuclear refurbishment period from 2016 through 2024) and new facilities would tend to operate for at least 20 years. There would be a cost associated with continuing to operate a new facility beyond the period of need.

5.2 Sensitivity of System Benefit for a Range of System Conditions

Figure 18 provides a summary of the net system benefit-cost of Pickering NGS continued operation for a range of system conditions. Of the ten sensitivity scenarios examined, Pickering NGS continued operation increases system costs in five of the scenarios whereas system costs are decreased in the other five. The net system benefit ranges from -$0.76 billion to $1.33 billion for the range of system conditions evaluated.

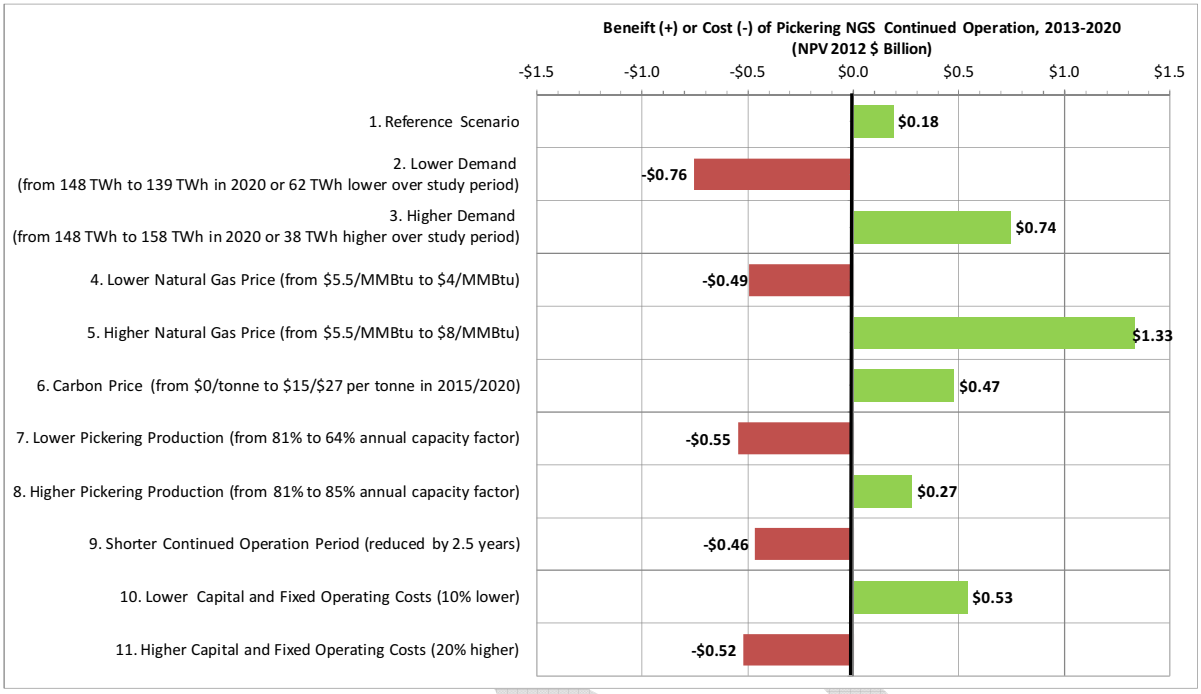
The first five sensitivity scenarios illustrate the impact of changes in system conditions independent to the operation of Pickering NGS. Three factors were explored in this regard: changes to demand, natural gas prices, and carbon prices.

A reduction in demand growth of 10 TWh by 2020 (62 TWh over the study period) had the affect of increasing net system cost to $0.76 billion. This is due to reduced benefits derived from displacing gas-fired generation and imports and increases in surplus energy. If demand were to increase 10 TWh by 2020 (38 TWh over the study period), the net system benefit increases to $0.74 billion.

Reducing the natural gas price to $4/MMBtu increased the net system cost to about $0.49 billion. However, increasing the natural gas price to $8/MMBtu increased the net system benefit to $1.33 billion. The analysis shows that for Pickering NGS continued operation to be a net system benefit, forecast natural gas prices would have to be above $5/MMbtu (all else being equal).

The sensitivity scenario illustrating higher carbon prices (and therefore affecting the cost competitiveness of natural gas and coal-fired sources (in the case of imports)) resulted in a net system benefit of $0.47 billion. More aggressive carbon pricing systems than that assumed in this study during the continued operation period would further increase the system benefit of Pickering NGS continued operations.

Figure 18: Net Benefit–Cost of Pickering Continued Operation for a Range of System Conditions 2013 – 2020



Source: OPA

The last 5 sensitivity scenarios relate to the performance of Pickering NGS. Three factors were explored in this regard: annual energy output of Pickering NGS under continued operation, duration of the continued operation period, and the capital and fixed operating costs associated with continued operation.

Reducing the annual capacity factor (a measure of plant energy production) to 64% increased the net system cost to $0.55 billion. This is due to reduced opportunities for gas displacement while fixed costs of operating Pickering NGS remain unchanged. An increase in the annual energy production from Pickering NGS to an 85% annual capacity factor resulted in a $0.27 billion net system benefit.

Reducing the duration of continued operation by 50% increased the net system cost to $0.46 billion. This is as a result of most of the additional energy production from Pickering NGS occurring during periods of significant surplus energy, thereby reducing opportunities to displace gas-fired generation.

A 10% decrease in capital and fixed operating costs translated to a $0.53 billion increase in net system benefit whereas a 20% increase in capital and fixed operating costs resulted in a $0.52 billion increase in net system costs.

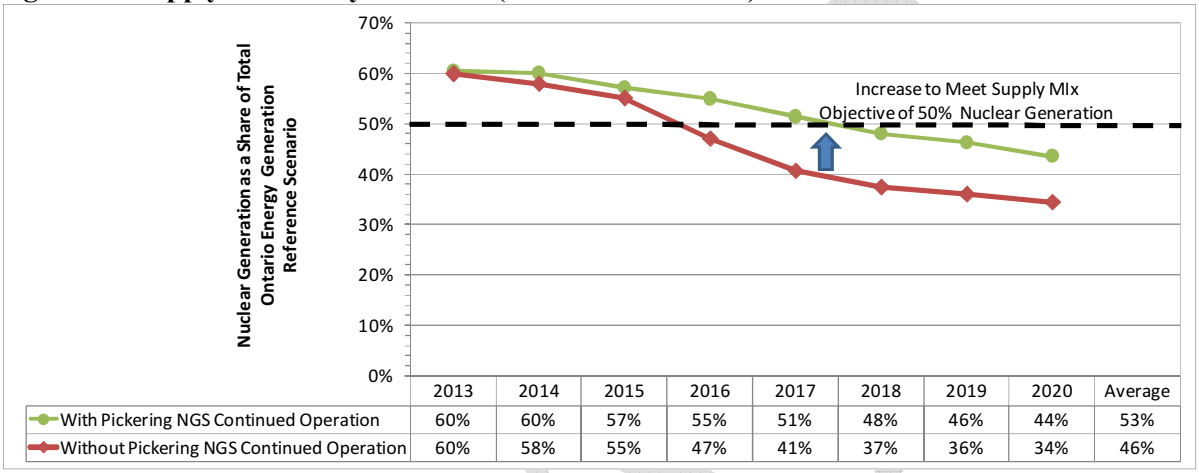
Drivers of costs and benefits of continued operation under sensitivity conditions considered were found to have similar relative impact as under the reference scenario. For example, cost savings associated with reduced natural gas-fired production and imports in Ontario

under scenarios of continued operation were typically seen to represent the largest share of total continued operation benefits.

5.3 Supply Mix Policy Direction

Between 2013 and 2020, average Ontario nuclear energy production with Pickering NGS continued operation represents 53% of the energy supply mix as compared to 46% without (Figure 19).

Figure 19: Supply Mix Policy Direction (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020	Average
With Pickering NGS Continued Operation	60%	60%	57%	55%	51%	48%	46%	44%	53%
Without Pickering NGS Continued Operation	60%	58%	55%	47%	41%	37%	36%	34%	46%

Source: OPA

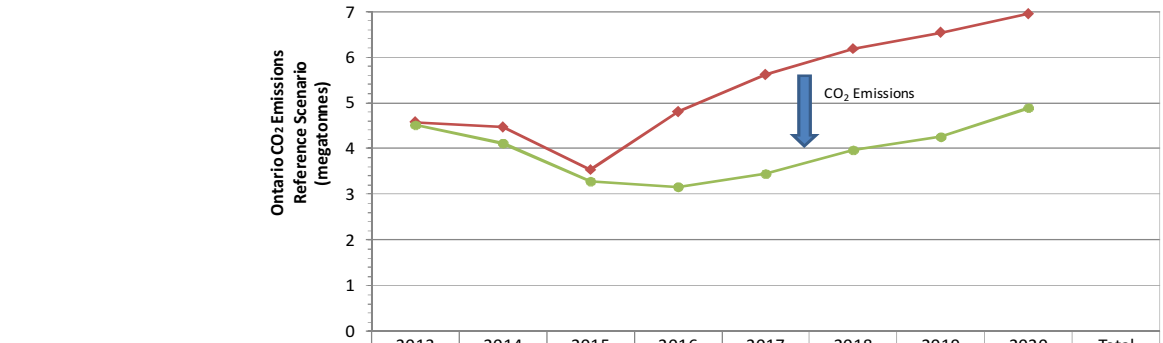
Pickering NGS continued operation is consistent with the 2011 Supply Mix Directive for 50% of Ontario generation to be supplied from nuclear generation. This policy is consistent with the OPA Supply Mix Advice provided to the Ontario government in December 2005, the Integrated Power System Plan submitted to the OEB in 2007, and in subsequent OPA planning.

5.4 Ontario CO_2 Emissions

Pickering NGS continued operation could avoid 11 megatonnes of total Ontario CO_2 emissions by 2020. The replacement energy provided by gas-fired generation is a source of increased CO_2 emissions which is not consistent with government policy to reduce greenhouse gas emissions as described in Section 2.4. Pickering NGS continued operation produces virtually no CO_2 emissions in operation.

Pickering NGS continued operation also reduces imports. Most of the imports are likely to come from coal-fired generation in NYISO and PJM. Emissions reductions in jurisdictions outside Ontario due to reduced imports were not considered in this analysis although would further increase the benefit.

Figure 20: Change in CO_2 Emissions (Reference Scenario)



	2013	2014	2015	2016	2017	2018	2019	2020	Total
Without Pickering NGS Continued Operation	4.6	4.5	3.5	4.8	5.6	6.2	6.5	6.9	42.7
With Pickering NGS Continued Operation	4.5	4.1	3.3	3.2	3.5	4.0	4.3	4.9	31.6
Reduction in Ontario CO2 Emissions with Pickering NGS Continued Operation	0.1	0.4	0.3	1.6	2.2	2.2	2.3	2.1	11.0

Source: OPA

5.5 Transmission Requirements

As described in Section 2.5 and 4.2.4, when Pickering NGS retires, additional transformer capacity will be needed to maintain reliable load supply to customers in the GTA. These facilities must be timed to precede the retirement of Pickering NGS. In the absence of Pickering NGS continued operation, the timing of the need for "Oshawa Area TS" is accelerated from an in-service date of approximately 2020 to approximately 2015. The estimated capital investment for Oshawa Area TS is $270 million (or $240 net present value in 2012 dollars). Deferral of Oshawa Area TS as a result of Pickering NGS continued operation would result in cash flow savings of $12 million for each year deferred. Deferring the in-service date from approximately 2015 to 2020 would result in a net present value savings of approximately $50 million over this period.

6.0 CONCLUSIONS

1. The net system benefit of Pickering NGS continued operation is expected to be $182 million, but could range from -$0.76 billion to $1.33 billion, based on the system conditions studied.

2. Conditions under which system economic benefits could be higher than those studied include higher than forecast natural gas prices or a combination of higher than forecast demands and carbon prices. These would tend to increase the value of displacing Ontario gas-fired generation as well as increase the potential value of net exports. A combination of lower capital and fixed operating costs and/or higher production during the continued operation period could also lead to higher system economic benefits.

3. There are several potential benefits to Pickering NGS continued operation. These include:

   - A reduction in the need for replacement capacity and energy during the nuclear refurbishment period and associated acquisition costs;

- A hedge against factors including increased demand, delay in achieving conservation targets, higher natural gas or carbon prices, nuclear refurbishment delays, or delays in the in-service of directed resources;
- Compliance with the Supply Mix policy direction of 50% nuclear energy;
- A reduction in Ontario CO_2 emissions; and
- Deferral of transmission enhancements to maintain reliable load supply to customers in the east GTA ("Oshawa Area TS") upon retirement of Pickering NGS.

7.0 RECOMMENDATIONS

Based on the potential benefits that have been identified, the OPA considers it prudent, on balance, to proceed with an expenditure of funds in 2013 and 2014 for Pickering NGS continued operation should it prove technically feasible.

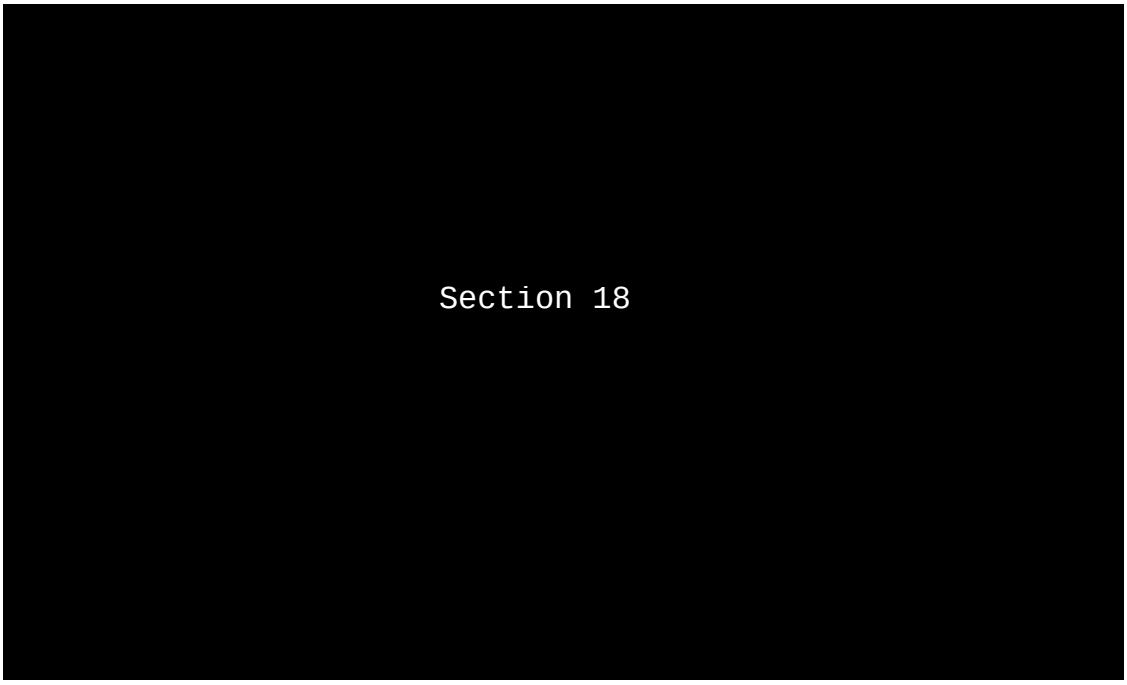
From: Bashir Bhana
Sent: April-24-12 4:51 PM
To: Andrew Pietrewicz
Cc: Bob Gibbons
Subject: Updated Demand/Pickering

Andrew – here is a quick comparison of the new demand forecast relative to the LTEP forecasts (used in the Pickering study).

The updated peak demand forecast is about the same as in the LTEP low growth forecast up to 2018 (~23,000 MW). Between 2019-2020, the updated peak demand forecast falls between the LTEP low and LTEP medium forecasts (23,400 MW).

The updated energy demand forecast is lower than the LTEP low growth forecast by an average 3 TWh per year beginning in 2015. The average updated energy demand forecast between 2013-2020 is 136 TWh/year. In comparison, the LTEP low and medium forecasts average 138 TWh/year and 146 TWh/year, respectively between 2013-2020.

Regarding the Pickering study, I would expect the new demand forecast to produce a net benefit similar to that in the low demand sensitivity case (net cost of $760M).



From: Bashir Bhana
Sent: August-02-12 2:51 PM
To: Andrew Pietrewicz
Subject: Exports in Pickering Study

Looks like we gutted the section on "export profits" from the report. What we say with respect to export revenues is:

"Hourly exports occur due to economic opportunities that exist between Ontario and external electricity markets. The revenues associated with these transactions are based on the Hourly Ontario Electricity Price (HOEP). Export revenues decrease by $0.05 billion over the period as the average value of HOEP decreases due to the lower cost of supply resulting from Pickering NGS continued operation."

Here's what I had written in an older draft:

"In the absence of bilateral contracts between Ontario and external electricity markets, the full value of electricity exports is not received by Ontario ratepayers. The value or profit from Ontario electricity exports is currently captured by energy traders, including OPG. OPG as an energy trader may be able to return some of these proceeds to Ontario ratepayers by way of a reduction in the revenue they seek in rate applications before the Ontario Energy Board or to Ontario taxpayers by way of dividend payments to government and increased government tax revenues."

Bashir

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From: Bashir Bhana
Sent: March-21-12 3:33 PM
To: Bob Gibbons; Andrew Pietrewicz; Victor Stein; Bonnie Chan; Steve Chui
Cc: Nancy Marconi; Wajiha Shoaib
Subject: Pickering Study - Review of OPG Results

Sorry for this long email. I've reviewed OPG's modelling results (provided in this morning's meeting) and have come to the conclusion that key differences between our two assessments are with respect to *export price* and *renewable curtailment* assumptions:

Export Prices

OPG prices exports at its value to the overall electricity market whereas the OPA prices exports at the Ontario marginal cost (consistent with current market rules). OPG said they will look into this.

Section 17

Renewable Curtailment

In our assessment, we observe a 9 TWh reduction in renewable production in the presence of continued operation

Section 17

Impact on Pickering Net Benefit

Accounting for the above differences and including the impact of Clarington TS, the net impact on OPG's assessment would be as follows:

Section 17

Section 17