ONTARIO ENERGY BOARD

EB-2016-0152

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 (OPG) pursuant to section 78.1 of the *Ontario Energy Board Act*, 1998 for payment amounts for the period from January 1, 2017 to December 31, 2021.

SUBMISSIONS OF ENVIRONMENTAL DEFENCE

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Contents

Pickering's Costs are not Just or Reasonable (Issues 6.1 & 6.5)

1. OPG is seeking to recover approximately **$7.5 billion** from ratepayers over the next five years in relation to its Pickering Nuclear Generating Station ("Pickering").[1] Environmental Defence submits that the costs to operate Pickering beyond 2018 are not just or reasonable and will burden consumers with as much as $2.5 billion in unnecessary net costs.

2. Pickering is incredibly expensive, inefficient, and unreliable. Its performance is frequently the worst among all nuclear power plants in North America.[2] OPG justifies the continued operation of this costly and unreliable station based on a cost-benefit analysis prepared by the Independent Electricity System Operator ("IESO") in 2015. However, that analysis did **not** recommend that Pickering continue to operate – it simply said that this option was worth "further exploration".[3]

3. Much has changed since the 2015 report. For example:

    a. Energy sources to replace Pickering are much cheaper because (a) natural gas prices are far lower (less than 50% of those assumed in the report) and (b) Ontario has agreed to buy inexpensive hydro power from Quebec and is in discussions to purchase more.[4]

    b. Capacity resources to replace Pickering during times of peak electricity demand are much cheaper because (a) the IESO plans to use non-firm imports (which is "free" capacity), (b) demand response has become available at a low cost (35% cheaper than the cost of capacity assumed in the report), and (c) peak summer electricity demand can be addressed by an import agreement with Quebec.[5]

    c. OPG has admitted that Pickering's costs are 22% higher than those included in the cost-benefit analysis (and has not justified this).[6]

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[1] The total figure is $7,412,000,000 in operating and fuel costs per exhibit JT2.5, p. 2, ln. 19. However, if Pickering's portion of the Tritium Removal Facility, OPEB and Pension costs excluded from centrally held costs, IESO non-energy charges, income tax, and property tax are included, the amount increases by $465 million to $7,877,000,000. See response to undertaking J2.4, p. 3.
[2] See paras. 6 to 10 below.
[3] Transcript, vol. 12, p. 112, lns. 13-17; IESO October 2015 Analysis, p. 2 & 9 (Exhibit F2-2-3, Attachment 1, p. 2 & 9).
[4] See paras. 14 to 18 below.
[5] See paras. 19 to 34 below.
[6] See paras. 35 to 37 below.

4. All of these factors would make Pickering far more expensive vis-à-vis alternatives. Despite this, OPG has not provided an updated cost-benefit analysis. It has thus failed to meet its burden to show that the costs it seeks are reasonable.

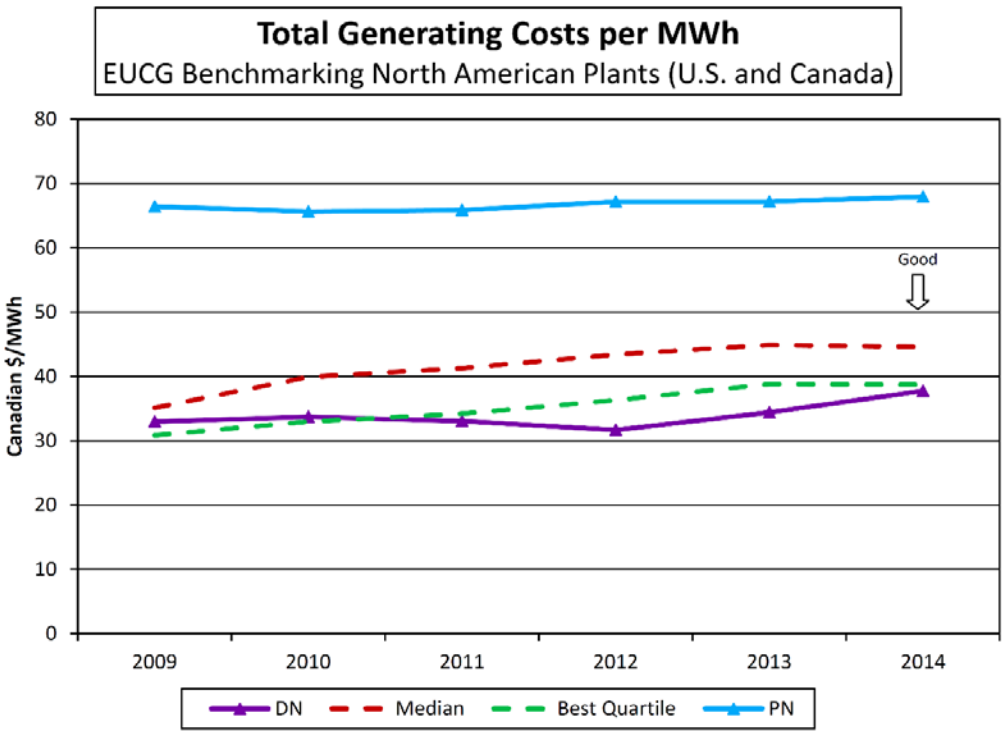
5. However, the IESO's report includes sufficient details to allow a rough estimate of the impact of the changes outlined above. Based on updated assumptions, operating Pickering beyond 2018 will saddle consumers with between **$1.3 and $2.5 billion in additional unnecessary costs**.[7]

Pickering is Extremely Expensive, Inefficient, and Unreliable

6. Pickering is highly inefficient and expensive. According to OPG's most recent Nuclear Benchmarking Report, Pickering has the **highest** non-fuel operating costs per MWh of all nuclear plants in North America.[8] Its total operating costs per MWh are far higher than average and always in the most expensive quartile.[9] From 2015 to 2020, its costs are forecast to rise from $78.4/MWh to $90.5/MWh (Levelized Unit Energy Costs).[10] Its LUEC over the application period will be an average of $89.6/MWh.[11]

7. This poor performance is not new. Pickering has been far more inefficient and expensive than average for many years. The chart on the following page, which is excerpted from OPG's latest benchmarking report, compares Pickering's cost/MWh (the top blue line) with the median (the dotted red line) and top quartile (the dotted green line) of North American plants.[12] It illustrates how expensive Pickering is versus its peers.

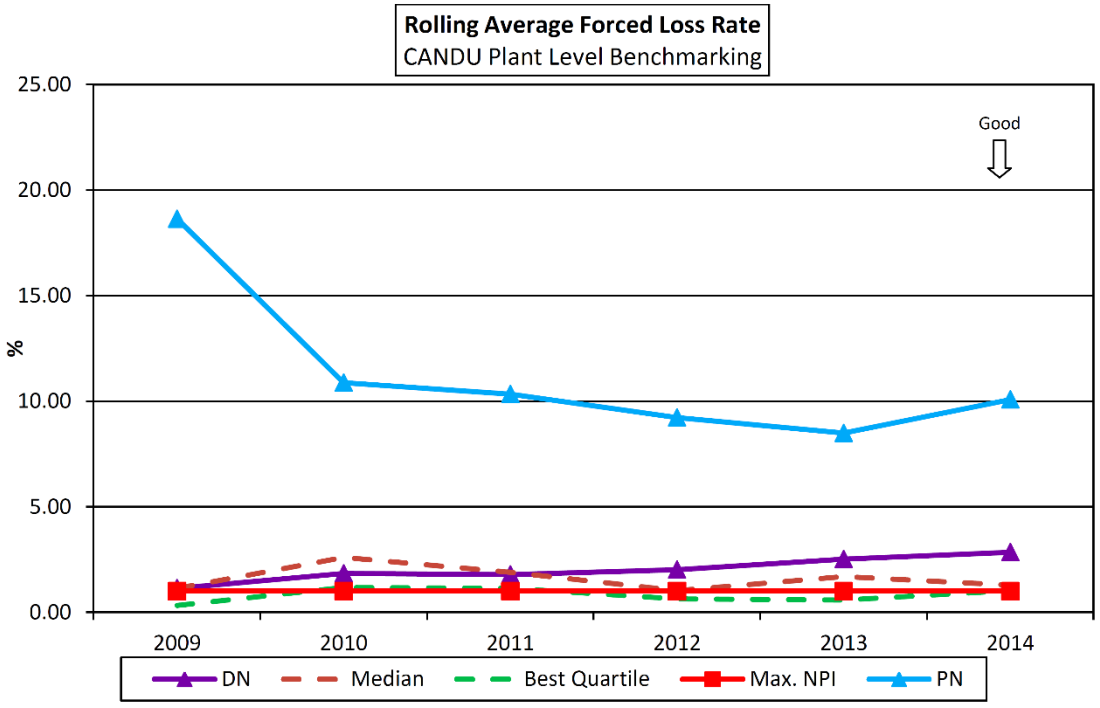
[7] See paras. 44 to 64 below.
[8] OPG, 2015 Nuclear Benchmarking Report, exhibit F2-1-1, p. 71.
[9] *Ibid*. p. 72.
[10] Response to Undertaking J2.4, attachment 1.
[11] *Ibid*.
[12] OPG, 2015 Nuclear Benchmarking Report, exhibit F2-1-1, p. 68.



8. Pickering is also very unreliable. It's rolling forced loss rate is **6.5 times** worse than the median for North American nuclear plants and **13 times** worse than the best quartile (2014 actuals).[13] Also, Pickering is ill-suited as a capacity asset to meet *peak* electricity needs because it cannot be relied on when electricity demand is highest (i.e. hot summer days).

9. Again, this poor performance is not new. Pickering has been far more unreliable than average for many years. The chart on the following page, which is excerpted from OPG's latest benchmarking report, compares Pickering's forced loss rate (the top blue line) with the median (the dotted red line) and top quartile (the dotted green line) of North American plants.[14]

[13] OPG, 2015 Nuclear Benchmarking Report, exhibit F2-1-1, p. 102.
[14] *Ibid*. p. 50.



10. On cross-examination, OPG acknowledged that Pickering is the primary reason for OPG's overall poor overall performance on total generating cost.[15] Pickering's bad results caused OPG as a whole to have the second highest 3-year total generation costs ($/MWh) of all nuclear operators in North America.[16] OPG also acknowledged that Pickering is expected to face even higher costs going forward over the next five years.[17]

The IESO Cost-Benefit Analysis

11. In 2015, the IESO prepared a cost-benefit analysis of continuing to operate Pickering. Overall, the IESO concluded that continued operation of Pickering "merits further consideration."[18] It did **not** recommend the continued operation of Pickering.[19] Indeed, it found that there are significant "potential pitfalls," including risks and uncertainties relating to gas prices and the cost and reliability of Pickering.[20]

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[15] Transcript, Vol. 13, p. 31, lns. 22-26 & p. 32, lns. 9-12; Board Staff Compendium for Panel 3B, p. 18.
[16] *Ibid.*
[17] Transcript, Vol. 13, p. 35, lns. 1-11.
[18] Transcript, vol. 12, p. 112, lns. 13-17; IESO October 2015 Analysis, p. 2 & 9 (Exhibit F2-2-3, Attachment 1, p. 2 & 9).
[19] *Ibid*.
[20] IESO October 2015 Analysis, p. 2 & 3 (Exhibit F2-2-3, Attachment 1, p. 2 & 3).

12. In its latest update (October 2015), the IESO assessed the continued operation of Pickering based on two incremental energy production scenarios: 62 and 65 TWh.[21] OPG now acknowledges that 65 TWh is impossible due to planned outages and that only 62 TWh will be produced.[22] Indeed, even the 62 TWh scenario is based on production levels that are 3.6 TWh higher than the production estimates in OPG's current application.[23] Therefore, the 65 TWh scenario can be ignored and the 62 TWh scenario can be considered to be overly optimistic.

13. Based on the overly optimistic 62 TWh production estimate and other assumptions made by the IESO back in 2015, the IESO estimated that operating Pickering from 2020 to 2022/2024 could provide $300 million in net benefits.[24] However, the IESO also provided a sensitivity analysis regarding gas prices and a breakdown of the various components of the cost-benefit assessment.[25] These features can be used to roughly estimate the impact of updated estimates on the net cost/benefit from continuing to operate Pickering.

Lower Replacement Energy Costs

14. The most important factor in the IESO's study is the cost of energy to replace what would otherwise be produced by Pickering. It is clear that replacement energy could be sourced at a far lower price than assumed in the 2015 study.

15. The cost of replacement power in the IESO's analysis is highly dependent on a forecast of the cost of natural gas, which has dropped significantly since 2015 when the report was prepared. The IESO has confirmed that the financial markets predict

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[21] IESO October 2015 Analysis, p. 4 (Exhibit F2-2-3, Attachment 1, p. 4).
[22] OPG Submissions, May 3, 2017, p. 88 ("Pickering is expected to produce approximately 62 TWh of incremental generation"); Response to Board Staff IR#126, p. 3 (Exhibit L-6.5-1-Staff-126); The IESO was not aware that the 65 TWh scenario was impossible when it prepared its report, see Transcript, vol. 8, p. 48, lns. 3-16; see also the below footnote.
[23] The IESO assumptions from October 2015 are 3.6 TWh more optimistic (i.e. higher) than the latest actual and forecast figures for 2015-2021. The production levels assumed by the IESO in the 62 TWh scenario are compared to the latest production figures and forecast from OPG's application in the response to undertaking J12.6, attachment 1, lns. 5 & 6 (Exhibit J12.6). No comparison is possible for 2022 to 2024 as this is outside the application period, although the October 2015 estimates will presumably continue to be overly optimistic for those years.
[24] IESO October 2015 Analysis, p. 6 (Exhibit F2-2-3, Attachment 1, p. 6); The analysis speaks of estimates ranging from $300 to $500 million, but the latter figure is based on the 65 TWh production level scenario that OPG acknowledges is not possible (see para. 12 above).
[25] IESO October 2015 Analysis, p. 16-17 [sensitivity analysis], 17-18 [probabilistic analysis], & 6 [cost/benefit breakdown] (Exhibit F2-2-3, Attachment 1, p. 6 & 16-18).

future gas prices that are **half** of those assumed in the 2015 report.[26] Gas futures prices are approximately $3.07/MMBtu on average over 2017 to 2024 whereas the 2015 report assumed $6.07/MMBtu on average over that same period (nominal USD).[27]

16. Based on the IESO's "best current estimate," future carbon prices will add less than $1/MMBtu to the price of gas on average from 2017 to 2024.[28] A price of $1/MMBtu would bring the combined carbon/gas price to $4.07/MMBtu – still **far lower** than the $6.07/MMBtu figure used in the 2015 report.

17. However, an even less expensive option is available: hydro power from Quebec. Although there is debate about the possibility of using inexpensive Quebec power to address *capacity* requirements (see para. 27 below), there is no doubt that Quebec power imports could address replacement *energy* needs. The IESO confirmed that hydro power from Quebec can be sourced at a lower cost as compared to gas generation and that Ontario is in talks to purchase more power from Quebec.[29]

18. Another major benefit of hydro power from Quebec is that it is not impacted by carbon pricing.

Lower Replacement Capacity Costs

19. The IESO assumes that replacement *capacity* will be needed if Pickering is closed. Capacity is distinct from energy. **Capacity** is a generation source that can be relied on to meet the province's peak electricity needs. We need sufficient capacity to ensure the lights stay on when demand is highest (i.e. hot summer days). A capacity price ($/kWyr) is paid to a generator to guarantee availability, which is separate from the cost of purchasing electricity from the generator. That price must be paid whether or not the capacity is ever needed and whether or not electricity is ever purchased from the generator. In contrast, replacement **energy** refers to the actual electricity that is

[26] Response to Undertaking J8.5.
[27] *Ibid*.; Note that the IESO gas price assumptions for 2017 to 2024 in its 2015 report were in 2015 dollars. A conversion to nominal values is needed for a comparison with prices predicted by the futures market. This is confirmed in the response to undertaking J8.5.
[28] The IESO "best current estimate" of carbon prices from 2019 to 2024 is an average of $18.68/tonne (nominal, US$/kg CO2) according to its response to ED Interrogatory # 29, p. 5 (Exhibit L-6.5-7-29, p. 5). For the conversion to $/MMBtu, see IESO March 2015 Analysis, p. 23 (Exhibit F2-2-3, attachment 1, p. 64), which assumes 54 kg CO2/MMBtu natural gas.
[29] Transcript, vol. 8, p. 129, lns. 20-25 & p. 130, lns. 13-20.

needed if Pickering is closed down, typically priced at $/TWh (replacement energy is addressed in the previous section).

20. The October 2015 cost-benefit analysis assumes replacement capacity costs on a flat line basis at $130/kWyr.[30] That price is based on the capital cost of a new simple cycle gas plant.[31] It is now clear that replacement capacity could be obtained at a much lower price from options such as non-firm imports, demand response, firm imports, or a combination of those. This greatly impacts a cost-benefit analysis of Pickering.

21. Although the IESO priced replacement capacity at the cost of a new simple cycle gas plant in October 2015, this is no longer what the IESO plans to use in the event that Pickering is shut down. The IESO is developing a contingency plan to secure replacement capacity if Pickering must close early (e.g. because its CNSC licence is not approved).[32] Its current plan involves "taking greater advantage of supply resources whose existing contracts expire in the coming years, taking advantage of resource options via capacity auctions, and greater use of non-firm intertie transactions."[33] These options would be much less expensive than the $130/kWyr assumed in the October 2015 report.

"Free Capacity" from Non-Firm Electricity Imports

22. The IESO's current contingency plan includes "greater use of non-firm intertie transactions."[34] This refers to energy imports from neighbouring jurisdictions without a firm contract. Historically, non-firm imports have not been relied on in electricity capacity planning.[35] However, the IESO now believes that this is a promising

[30] Transcript, vol. 12, p. 2, lns. 14-19.
[31] *Ibid.*
[32] Response to GEC interrogatory #56 (Exhibit L-6.5-8-GEC-056); Transcript, vol. 8, lns. 11-21.
[33] *Ibid.*
[34] *Ibid*.
[35] Transcript, vol. 8, p. 124, ln. 18 to p. 125, ln. 7; IESO, *Ontario Reserve Margin Requirements 2017-2021*, December 30, 2016, p. 2 ("experience shows that Ontario's interconnections can be relied on during times of need and that occasional use of the interties to support Ontario's reliability is feasible. In light of this, the IESO is continuing to investigate the potential for considering non-firm imports to reduce future reserve margin requirements…") & p. 10-11 ("Although the NPCC resource adequacy criterion allows for reliance on interconnection support when evaluating system LOLE, in the current study such reliance has not been considered when determining Ontario's reserve margin requirements. … The IESO intends to further evaluate the reliability benefits offered by the interties and will, as appropriate, incorporate potential interconnection support in determining Ontario's future reserve margin requirements.").

opportunity, including because it has been used in the past and is allowed by the Northeast Power Coordinating Council ("NPCC") adequacy criterion.[36]

23. Relying on non-firm imports is "free capacity," to use the words of the IESO's witness.[37] There is no cost associated with using non-firm imports to meet capacity adequacy requirements. Instead of $130/kWyr, non-firm imports would be $0/kWyr.

24. Although more analysis is needed, the IESO's ballpark estimate of the non-firm imports that could be relied on for capacity purposes is in the range of 1,000 MWs.[38] The potential capacity deficit created by the closure of Pickering ranges from roughly 1,000 to 2,300 MWs over 2020 to 2024.[39] Therefore, the "free capacity" from non-firm imports could potentially address between roughly half or all of the replacement capacity needs in the relevant years. The actual figure could end up higher seeing as Ontario has an expected coincident import capability of 5,200 MW.[40]

25. This is not a criticism of the IESO's preparation of its report back in 2015. The situation has changed significantly since then, including the IESO's thinking on the use of non-firm imports and its inclusion of this option in its contingency planning for a Pickering shutdown. OPG should be submitting a revised cost-benefit analysis that accounts for this option and the other important changes since 2015.

Inexpensive Firm Imports

26. Replacement capacity could also be obtained by firm imports. One promising option would be increased inexpensive hydro power imports from Quebec, which are cheaper than gas fired generation.[41]

27. Although Quebec cannot provide guaranteed power throughout the winter (because Quebec's demand peaks in the winter), it *could* provide guaranteed power during the summer months when Ontario's demand is at its highest peak. Based on the

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[36] *Ibid*.
[37] Transcript, vol. 12, p. 33, ln. 23 to p. 34, ln. 5; Transcript, vol. 8, p. 126, lns. 8-14.
[38] Transcript, vol. 8, p. 126, ln. 15-23.
[39] Response to Undertaking JT1.17, attachment H, p. 3 (The deficits by year are: 2021 - 2,316 MW, 2022 - 2,301 MW, 2023 - 2,064 MW, 2024 - 1,090 MW; Transcript, vol. 8, p. 101, lns. 8-15.
[40] Response to Undertaking JT1.17, attachment I, p. 2; Transcript, vol. 8, p. 123, lns. 12-17.
[41] Transcript, vol. 8, p. 129, lns. 20-25.

assumptions in the 2015 report, closing Pickering would create a capacity deficit only in the summer, not in the winter.[42]

28. Ontario is currently in talks to purchase more power from Quebec.[43]

Demand Response – 35% Less Costly

29. Demand response is an inexpensive way to secure capacity by paying customers to curtail their electricity use when demand is at its peak. The cost of demand response for 2017 is $75/kWyr (winter) and $83/kWyr (summer), which is **over 35% cheaper** than the $130/kWyr assumed in the 2015 report for capacity costs.[44]

30. Although the IESO witness could not quantify the amount incremental demand response that could be relied on, he was able to provide the following comment:

> I don't think we could say right now whether it's 2,000, 3,000, or more. I don't know. Certainly **it could be part of the solution** set, and I think it would be a good thing. It's short-lived. It's **lower cost** than the physical plant. **It doesn't emit**… (emphasis added)[45]

Availability at Peak

31. The cost of replacement capacity depends in part on the likelihood that the resource will be available at times of peak demand when it is needed. The less likely that it will be available, the less valuable the resource is for capacity planning purposes. Because Pickering is so unreliable (with a forced loss rate of over 10% and a unit capability factor of under 75%), its contribution to capacity should be discounted versus more reliable capacity such as import contracts or natural gas.[46] Instead, the 2015 report assumed that Pickering would be *more* likely to be available at times of peak demand in comparison to natural gas for the purposes of determining capacity replacement costs.[47] According to an undertaking response, the IESO assumed that Pickering would be available 99% of the time at the peak versus only 89% of the time for natural gas (which is assumed to be a new simple cycle plant).[48] This is absurd.

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[42] Response to undertaking J8.10, p. 3, tables 3 & 4;
[43] Transcript, vol. 8, p. 130, lns. 13-20.
[44] Market Price for Demand Response (Exhibit J8.5, tab 5, p. 9); Transcript, vol. 8, p. 103, lns. 9-21.
[45] Transcript, vol. 8, p. 104, lns. 21-25.
[46] OPG, 2015 Nuclear Benchmarking Report, Exhibit F2-1-1, p. 102.
[47] Response to Undertaking J13.13; Transcript, vol. 13, p. 153, ln. 18 to p. 155, ln. 26.
[48] *Ibid.*

32. Starting in the 4th quarter of 2016, the IESO transitioned to using Equivalent Forced Outage Rate on demand (EFORd), a measure of the probability that a generating unit will not be available due to forced outages or forced deratings when there is demand on the unit to generate.[49] This methodology was not used in the 2015 report.

33. Using EFORd in assessing capacity replacement costs would very significantly decrease the cost of replacement capacity vis-à-vis the continued operation of Pickering. This would in turn make an extension of Pickering look even less cost-effective.

Load Forecast

34. It may be that the capacity deficit from closing Pickering is significantly smaller than assumed in 2015. The declines in demand forecasts discussed in the submissions of the Green Energy Coalition and other intervenors suggest that this is the case. A decline in the capacity deficit would serve to increase the net costs of operating Pickering in comparison to alternatives, further "tipping the scales" against Pickering.

Pickering's Costs are Much Higher than Assumed

35. Pickering's forecast costs are another key factor in the IESO's analysis. To forecast Pickering's costs, the IESO adopted estimates provided by OPG in 2015.[50] However, OPG now admits that the cost to operate Pickering is actually **22% higher** than the costs provided to the IESO and used in its cost-benefit analysis.[51] This amounts to **$778 million** in costs over 2021-2024 that are not included in the IESO analysis.[52]

36. OPG excluded this amount on the assumption that OPG cannot reduce 100% of Pickering's costs after a shutdown because the loss of economies of scale.[53] OPG refers to the costs that cannot be eliminated after a shutdown as "non-incremental costs."

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[49] IESO, *Ontario Reserve Margin Requirements 2017-2021*, December 30, 2016, p. 9 (Exhibit K13.2, p. 27).
[50] Transcript, vol. 12, p. 14, lns. 20-26.
[51] Pickering GS OM&A Costs (Exhibit K13.2, ED Compendium for Panel 3, p. 22); transcript vol. 13, p. 136, ln. 27 (confirming accuracy of the table at p. 22) & p. 137, p. 141, lns. 26-27 (confirming the 22% difference).
[52] *Ibid.*
[53] Transcrpt, vol. 13, lns. 5-22.

37. OPG did not provide a breakdown of the over $778 million in non-incremental costs, let alone provide a report to explain or justify the exclusion of such a large percentage of the costs, despite repeated requests.[54] OPG has the burden to show that its costs are just and reasonable. Without a breakdown or detailed justification, excluding $778 million from the cost-benefit analysis is simply not credible.

38. Furthermore, staffing figures suggest that a much greater proportion of Pickering's costs should have been accounted for in the cost-benefit analysis as being avoidable incremental costs. OPG advised the Ministry of Energy that continuing to operate Pickering would protect 4,000 OPG jobs.[55] However, OPG's avoidable/incremental cost figures correspond to only 3,025 employees being let go in a shutdown (full time equivalent, average over 2021-2024).[56] These figures should be equal. Either the Ministry of Energy was given an inflated estimate of job losses or the incremental costs have been undercounted, or some combination of both.

39. In addition, there is a significant risk that the costs associated with Pickering over 2021 to 2024 will be higher than forecast. For example, additional costs may arise from conditions of a potential approval by the Canadian Nuclear Safety Commission for Pickering to continue to operate beyond its design life. One example is the over $100 million container filter venting system that is under consideration.[57] Furthermore, the scope of work to extend Pickering's operations has not been finalized, which raises the prospect of cost escalation when the final engineering is complete.[58] In addition, significant cost escalation is possible in 2022-2024 seeing as OPG has only had to provide firm cost estimates for revenue requirement purposes up to 2021.

40. The IESO stated that continued operations would result in net costs if Pickering's costs are 15% greater than the estimate provided by OPG, everything else equal.[59] In

[54] Transcript, vol. 13, p. 142, lns. 4-9 & p. 143, lns. 18-28; Transcript, vol. TC2 (Nov 15, 2016), p. 32, lns. 14-18; although the updated response to undertaking J2.5 indicates that the non-incremental OM&A costs for 2021 are $292 million, it does not provide a breakdown, explanation, or justification of that number.
[55] Transcript, vol. 13, p. 125, lns. 2-11; News Release re Pickering (Exhibit L-6.5-1-Staff-155, attachment 1).
[56] Response to undertaking J13.9; Note: This undertaking arises from a question that OPG strenuously objected to during the hearing and only answered at the request of the Board.
[57] Transcript, vol. 31, p. 191, lns. 14-20 & p. 189, lns. 25-27.
[58] Transcript, vol. 13, p. 179.
[59] IESO October 2015 Analysis, p. 3 (Exhibit F2-2-3, Attachment 1, p. 3).

light of the above, there is a significant likelihood that this factor alone would cause Pickering to result in net costs.

41. Finally, it is important to note that OPG did not tell the IESO that it was excluding such a large proportion of Pickering's costs when it provided its cost data to the IESO in 2015.[60]

OPG has not Established the Reasonableness of Pickering's Costs

42. Environmental Defence submits that OPG should have submitted an updated cost-benefit analysis relating to Pickering. Since 2015, there have been major developments that all negatively impact Pickering's purported benefits, including:

a. Far lower natural gas prices;

b. Agreements with Quebec for inexpensive power imports and ongoing discussions regarding additional imports;

c. The IESO's progress toward using non-firm imports as "free capacity";

d. The IESO's new methodology to measure the availability of a capacity resources at times of peak demand (EFORd);

e. Updated load forecasts;

f. Positive results in Demand Response auctions; and

g. New information regarding the huge costs that OPG excluded from the cost-benefit analysis.

43. OPG has the burden of proof to establish that its requested payment amounts are just and reasonable.[61] Environmental Defence submits that OPG has failed to meet this burden by failing to provide an updated cost-benefit analysis.

44. To establish that the costs of Pickering are unreasonable, Environmental Defence does not have the legal burden to estimate the net cost to ratepayers of continuing to operate Pickering in light of the above information. However, a rough estimate is possible based on the IESO's report, as detailed below. This estimate provides an indication of

[60] Transcript, vol. 12, p. 15, ln. 24 to p. 16, ln. 1.
[61] *Ontario Energy Board Act*, 1998, S.O. 1998, c. 15, Sched. B, s.. 78.1 (1) & (6).

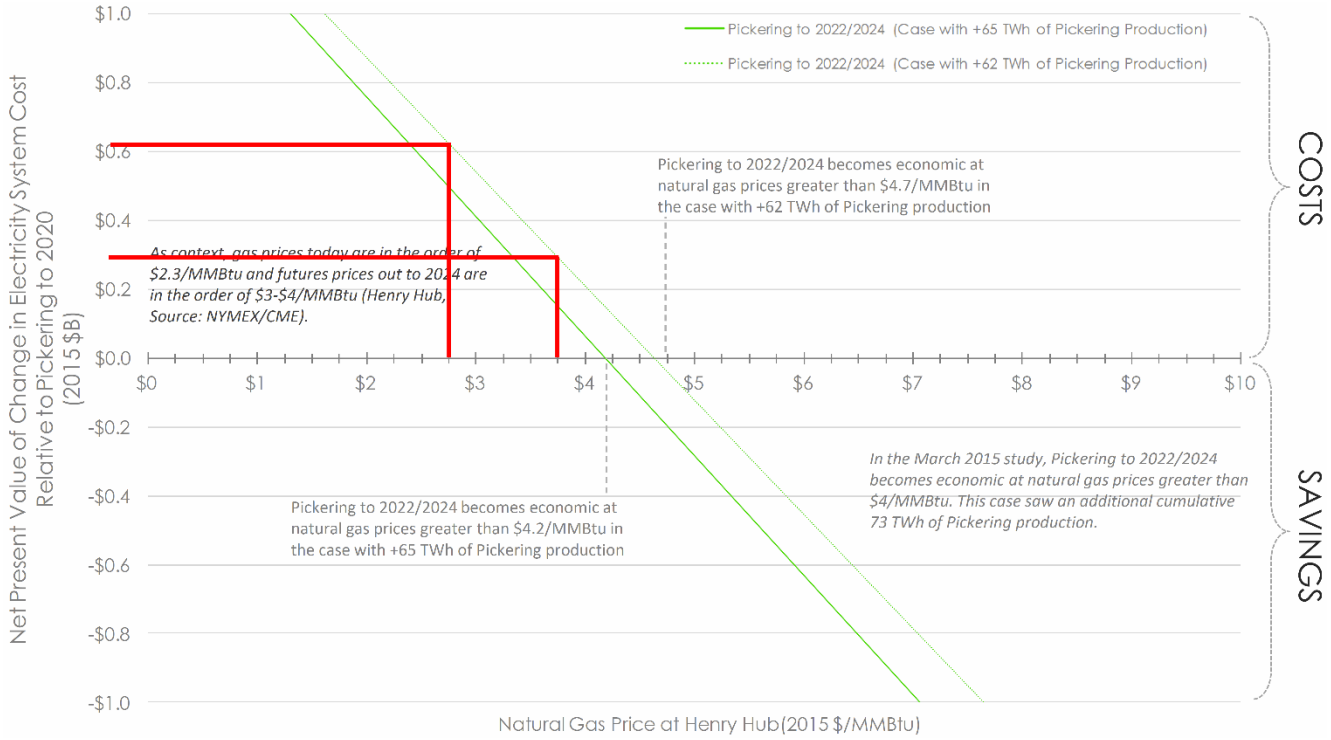
the cumulative impact of the many factors that have changed to the detriment of the cost-effectiveness of continuing to operate Pickering.

Pickering will Cost $1.3 to $2.5 Billion More than Alternatives

45. Operating Pickering beyond 2018 will likely result in **net costs of $1.3 to $2.5 billion** versus alternatives. This approximate estimate is derived based on the IESO's 2015 report and updated assumptions regarding (a) replacement energy costs, (b) replacement capacity costs, and (c) Pickering's costs. Two scenarios are examined below, with the first using best available information and the second using highly conservative assumptions that favour Pickering.

Lower Replacement Energy Costs

46. The impact of lower replacement energy costs on the net benefit/cost of operating Pickering beyond 2020 can be estimated using the IESO's gas price sensitivity chart, as shown below.



47. This chart shows the net benefit/cost of extending Pickering from 2020 to 2022/2024 as a function of natural gas prices. As gas prices go down, extending Pickering's life turns from a net benefit to a net cost (at $4.7/MMBtu in 2015 dollars).

48. Two scenarios are indicated in the chart with red lines. In scenario 1, replacement energy is assumed to be primarily sourced from Quebec hydro power imports at a cost equivalent to the cost gas-fired generation (at gas prices forecast by the futures market). Futures markets predict an average gas price of $3.07/MMBtu.[62] However, this must be converted to 2015 dollars to be consistent with the units used in the above chart. In 2015 dollars, the cost is $2.76/MMBtu on average (see below table).

Table 1: NYMEX Futures Prices ($USD/MMbtu, Source: Undertaking J8.5)									
	2017	2018	2019	2020	2021	2022	2023	2024	**Avg.**
Nominal[63]	3.37	3.07	2.99	2.99	3.00	3.01	3.04	3.11	**3.07**
2015$[64]	3.24	2.89	2.76	2.71	2.66	2.62	2.59	2.60	**2.76**

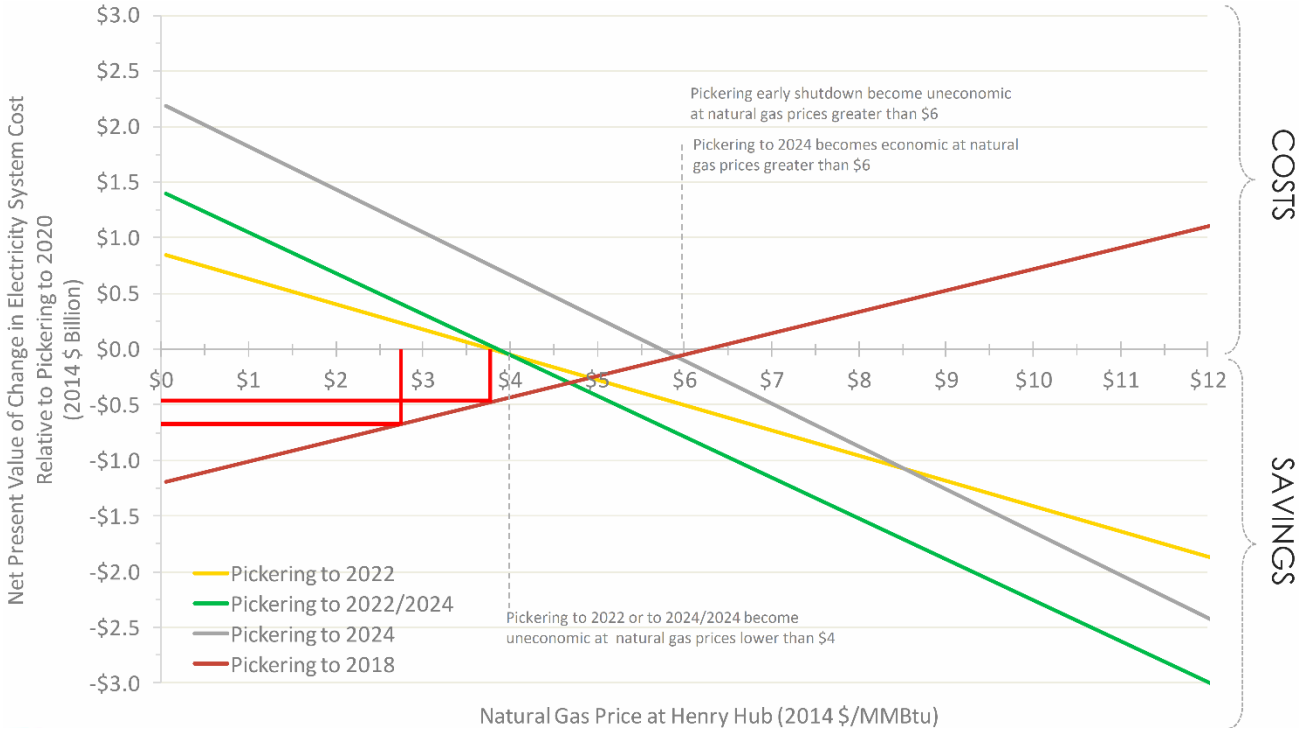
49. This is a conservative estimate of the cost of Quebec hydro power seeing as the IESO has acknowledged that Quebec hydro power is less expensive than gas generation.[65] Also, hydro power will not be significantly impacted by carbon prices.

50. In scenario 2, replacement energy is costed based on gas futures prices plus an additional $1/MMBtu for carbon prices (which is the IESO's best estimate of carbon prices averaged over 2017 to 2024 and rounded up to the nearest dollar).[66] In nominal dollars, the combined gas/carbon price is $4.07/MMBtu. In 2015 dollars it is $3.76/MMBtu.

51. As indicated by the red lines in the above chart, these two scenarios cause the continued operation of Pickering from 2020 to 2022/24 to change from a net benefit of $300 million to a **net cost** of approximately $600 million (scenario 1) or $300 million (scenario 2).

[62] Response to Undertaking J8.5.
[63] Undertaking J8.5
[64] Adjusted by 2% per year to convert to 2015 dollars per Undertaking J8.5.
[65] Transcript, vol. 8, p. 129, lns. 20-25.
[66] See paras. 15 & 16 above; Response to Undertaking J8.5; The IESO "best current estimate" of carbon prices from 2019 to 2024 is an average of $18.68/tonne (nominal, US$/kg CO2) according to its response to ED Interrogatory # 29, p. 5 (Exhibit L-6.5-7-29, p. 5). For the conversion to $/MMBtu, see IESO March 2015 Analysis, p. 23 (Exhibit F2-2-3, attachment 1, p. 64), which assumes 54 kg CO2/MMBtu natural gas.

52. The same methodology can be applied to the the net cost/benefit of continuing to operate Pickering from 2018 to 2020 as set out in the IESO's Mach 2015 report. This is shown with red lines in the below chart.



53. The IESO's March 2015 report found that operating Pickering from 2018 to 2020 will result in a net cost equal to $148 million.[67] The revised replacement energy cost assumptions in scenario 1 and 2 increase that net cost to approximately $650 million and $500 million respectively.

54. These and the other approximate impacts of updated assumptions are detailed in Table 2 at page 19 below.

Lower Replacement Capacity Costs

55. Replacement capacity costs are assumed to be reduced by 70% in scenario 1. This is reasonable seeing as (a) roughly half of the capacity deficit can potentially be met with "free capacity" from non-firm imports (see paras. 22 to 25 above); (b) the remaining deficit can be met at a far lower cost than the $130/kWyr assumed in the 2015 analysis, including with demand response (at $75 to $83/kWyr) and firm imports (see paras. 26 to 30 above); and (c) the cost will be further reduced if the inferior reliability

[67] IESO March 2015 Analysis, p. 20 (Exhibit F2-2-3, attachment 1, p. 61); Transcript, vol. 12, p. 23, lns. 1-9.

of Pickering versus alternatives is accounted for using the latest IESO methodology (see paras. 31 to 33 above re EFORd).

56. Scenario 2 assumes only a 30% reduction in replacement capacity costs, which is very conservative in light of the above factors.

57. The IESO's analysis includes $800 million in replacement capacity costs between 2020 and 2022/24 and $387 million between 2018 and 2020.[68] These are net present value (NPV) figures and therefore can be used to approximate the approximate impact of a percentage change in replacement capacity costs to the overall net benefit/cost (which is also expressed as an NPV figure). A 70% decrease in replacement capacity costs (scenario 1) increases the net costs of operating Pickering from 2018 to 2022/24 by over $500 million and scenario 2 (30% increase) increases the net costs by over $150 million.[69] The detailed figures are provided in Table 2 on page 19 below.

Higher Pickering Non-Fuel Costs

58. In scenario 1, Pickering's non-fuel costs are assumed to be 15% higher than the figure in the 2015 report. This is reasonable in light of (a) the recent revelation that Pickering's costs are 22% higher than those included in the cost-benefit analysis (see paras. 35 to 37 above); and (b) the likelihood that Pickering's cost will increase, including because the scope of work to extend Pickering's operations has not been finalized and the work required for CNSC approval is unknown (see para. 13 above).

59. Scenario 2 conservatively assumes only a 5% increase in costs vis-à-vis those included in the 2015 report.

60. The IESO's analysis includes $2.1 billion in non-fuel costs between 2020 and 2022/24 and $1.4 billion between 2018 and 2020.[70] These are net present value (NPV) figures and therefore can be used to approximate the impact of a percentage change in Pickering's cost to the overall net benefit/cost (which is also expressed as an NPV figure). A 15% increase in costs (scenario 1) increases the net costs of operating Pickering from 2018 to 2022/24 by over $800 million and a 5% increase results in an

[68] IESO October 2015 Analysis, p. 6 (Exhibit F2-2-3, attachment 1, p. 6); IESO March 2015 Analysis, p. 57 (Exhibit F2-2-3, attachment 1, p. 98)
[69] For scenario 1, the increase in net costs is $315M for 2020 to 2022/24 and $213M for 2018 to 2020. For scenario 2, the increase in net costs is $105M for 2020 to 2022/24 and $71M for 2018 to 2020. See Table 2.
[70] *Ibid*.

additional $350 million in net costs.[71] The detailed figures are provided in Table 2 on page 19 below.

Overall Impact on Net Benefit/Cost - $1.3 - $2.5 Billion

61. The impacts of the revised assumptions are detailed in the below table:

Table 2: Impact of Updated Assumptions on Net Cost/Benefit of Extending Pickering to 2020 or 2022/24 ($M)

ln		Scenario 1			Scenario 2	
1		2020 to 2022/24	2018 to 2020		2020 to 2022/24	2018 to 2020
2	**Initial Net Benefit(+)/Cost(-)**	$300	-$148		$300	-$148
3						
4	**Replacement Energy Costs**					
5	Updated Energy Cost Assumption	$3.07/MMBtu			$4.07/MMBtu	
6	Net Cost per Gas $ Sensitivity Chart	-$600	-$650		-$300	-$500
7						
8	**Pickering's Non-Fuel Costs**					
9	Initial Non-Fuel Costs (NPV)	-$2,100	-$1,419		-$2,100	-$1,419
10	% Increase	15%	15%		5%	5%
11	Change to Net Cost (NPV)	-$315	-$213		-$105	-$71
12						
13	**Replacement Capacity Costs**					
14	Initial Capacity Costs (NPV)	-$800	-$387		-$800	-$387
15	% Decrease	70%	70%		30%	30%
16	Change to Net Cost (NPV)	-$560	-$271		-$240	-$116
17						
18	Net Cost Sub-total (ln 6 + ln 11 + ln 16)	-$1,475	-$1,134		-$645	-$687
19						
20	Total Net Costs for 2018 to 2022/24 (2015$)	**-$2,587**			**-$1,319**	

62. As detailed above, operating Pickering from 2018 to 2022/24 would likely result in unnecessary additional net costs for consumers in the range of **$1.319 billion to**

[71] For scenario 1, the increase in net costs is $560M for 2020 to 2022/24 and $271M for 2018 to 2020. For scenario 2, the increase in net costs is $240M for 2020 to 2022/24 and $116M for 2018 to 2020. See Table 2.

$2.587 billion based on updated assumptions. Even just the period from 2020 to 2022/24 would likely result in a net cost in the range of $645 million to $1.475 billion.

63. The assumptions underlying the two scenarios, which were discussed above, are summarized in the below table.

Table 3: Updated Assumptions for Scenarios Analysis		
	Scenario 1	**Scenario 2**
Replacement Energy Costs (Gas price, USD, Henry Hub, Nominal Avg. 2017-2024)	$3.07/MMBtu	$4.07/MMBtu
Replacement Capacity Costs	Decreased by 70%	Decreased by 30%
Pickering Non-fuel Costs	Increased by 15%	Increased by 5%

64. Of course, these are very rough "back of the envelope" estimates. However, the approximate nature of the estimates is mitigated by the use of two scenario, including one that includes conservative assumptions that favour Pickering. This analysis provides a solid indication of the magnitude and likelihood of massive net costs.

65. Although the figures of $1.3 to $2.5 billion in net costs seems staggeringly high, they are not so high in light of the incredibly high cost of operating Pickering. Customers pay approximately $1.5 billion every year to run Pickering.[72] Over the 5-year application period they will pay roughly $7.5 billion.[73] The $2.5 billion in net costs from scenario 1 are only about 1/3 of that amount. It should not be surprising that continuing to operate such an incredibly inefficient, costly, and unreliable plant could end up costing consumers so much in comparison to alternatives.

Jobs, Decommissioning Costs, and GHG Emissions

66. OPG suggests that the protection of jobs is a reason to keep Pickering open. However, the number of jobs protected are far fewer than OPG suggests and only span a mere 4 years.[74] Furthermore, saving jobs is no justification for saddling electricity consumers

[72] Exhibit JT2.5, p. 2, ln. 19.
[73] The total figure is $7,412,000,000 in operating and fuel costs per exhibit JT2.5, p. 2, ln. 19. However, if Pickering's portion of the Tritium Removal Facility, OPEB and Pension costs excluded from centrally held costs, IESO non-energy charges, income tax, and property tax are included, the amount increases by $465 million to $7,877,000,000. See response to undertaking J2.4, p. 3.
[74] Undertaking J13.9.

with billions of dollars in unnecessary costs. If jobs are a primary concern, it is better that Pickering be closed so that work can begin on decommissioning. This will create jobs actually doing something useful.

67. Another benefit of creating jobs through decommissioning (versus operating an extremely inefficient plant) is that the decommissioning fund is fully funded already. These costs would not need to come out of future rates.

68. OPG suggests that Pickering should be kept open to reduce greenhouse gas emissions. This argument is no longer valid now that cap and trade is in place in Ontario. Ontario's cap and trade system sets a firm cap on emissions arising from domestic and imported energy.[75] Any increased emissions from replacement power (e.g. gas) must be offset elsewhere through the carbon market. Furthermore, replacement power can be sourced from Quebec hydro power, which has no carbon footprint.

Jurisdiction of the Board re Pickering

69. OPG appears to argue that the Board has no jurisdiction to disallow any costs relating to Pickering even if extending the life of Pickering is not needed and is not cost-effective in that it would result in massive net costs. This issue was addressed in an earlier motion and the Board reserved its decision. Environmental Defence adopts the submissions made by Board Staff in that motion, excerpted here for ease of reference:

> OPG is seeking significant money from ratepayers to operate Pickering. The OEB's mandate is to ensure that payment amounts are just and reasonable, which should include an assessment of the ongoing operating costs of Pickering.
>
> **What is the scope of the OEB's review of Pickering continued operations?**
>
> The OEB is empowered by section 78.1 of the OEB Act to set "just and reasonable" payment amounts for OPG's prescribed generation facilities, including Pickering. Section 78.1(6) further provides that the burden of proof rests with the applicant. The OEB's objectives with respect to electricity include: "[protecting] the interests of consumers with respect to prices and the adequacy, reliability and quality of electricity service."
>
> The OEB's powers to set just and reasonable payment amounts are very broad. Many court decisions confirm this view; for example in *Toronto Hydro-Electric System Ltd. v. Ontario Energy Board*, the Divisional Court stated: "The OEB has broad powers to set

[75] Exhibit K8.5, tab 13, p. 44-47.

rates. […] Rate-setting, and the determination of what is just and reasonable as between the utilities and the ratepayers, is at the heart of the OEB's jurisdiction."[76]

The onus rests with OPG to show that the costs it seeks to recover through OEB approved payment amounts are reasonable. The OEB's enquiry into the reasonableness of the proposed payment amounts could extend to asking whether a particular project is necessary at all. If the OEB determines that a proposed project provides poor value for ratepayers, then it should not approve the costs associated with that project.

OEB staff recognizes that the OEB is not the system planner. Typically that role is performed by the IESO based on the government's Long-Term Energy Plan (LTEP). In its decision on OPG's application for 2014-2015 payment amounts, the OEB indicated that it would place significant reliance on the LTEP.[77] However, extending Pickering operations beyond 2020 is not in the current LTEP.

The government also has the power to direct the OEB to not consider need for specific projects. It exercised this power recently through amendments to O. Reg. 53/05, where it directed the OEB to not consider need in assessing the prudence of costs related to the Darlington Refurbishment Program.

The government did not carve out any other projects (such as Pickering) for similar treatment. Under the doctrine of "implied exclusion" one can infer that had the government wanted to shield Pickering from a "need" analysis it would have specified this through the regulation. The doctrine of implied exclusion is a principle of statutory interpretation; it is described in *Sullivan on the Construction of Statutes* as follows:

> An implied exclusion argument lies whenever there is reason to believe that if the legislature had meant to include a particular thing within its legislation, it would have referred to that thing expressly. Because of this expectation, the legislature's failure to mention the thing becomes grounds for inferring that it was deliberately excluded. Although there is no express exclusion, exclusion is implied. The force of the implication depends on the strength and legitimacy of the expectation of express reference. The better the reason for anticipating express reference to a thing, the more telling the silence of the legislature.[78]

Absent an explicit fettering of the OEB's jurisdiction through a regulation (or, potentially, the LTEP), the OEB's ordinary and broad just and reasonable powers continue to apply, and this can include an assessment of need.

The only indication that the OEB has of the government's support for Pickering's continued operations beyond 2020 comes from a press release that was issued on January 11, 2016. The press release states:

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[76] 2009 CanLII 30148, para. 23. Upheld by the Ontario Court of Appeal: *Toronto Hydro-Electric System Limited v. Ontario Energy Board*, 2010 ONCA 284

[77] EB-2013-0321, Decision with Reasons, p. 51. See also Achieving Balance, Ontario's Long-Term Energy Plan, December 2013

[78] Ruth Sullivan, *Sullivan on the Construction of Statutes*, Sixth Edition, 2014, p. 248.

> The Province has also approved OPG's plan to pursue continued operation of the Pickering Generating Station beyond 2020 up to 2024, which would protect 4,500 jobs across the Durham region, avoid 8 million tonnes of greenhouse gas emissions, and save Ontario electricity consumers up to$600 million. OPG will engage with the Canadian Nuclear Safety Commission and the Ontario Energy Board to seek approvals required for the continued operation of Pickering Generating Station.

Although the press release appears to show government support for the project, it cannot be considered a directive to the OEB to not assess need. Nor does it have the weight of the LTEP, which is prepared after extensive review of the province's supply and demand forecast. In fact the press release specifically references the need for OEB approval, which suggests that the government does not intend to shield any part of the project from review.

The OEB should certainly consider the press release, but it should not be considered binding. The Minister, for example, approves OPG's Business Plan, which is the foundation upon which the entire payments application is based. If the OEB were bound by the Minister's assessment of the Business Plan then it would have little ability to disallow any of the matters addressed in the Business Plan. The OEB has in fact over the years made a number of disallowances for matters that were supported by the Business Plan. Obviously if the OEB is not bound by the Business Plan it is also not bound by a press release.

OEB staff submits, therefore, that the OEB has the jurisdiction to explore the cost effectiveness of ongoing operating costs of Pickering. The results of this enquiry could ultimately be a decision by the OEB to disallow some (or even all) costs related to operating Pickering beyond 2018 or beyond 2020. To be clear, OEB staff is not commenting at this stage on whether or not the proposed costs are reasonable. However, the assessment of the cost effectiveness of continuing to operate Pickering is within the OEB's jurisdiction to consider.[79]

70. Environmental Defence adopts those submissions.

71. In addition, subsequent to the motion, OPG acknowledged during cross-examinations that:

a. The Long-Term Energy Plan states that a shutdown prior to 2020 is possible;[80]

b. The Long-Term Energy Plan does not discuss Pickering's life being extended to 2022/24;[81]

c. OPG does not have a government directive to extend Pickering's life to 2022/24;[82] and

[79] Submissions of Board Staff, December 9, 2016, pp. 6-8.
[80] Transcript, vol. 13, p. 167, lns. 20-26.
[81] Transcript, vol. 13, p. 168, lns. 10-12.
[82] Transcript, vol. 13, p. 169, lns. 11-13.

d. OPG does not have any "final approval" from the government regarding Pickering to 2022/24.[83]

72. Furthermore, it is now clear that the much-referenced government press release relating to Pickering contains outdated and inaccurate information provided by OPG, which greatly diminishes its weight.[84] The outdated and inaccurate information includes the following:

a. The press release refers to $600 million in savings. This is based on a 65 TWh production scenario that OPG has admitted is not possible due to planned outages.[85] Furthermore, this figure is based on the IESO analysis discussed above, which results in massive net costs if updated assumptions are used.

b. OPG advised the Ministry of Energy that continuing to operate Pickering would protect 4,000 OPG jobs.[86] However, OPG's cost figures correspond to only 3,025 employees being let go in a shutdown (full time equivalent, average over 2021-2024).[87]

c. The press release states that 8 million tonnes of greenhouse gas emissions will be saved. That is no longer true because of the availability of carbon-free Quebec hydro power and due to Ontario's cap and trade system, which sets a firm cap on emissions arising from domestic and imported energy.[88]

73. Furthermore, statements by the Ministry of Energy in the Legislature make it abundantly clear the government has not approved a life extension of Pickering to 2022/24. The Deputy Minister of Energy said as follows:

> Mr. Peter Tabuns: Just to be clear, **you have not yet made a final decision to extend to 2024. Is that correct?**

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[83] Transcript, vol. 13, p. 169, lns. 26-27.
[84] Exhibit L-6.5-1-Staff-115, attachment 1.
[85] OPG Submissions, May 3, 2017, p. 88 ("Pickering is expected to produce approximately 62 TWh of incremental generation"); Response to Board Staff IR#126, p. 3 (Exhibit L-6.5-1-Staff-126); The IESO was not aware that the 65 TWh scenario was impossible when it prepared its report, see Transcript, vol. 8, p. 48, lns. 3-16; see also the below footnote.
[86] Transcript, vol. 13, p. 125, lns. 2-11; News Release re Pickering (Exhibit L-6.5-1-Staff-155, attachment 1).
[87] Response to undertaking J13.9; Note: This undertaking arises from a question that OPG strenuously objected to during the hearing and only answered at the request of the Board.
[88] Exhibit K8.5, tab 13, p. 44-47.

> Mr. Serge Imbrogno: **That's correct**. We've given OPG the authority to go forward, to go through the OEB, and also to the CNSC for regulatory approvals, and then to return, closer to 2017, I believe, for a final decision.[89]

74. The Deputy Minister of Energy also stated that OPG merely has the "green light" to pursue approvals from "the OEB and the CNSC, **and then to return to the government after we have all the information.**"[90] The Ministry of Energy is expecting the Board to examine the reasonableness of the cost of operating Pickering to 2024 and to provide information that will inform the government's final decision. The Ministry of Energy is not seeking or expecting a rubber stamp approval as OPG seems to suggest.

75. The fact that OPG attempts to present the continued operations of Pickering as a *fait accompli* is an indication that it does not believe that this project will stand up to scrutiny regarding its cost-effectiveness for ratepayers.

Relevance of 2018

76. In the past, Ontario has needed Pickering in order to keep the lights on in the eastern part of the province.[91] When Pickering was needed, Ontarians had to pay for it even though it was so expensive and inefficient to operate. That all changes in 2018 when the Clarington Transformer station is built, which would allow Ontario to source its electricity from elsewhere.[92] Ontario is no longer beholden to pay whatever Pickering costs. We can now ask whether the high cost of Pickering is truly reasonable.

77. The cost-effectiveness of operating Pickering from 2018 onward is relevant (and in our submission, central) to issue 6.1. That issue asks whether the OM&A budget for the nuclear facilities is appropriate. Environmental Defence submits that the costs for operating Pickering beyond 2018 are simply unreasonable. OPG has not established that they are cost-effective and the evidence on the record suggests the opposite. Even without updated assumptions, the IESO's March 2015 report found that operating

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[89] Hansard, Legislative Assembly of Ontario, Oct. 26, 2016, E-10, Standing Committee on Estimates, p. E-162 (Exhibit J8.5, tab 19, p. 70).
[90] Hansard, Legislative Assembly of Ontario, Oct. 26, 2016, E-10, Standing Committee on Estimates, p. E-160 (Exhibit J8.5, tab 19, p. 68).
[91] Ontario Ministry of Energy, *Long-Term Energy Plan*, December, 2013, p. 57 & 67; Transcript, vol. 12, p. 31, lns 13-16.
[92] *Ibid*.

Pickering from 2018 to 2020 will result in $148 million in net costs.[93] The updated assumptions in scenario 1 and 2 above bring the net costs to $0.6 to $1.1 billion.[94]

78. The cost effectiveness of operating Pickering from 2018 to 2020 is also relevant to issue 6.5. This issue asks whether the expenditures for extending Pickering's operations from 2020 to 2022/24 are appropriate. The purpose of operating Pickering from 2018 to 2020 at a *net cost* to consumers is to enable the continued operation to 2022/24. It is therefore necessary to include the 2018-2020 net costs when assessing the cost-effectiveness of operating to 2022/24. In other words, the net costs of operating from 2018 to 2020 must be treated as an incremental cost of extending Pickering's life to 2022/24 because they cannot be justified in isolation.

Orders re Pickering's Cost

79. Environmental Defence agrees with the following Board Staff position regarding potential orders open to the Board regarding Pickering:

> [T]he OEB has the jurisdiction to explore the cost effectiveness of ongoing operating costs of Pickering. The results of this enquiry could ultimately be a decision by the OEB to disallow some (or even all) costs related to operating Pickering beyond 2018 or beyond 2020.[95]

80. If the Board finds that the ongoing operation of Pickering is not cost effective, it should disallow some (or even all) of Pickering's costs.

81. Alternatively (or in addition), the Board could include conditions in its order as it is empowered to do under s. 78.1(4) of the *Ontario Energy Board Act*.[96] For example, the Board could order OPG to prepare an updated cost-benefit analysis to provide to the Board and the Ministry of Energy. The Board could also stipulate that this analysis be based on up-to-date assumptions and address the issues raised by intervenors in this proceeding.

82. Environmental Defence requests that the Board make a finding regarding the reasonableness of Pickering's costs and issue one of the orders described above. The government is looking to the Board for its decision regarding Pickering's costs. If this

[93] IESO March 2015 Analysis, p. 20 (Exhibit F2-2-3, attachment 1, p. 61); Transcript, vol. 12, p. 23, lns. 1-9.
[94] See para. 60 and the associated table above.
[95] Submissions of Board Staff, December 9, 2016, pp. 6-8.
[96] *Ontario Energy Board Act*, 1998, S. O. 1998, c. 15, Schedule B, s. 78.1(4).

application is approved without holding OPG to its evidentiary burden and without a robust examination of Pickering's cost, the government may assume that the Board is satisfied that Pickering's costs are reasonable. This could result in billions of unnecessary costs for Ontario electricity consumers.

Darlington Reporting

83. Although Environmental Defence believes that the Darlington Refurbishment Program is not in the best interests of consumers, its primary arguments in this regard are precluded by O. Reg. 53/05. Therefore, Environmental Defence is only making submissions regarding the reporting that OPG should be required to provide for the Darlington Refurbishment Program (issue 10.4). In addition, Environmental Defence supports the submissions made by the Green Energy Coalition regarding the Darlington Refurbishment Program.

Importance of Robust, Timely Reporting

84. Robust and timely reporting on the refurbishment program is extremely important.

85. First and foremost, timely reporting is necessary in order to retain the option of off-ramps as required by the Long-Term Energy Plan. If cost overruns are accumulating that warrant a potential off-ramp, it is important to know that as soon as possible to begin planning.

86. Second, timely reporting is needed, more generally, to flag any cost overruns so that appropriate actions can be taken.

87. Third, robust and timely reporting is required as a matter of transparency and respect for the public. Ratepayers are paying over $12 billion for this project. Past nuclear projects have gone far over budget, saddling ratepayers with huge debts that are still being repaid today. The public, including Board intervenors, have a right to robust and timely reporting on the progress of this project.

88. Fourth, robust and timely reporting is warranted because the risk of cost overruns is very significant in light of OPG's track record as well as its current contracting strategies. OPG acknowledged that it would be responsible for **85%** of cost overruns in a scenario where costs increased by 25% and **86%** of cost overruns where costs

increased by 100%.[97] Ratepayers are responsible for by far the largest portion of overall cost overruns.

89. OPG argued that Environmental Defence's interrogatory about OPG's liability for cost overruns was unrealistic because it asked that the overruns to applied proportionally to all costs, both contractor costs and OPG's own project management costs.[98] Although it said that cost growth of its project management costs is "unlikely," it provided no proof of this. OPG also objected to applying cost overruns in addition to contingency amounts.[99] However, OPG's own evidence states that "contingency refers to amounts that are expected to be expended," and so it is reasonable to consider cost overruns to be above and beyond contingency.[100]

90. The fact remains that ratepayers are on the hook for a massive proportion of cost overruns and deserve robust and timely updates on this project.

Reporting Requirements

91. Environmental Defence requests that OPG be required to report quarterly on:

    a. Its actual versus forecast cumulative capital costs for the Darlington Refurbishment Program;[101]

    b. The Cost Performance Index (CPI); and

    c. The Schedule Performance Index (SPI).

92. Reporting is needed *quarterly* so that cost overruns or delays can be identified as early as possible so that planning can begin immediately regarding potential remedial steps, including off-ramps. Quarterly reporting is not onerous. OPG already prepares the above metrics for its own internal purposes on a *monthly* basis.[102]

93. The actual versus forecast cumulative capital costs is a useful figures because it does not require significant assumptions or underlying calculations as do the CPI and SPI. It is a straightforward figure. It would be helpful as a "first cut" look at OPG's

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[97] Response to Undertaking JT1.20, attachment 1; Response to ED Interrogatory #4 (Exhibit L-4.3-7-ED-004).
[98] Response to ED Interrogatory #4, p. 3 (Exhibit L-4.3-7-ED-004).
[99] *Ibid.*
[100] Exhibit D2-2-7, p. 1.
[101] The forecast cumulative capital costs can be found in the response to Undertaking JT1.17C.
[102] Transcript, vol. 2, p. 157, ln. 27 to p. 158, ln. 2; The cumulative capital costs would presumably need to be calculated for the purposes of calculating the CPI and SPI.

progress. It would also be helpful for the purposes of double checking the CPI and SPI with a concrete figure that is not subject to changes to assumptions or baselines.

94. The CPI and SPI are useful figures as they are OPG's own tools to track its progress with respect to cost and schedule. Although OPG plans to publish qualitative information on cost and schedule performance, that kind of information is a far cry from the actual CPI and SPI. The CPI and SPI are each based on "a precise mathematical calculation" with "a prescribed formula."[103] In contrast, the information that OPG plans to provide quarterly is merely a "qualitative measure."[104]

95. Mr. Lyash stated that the SPI and CPI "are metrics created for us to manage the project, not the best communication tools for the broad public."[105] He further stated that OPG is attempting to provide reporting "in a way that the public can understand."[106] Withholding these metrics on this basis is disrespectful to intervenors and to other members of the public that are perfectly capable of understanding these figures.

96. OPG is already tracking the metrics that Environmental Defence is seeking. It simply does not want to release them. Rather than provide actual data, it wants to provide its own qualitative assessment of its own progress. This is not sufficient for a $12.8 billion project, especially in light of the history of cost overruns in nuclear projects, the need to keep the off-ramp options open, and the fact that OPG bears the lion's share of the risks of cost overruns.

Requested Relief

97. For the above reasons, Environment Defence requests that the Board:

    a. Make a finding that the costs to operate Pickering beyond 2018 are not reasonable;

    b. Disallow some or all of Pickering's costs beyond 2018 or, in the alternative, order that OPG submit an updated cost-benefit analysis regarding Pickering that addresses the issues raised by intervenors; and

    c. Order OPG to publish the following metrics on a quarterly basis:

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[103] Transcript, vol. 2, p. 158, lns. 16-23 & p. 159, ln. 20 to p. 160, ln. 8.
[104] *Ibid*.
[105] Transcript, vol. 2, p. 158, ln. 28.
[106] Transcript, vol. 2, p. 159, lns. 18-19.

i. Actual versus forecast cumulative capital costs for the Darlington Refurbishment Program;[107]

ii. The Cost Performance Index (CPI); and

iii. The Schedule Performance Index (SPI).

All of which is respectfully submitted this 29th day of May, 2017.

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[107] The forecast cumulative capital costs can be found in the response to Undertaking JT1.17C.